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Original Article

Effect of Warm Foot Bath on Fatigue among Diabetic Older Adults

Farahnaz Farnia [1], Sedighehalsadat Mokhtari [*2], Masoud Rahmanian [3]

[1.] Research Center for Nursing and Midwifery Care, School of Nursing and Midwifery, Shahid Sadoughi University of Medical Sciences, Yazd, Iran
[2.] Department of Nursing, School of Nursing and Midwifery, Shahid Sadoughi University of Medical Sciences, Yazd, Iran
[3.] Diabetes Research Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

[*] **Corresponding Author:** Department of Geriatric Nursing, School of Nursing and Midwifery, Shahid Sadoughi University of Medical Sciences, Yazd, Iran. **Tel:** +989304079986**, Email address:** s.sadat.mokhtari@gmail.com

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A B S T R A C T

Introduction: Fatigue is one of the most common causes of disability in most elderly people affected with diabetes. Considering the growing population of this group, the present study aimed to determine the effect of warm foot bath on the fatigue of the elderly people with diabetes.

Methods: The randomized clinical trial study was carried out on 66 elderly diabetic patients who had referred to the Diabetes Research Center in Yazd. Eligible participants were selected by convenience sampling and randomly divided into two experimental and control groups. Participants of the experimental group performed a warm foot bathing for 20 minutes during two weeks. The Piper Fatigue Scale was completed in three steps (at the beginning of the study, two and four weeks after intervention). Data were analyzed by SPSS software, using ANOVA for repeated measures, independent t-test, Chi-Square and Fisher exact test.

Results: The mean ± standard deviation of fatigue in the three phases of evaluation in the experimental group was 5.91 ± 0.81, 4.80 ± 1.19, 4.55 ± 1.57 and in the control group was 5.95 ± 0.97, 6.06 ± 1.13 and 5.79 ± 1.33, respectively. The difference in the mean of fatigue scores in both groups after the intervention was significant ($p < 0.001$).

Conclusion: Revealing the positive effects of warm foot bathing, this method, as a non-pharmacological and easy-to-use method, is recommended to improve fatigue condition in the elderly patients with diabetes.

Keywords: Fatigue, Warm Foot Bath, Diabetes Mellitus, Elderly

Introduction

Fatigue is a multidimensional feeling comprising physical, mental and situational dimensions with various reasons (1). Defined by North American Nursing Diagnosis Association, fatigue is regarded as the self-identified state of decreased capacity along with an individual experience in sustained sense of fatigue so that even rest cannot eliminate fatigue resulting from physical and mental work (2). Fatigue is one of the most common physical problems in the elderly with the prevalence of about 5 to 50%, and the cases occur 1.2 to 2.3 times more in females than in males (3, 4). In addition, the increased population of the elderly in the world and Iran (5, 6) has led to higher morbidity and chronic illnesses associated with an increase in fatigue-related complaints (7). One of these diseases, along with increased fatigue, is diabetes (8). In other words, fatigue is a continuing and distressing complaint in diabetic patients (1). Additionally,

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elderly people are more likely to experience diabetes than the young (9).The prevalence of fatigue in 1137 cases over 40 years old, with a recent diagnosis of type 2 diabetes, was 61% in Denmark (8).

Although fatigue is a classic sign of hyperglycemia (10), related fatigue associated with diabetes has several causes and pathologic mechanisms. Prolonged inflammation is one of the key mechanisms behind this problem (11). Fatigue is an important alarm for human health (4). Fatigue has consequences such as decreasing muscle reserve, psycho-physiological dysfunction, severe weakness (12), impact on the daily mood and function of the elderly (13) and ultimately increased mortality (14). In addition, fatigue in healthy people has a negative effect on health, physical functioning, ability to manage routine daily activities and quality of life. However, in patients with diabetes, it prevents health promoting behaviors (15). The experience of fatigue in people with type 2 diabetes affects self-care and quality of life (16). According to Singh et al. (1), despite the presence of fatigue in other medical conditions, the importance of fatigue in people with type 2 diabetes is greater because of the need to follow complex therapeutic strategies and their impact on their quality of life. Therefore, considering the prevalence and outcomes of fatigue in this group of patients, evaluation and management is important. For this reason, the use of vitamins, exercise and diet modification has been proposed (17). Also, medication is used to reduce the symptoms associated with fatigue, such as pain and sleep disorder (11). Evidence suggests the positive effects of exercises like Yoga (18), energy conservation strategies (6), foot massage (19-20) and stroke (21), massage with aromatherapy (22), laughter therapy (23), physio-chest (24) and warm-water footbath (25) on the fatigue condition of different patients. In addition, non-pharmacological strategies and complementary therapies with benefits such as ease of use at home, affordability, and fewer side effects are more acceptable to patients. Therefore, the effect of non-pharmacological strategies is important due to polypharmacy of the elderly arising from the increased incidence of chronic diseases and the possibility of increased adverse effects of drugs emerging from age-related physiological changes (26).

In this regard, warm foot bath may be beneficial from complementary therapies such as combination of both hydrotherapy and thermal therapy (27). This method can be used repeatedly, in a manner that involves a combination of vibration, tremor, aromatherapy, massage and reflexology (28, 29). Hydrotherapy is based on the physical properties of water, including hydrostatic pressure, flotation, viscosity and thermodynamics with therapeutic properties. The hydrostatic pressure induced by immersion in hot water improves blood flow (27), and water with a temperature of more than 34 degrees leads to muscle relaxation and increased tendon stretch (30). Relaxation, increased comfort, and pain relief in incurable cancer patients (31), hand transplantation surgeries (32), and low back pain in pregnant women (33), as well as decreased symptoms of fatigue and insomnia during chemotherapy (34) have been identified. However, with a considerable search in scientific databases, the study failed to find the effect of this factor on fatigue in the elderly with diabetes. Therefore, the present study's goal was to determine the effect of warm foot bath on the fatigue of the elderly people with diabetes.

Methods

Study design and participants

This is a randomized clinical trial with repeated measures intervals. The study setting was Diabetes Research Center of Yazd city in Iran. Initial sampling was performed by a convenience method with some eligible individuals who were randomly assigned to the experimental and control groups (equal in each). Data before and after the intervention (two and four weeks later), were collected three times. The population and the research sample were elderly people who had referred to the Diabetes Research Center in Yazd in 2018. The sample size in each group was estimated to be 35, taking into account the 95% confidence level, 80% test power, and according to the similar study results (35) a mean difference of at least 1.3, a standard deviation of 1.27 and a typical reduction of 10%. The sampling continued until the sample size was completed with equal proportions. The inclusion criteria comprised people with diabetes aged 60 and above with any degree of disease control and willing to participate in the study voluntarily and consciously, by obtaining a minimum score of four in the fatigue scale of Piper (36). Exclusion criteria comprised patients with leg ulcers, skin conditions such as eczema, cognitive impairment, and known depression as well as probable or definite cases of deep venous thrombosis and varicose veins. Eventually, of the 419 elderly participants in the assessment, 70 eligible cases were selected. Four samples (in cases of foot wounds, travel, or hospitalization) were ultimately excluded from the study.

Measure

Data gathering tools were demographic questionnaire and Piper Fatigue Scale. The scale includes 27 questions in four areas of behavior / severity (items 2-7), affective meaning (items 8-12), sensory (items 13-17), and cognitive / mood (items 18-26). The remaining questions (5 items) are qualitative and solely for the richness of the questionnaire thus not included in the scoring. The 11 point Likert type items are scored from 0-10. Then the obtained scores are divided to number of items to calculate the fatigue score between 0-10 for total scale and also its subscales (36). The reliability of the scale was confirmed by split half method with

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a correlation coefficient of 79% and Cronbach's alpha of 98%. Sabouhi et al. confirmed the internal validity (α = 0.77) and the reliability of it by test re-test(r = 82.2%) (37).

Interventions

Participants of the experimental group, in addition to continuation of routine care, were subjected to warm foot bath intervention. Warm foot bathing included 20 minutes immersion of both feet (at least 10 cm above the wrist) in 6 liters of water at 40 ± 2 ° C. This intervention, eight sessions every day, was performed over a two-week period by all experimental participants. The intervention was performed and taught at the first session for participants. Then the repetition was requested. After ensuring the correctness of the implementation of the method, the educational pamphlet was presented including the method of preparing the warm water bath, using a thermometer, a timetable for the dates of the intervention, and the contact number of the researcher in the event of a problem.

Ethical considerations

The study was conducted using the code IR.SSU.REC.1396.144 from the Ethics Committee in Sahid Sadoughi University of Medical Sciences, Yazd. Ethical considerations such as informed consent and compliance with the principle of respect for autonomy, beneficence, justice and confidentiality were observed.

Data analysis

Data were analyzed using SPSS software version 16. Data were described with mean ± standard deviation and absolute and relative frequency. The data from the normal distribution were examined by Kolmogorov-Smirnov test. Data analysis was performed with chi-square test, modified Fisher test and t-test (Matching of the underlying demographic variables in the two groups) as well as repeated measures ANOVA (comparing the fatigue score before, two and four weeks after the intervention).

Results

The participants were in the age range of 60-82 years with an average age of 64.6. The majority of whom were female (71.2%) and married (83.3%). The two groups were matched for all the confounding variables studied including age, sex, marital status, duration of diabetes and mean fatigue score (Tables 1 and 2).

The mean ± standard deviation of fatigue score in the experimental group in the pretest, two and four weeks after the intervention were 5.91 ± 0.81, 4.80 ± 1.19, and 4.55 ± 1.57, respectively. However, the mean score of the control group in the pre-test, two and four weeks after the intervention leveled at 5.95 ± 0.97, 6.06 ± 1.13 and 5.79 ± 1.33, respectively. The mean of fatigue scores before intervention was not statistically significant (p = 0.122). However, a significant difference emerged after the intervention (p < 0.001) (Table 3).

Before the intervention, the mean score of total fatigue and each of its dimensions in both groups were not statistically significant (p = 0.122). According to the results, two weeks after the intervention, the mean of total fatigue score and score in behavioral / severity, affective meaning, sensory and mood / cognitive / group dimensions turned out to be significant (p = 0.001) (Table 3).

Table 1. Comparison of demographic characteristics of participants in the two groups

Variable	Group	Experimental N (%)	Control N (%)	Total N (%)	p-value
Age(Year)	60-74	29 (87.9)	32 (96)	61 (92)	0.157
	75-90	4 (12.1)	1 (4)	5 (7.57)	
Gender	Male	9 (27.3)	10 (30.3)	19 (28.8)	0.786
	Female	24 (72.7)	23 (69.7)	47 (71.2)	
Marital status	Married	26 (78.8)	29 (87.9)	55 (83.3)	0.322
	Divorced	7 (21.2)	4 (12.1)	11(16.7)	
Duration	<10	12 (36.3)	14 (42.4)	26 (39.3)	0.282
	10-20	19 (57.5)	18 (54.5)	37 (56.06)	
	>20	2 (6.06)	1 (3.03)	3 (4.54)	
Drug	Oral	9 (27.3)	8 (24.2)	17 (25.8)	0.886
	Insulin	15 (45.5)	17 (51.5)	32 (48.5)	
	Both	9 (27.3)	8 (24.2)	17 (25.8)	
HLD*	Yes	31 (93.9)	30 (90.9)	61 (92.4)	0.642
	No	2 (6.1)	3 (9.1)	5 (7.6)	
HTN**	Yes	27 (81.8)	25 (75.8)	52 (78.8)	0.547
	No	6 (18.2)	8 (24.2)	14 (21.2)	

Chi square test and Fisher exact test *Hyperlipidemia **Hypertension
The values are expressed in terms of numbers (percentages) p < 0.05 was considered statistically significant

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Table 2. Comparison of mean± SD scores of fatigue in the two groups before intervention

Variable	Group	Mean ±SD	p-value
Fatigue	Experimental	5.91 ± 0.81	0.122
	Control	5.95 ± 0.97	
Behavioral/ Severity	Experimental	6.26 ± 1.15	0.476
	Control	6.22 ± 1.39	
Affective meaning	Experimental	6.22 ± 1.23	0.193
	Control	6.29 ± 1.47	
Sensory	Experimental	6.02 ± 1.07	0.227
	Control	5.89 ± 1.35	
Mood/ Cognitive	Experimental	5.56 ± 1.18	0.486
	Control	5.88 ± 1.29	

Discussion

The aim of this study was to determine the effect of warm foot bath on fatigue in the elderly with diabetes in 66 patients. The results revealed that warm foot bath can reduce the fatigue in the elderly people affected with this disease. In other words, changes of fatigue mean in the experimental group in the three stages of the study was tending to decrease. This is consistent with the results of Anilda and Thenmozhi study of the effect of hot water baths on level of fatigue among elderly patient (38). Although it was similar in sampling and intervention, was different in fatigue measurement instrument, and as a result, more than half of the samples suffered from severe fatigue, unlike the present study. In addition, this study is consistent with the study of Tanaka et al. Who exemaind the effects of pellet stove on recovery from mental fatigue (39). In this placebo-controlled, cross-over experiment, the effect of environment heat on mental fatigue has been measured and fatigue was measured by the VAS instrument. Subjective scores for fatigue were significantly lower in the pellet stove condition compared with the control condition. This study result is in contrast to the results of the Seo et al. regarding the contribution of foot bath to fatigue relief measured by using smart phone applied questionnaires (40). This effect is probably due to the differences fatigue measurement and age sample. These studies merely examined the short-term effect of intervention Therefore; the strength of our study is in assessing the effects of this intervention in a longer period.

The mean fatigue score at baseline of the study was about 6 out of 10 of the total scores and more than half of the participants were moderate in fatigue. These results are consistent with the findings of the studies conducted by Singh et al. (41), Murphy et al. (42), Tsay (43) as well as Fritschi and Fink. (11). In Singh's et al. study the estimated fatigue in patients with type 2 diabetes and mean age of 57 ± 7 years was in a medium range (41). In the study performed by Murphy et al. the fatigue of the elderly with osteoarthritis turned out to be moderate (42). In the Tsay's study, the mean fatigue score of the patients under hemodialysis with an average age of 58.16 years reached 5.97 (43). In other words, these results further confirm the fatigue of elder people with chronic diseases. In addition, comparison of scores of each of the different dimensions of Piper's fatigue scale (behavior / severity, affective meaning, sensory and cognitive / mood) in baseline phase of the study, shows a decreasing trend in the experimental group, two and four weeks after the intervention. However, in the control group, only in the emotional dimension there was a significant difference. Two weeks after the start of the study, the elderly's fatigue in the emotional dimension indicated a significant increase. In the O'Regan and Hegarty's study, the fatigue of the patients under chemotherapy was also moderate (4.9 ± 2.2) and their level of emotional exhaustion was even higher (5.4 ± 2.9) (44). This suggests the importance of paying attention to the emotional dimension of fatigue in people with chronic diseases. On the other hand, two to four weeks after the intervention, the difference in mean score between the two groups was considered as significant. In other words, the experimental group demonstrated a downward trend whereas the control group demonstrated an upward trend in the scores. Fritschi et al. believe that fatigue can be related to the severity of self-management in diabetes regimen (15). This is probably true for other chronic illnesses. On the other hand, the results of a descriptive-analytical study by Borji and Mottaghi indicated a positive correlation between physical activity, social support and fatigue of the healthy elderly (45). Therefore, it is possible that the results of the present study on the reduction of fatigue are partly impinged by the follow up and support provided during the intervention.

Table 3. Comparison of fatigue and its dimensions scores in participants at 3 stages of the study

	Group	Pretest Mean ± SD	After two weeks Mean ± SD	After 4 weeks Mean ± SD	Within groups p-value	Between groups p-value
Fatigue Score	Experimental	5.91 ± 0.81	4.80 ± 1.19	4.55 ± 1.57	<0.001	0.001
	Control	5.95± 0.97	6.06 ± 1.13	5.79 ± 1.33	0.107	
Behavioral/Severity	Experimental	6.26 ± 1.15	4.87 ± 1.50	4.77 ± 1.89	< 0.001	< 0.001
	Control	6.22± 1.39	6.59±1.34	6.24 ± 1.17	0.299	
Affective meaning	Experimental	6.22 ± 1.23	4.84 ± 1.68	4.84 ± 1.99	< 0.001	0.001
	Control	6.29± 1.47	6.81±1.05	6.26 ± 1.40	0.039	
Sensory	Experimental	6.02 ± 1.07	4.88 ± 1.68	4.67 ± 1.65	< 0.001	< 0.001
	Control	5.89 ±1.35	5.79±1.10	5.90± 1.46	0.830	
Mood/Cognitive	Experimental	5.56 ± 1.18	4.75 ± 1.33	4.14 ± 1.56	< 0.001	0.001
	Control	5.88±1.29	5.60± 1.33	5.35 ± 1.50	0.434	

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Conclusion

Foot immersion in warm water every day for 20 minutes can have a positive effect on lowering fatigue in elderly patients affected with diabetes. Warm water bath intervention with self-controlled temperature is readily available for all elders in home. This method can be used as an appropriate option, alone or in combination with drug therapies, to reduce or prevent fatigue in elderly people with diabetes. On the other hand, due to the higher probability of fatigue in this age group affected with diabetes, this method can be applied to reduce and prevent fatigue of the elderly suffering from other similar conditions.

Study limitations

Of the limitations of this study, we can refer to small sample size and the uncontrolled psychological effect of warm bath intervention on fatigue as well as limited access to more health centers enjoying the health record. It is hence suggested that future investigations address these shortcomings.

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Conflict of interest

There is no conflict of interest to declare.

Authors' contributions

All authors contributed to the design and implementation of the study, read and approved the final manuscript.

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