

# The Effects of Education on Foot Care Behaviors and Self-Efficacy in Type 2 Diabetes Patients

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**ABSTRACT**

**Background:** Diabetic foot significantly affects the quality of life of patients with diabetes. It leads to loss of labor force, psychosocial trauma, and high treatment costs due to serious morbidity and mortality. Nurses have an important responsibility to improve the metabolic status of individuals with diabetes, to protect them from foot complications, and to teach patients foot care skills. **Aim:** This study investigated the effects of education on type 2 diabetes patients regarding diabetic foot care and self-efficacy. **Materials and Methods:** This quasi-experimental study was conducted from February to July 2016 in hospitals located in the city of Balıkesir in Turkey with type 2 diabetes patients who were admitted to the internal medicine clinic and monitored by the endocrinology and internal medicine outpatient clinics. G\*power 3.1.9.2 software was used to calculate the sample size of 94 people with a 5% type 1 error, and 90% power. The study was carried out with stratified randomization, and a questionnaire was administered to the experimental and control groups. The experimental group received training, and both groups' scores on the Diabetic Foot Behavior Questionnaire [Appendix 1] and the Diabetic Foot Care Self-Efficacy Scale [Appendix 2] were compared after three months. The t-test, the paired t-test, and the Chi-square test were used. **Results:** While the self-efficacy and the foot care behavior scores of the control group did not show any differences ( $P > 0.05$ ), the experimental group's scores were significantly higher ( $P < 0.05$ ). The control group's self-efficacy and foot care behavior scores on the pre-test and final test were similar, while the experimental group's scores increased ( $P < 0.05$ ). **Conclusions:** Starting from the diagnosis of diabetes, it is advisable to carry out foot assessments and to follow up with diabetics who received foot care education to increase their self-efficacy, to make foot care a habit, and to re-evaluate missing or incorrect practices during check-ups.

**KEYWORDS:** Diabetic foot care, experimental study, self-efficacy, type 2 diabetes

## BACKGROUND

Diabetes is a complex chronic disease accompanied by life-threatening complications such as heart disease, stroke, blindness, kidney failure, neuropathy, diabetic foot ulcer, and lower extremity amputation.<sup>[1-4]</sup> It has been reported that 415 million individuals worldwide are diabetic and that this number will increase to 642 million by 2040.<sup>[5]</sup>

Diabetic foot significantly affects the quality of life of patients with diabetes. It leads to loss of labor force, psychosocial trauma, and high treatment costs due


to serious morbidity and mortality.<sup>[6-9]</sup> Approximately 25% of people with diabetes develop diabetic foot ulcers at some time in their lives, and worldwide an amputation is performed every 30 s due to diabetic foot complications.<sup>[10-12]</sup> Diabetic foot is one of the most common reasons for the hospitalization of diabetes patients.<sup>[6,11,13-15]</sup>

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Nurses have an important responsibility to improve the metabolic status of individuals with diabetes, to protect them from foot complications, and to teach patients foot care skills.<sup>[14,16,17]</sup> Studies have shown that foot care is an important way to prevent diabetic foot, that training about foot care should be given<sup>[12,14]</sup>, and that proper foot care can prevent diabetic ulcers, infections, and amputations.<sup>[14,18]</sup>

One of the basic factors in individual behavior is self-efficacy. Self-efficacy is the individuals' belief that they can initiate necessary actions and achieve effective results.<sup>[19,20]</sup> Self-efficacy is an important determinant in initiating and maintaining positive healthy behaviors in chronic diseases such as COPD, asthma, and diabetes.<sup>[20,21]</sup> Self-efficacy is a valuable tool for assessing the self-efficacy of patients nurses and can increase patients' motivation to look after themselves, regulate their health behaviors and prolong their life expectancy.<sup>[14,22,23]</sup> The findings in the literature suggest that self-efficacy is effective in the management of diabetes.<sup>[24-27]</sup> However, the number of experimental studies that examine self-efficacy and diabetic foot care behaviors is very low. Conducting experimental studies in order to prevent diabetic foot may contribute to the solution of the problem. This study was carried out in order to investigate the effect of education on diabetic foot care and self-efficacy in individuals with diabetes.

## MATERIALS AND METHODS

### Type of study

This is a quasi-experimental study. It was conducted from February to July 2016 in hospitals in the city of Balıkesir in Turkey.

### Sample

G\*power 3.1.9.2 software was used to calculate a sample size of 94 people with a 5% type 1 error, 90% power, and an effect size of 0.68.<sup>[28]</sup> A total of 94 people, were admitted to two hospitals in the city center of Balıkesir between February and March 2016 (hospitalized in the internal medicine clinic and followed up by the endocrinology and internal medicine outpatient clinics) and met the criteria for admission and participated in the study. The study consisted of two groups, one control, and one experimental group. The 94 people were divided equally by age, gender, and diabetic foot history using stratified randomization.

### Data collection

The data were collected in face-to-face interviews using the Individual Diagnosis Form (socio-demographic characteristics, diagnosis of diabetes and diabetic foot, metabolic control forms), the Foot Care Behavior Scale [Appendix 1], and the Diabetic Foot Care Efficacy Scale [Appendix 2].

### Appendix 1. The Foot Care Behavior Scale.

The Foot Care Behavior Scale was developed by Borges in 2007 in line with the American Diabetes Association criteria in order to develop self-care behavior. It consists of sixteen 5-point Likert-type questions. Its Turkish validity study was carried out by Kır Biçer.<sup>[17,29,30]</sup>

### Appendix 2. The Diabetic Foot Care Self-Efficacy Scale.

This 9-item Likert-type scale was developed by Bonnie Elliott Quarles in 2005. The Turkish validity study was carried out by Kır Biçer in 2011. The scale responses range from "I am not sure at all = 0" to "I am very sure = 10" on an 11-point visual scale. The lowest possible score on the scale is 0, and the highest is 100.<sup>[21,30]</sup>

### Study design

In this randomized controlled trial, the Individual Diagnosis Form, the Foot Care Behavior Scale, and the Diabetic Foot Care Efficacy Scale were administered to the control and the experimental group during the first interview. Educational materials were created for the patients in the experimental group. These materials are a powerpoint presentation and brochure. After the questionnaire was applied to the patients in the experimental group, education was given using educational materials. The training given by one of the researchers lasted about an hour in a single session. The education content consisted of how diabetes occurs, acute and chronic complications, protection against the diabetic foot, diabetic foot treatment and care, self-efficacy, and self-efficacy in diabetic foot care. The education was given by using techniques such as lectures, question-answer, and demonstration, and tried to reinforce by receiving feedback from the patients. Three months after the training, the experimental group was re-interviewed, and the same questionnaire was re-administered. The patients in the control group were asked questions again in the forms after three months of the first interview without training. Patients in the control group received routine hospital/polyclinic services. The control group was also given training after the study was completed [Figure 1]. The content of the training includes the following topics: What is diabetes? complications of diabetes, healthy feet, how does diabetes affect the feet? common foot problems, prevention of foot problems, and appropriate shoe selection.

### Inclusion criteria

- Being 18 years or older,
- According to fasting plasma glucose, oral

glucose tolerance test, random plasma glucose measurement, and HbA1c diagnostic criteria being diagnosed with type 2 diabetes mellitus for at least six months,

- No hearing loss, inability to speak, loss of consciousness, or psychiatric problem that would prevent communication.

### Statistical analysis

Statistical Package for the Social Sciences (SPSS) 25.0 was used for data analysis, and the threshold for significance was  $P < 0.05$ . Since the continuous variables were distributed normally, the student's t-test was used to compare the two-independent group means, the paired t-test was used to compare the dependent group means, and the Chi-square test was used to compare the categorical variables.

### Ethics approval

The Balıkesir Province Public Hospitals Association Ethics Committee and the Balıkesir University Faculty of Medicine Clinical Research Ethics Committee approved the study (8/2016).

## RESULTS

There were no significant differences between the experimental and control groups by age ( $T = 0.950$ ,  $P = 0.343$ ), age group ( $\chi^2 = 0.001$ ,  $1.000$ ), gender ( $\chi^2 = 0.043$ ,  $P = 0.837$ ), diabetic foot history ( $\chi^2 = 0.001$ ,  $1.000$ ), additional disease ( $\chi^2 = 1.831$ ,  $P = 0.176$ ), marital status ( $\chi^2 = 2.014$ ,  $P = 0.156$ ), employment status ( $\chi^2 = 3.072$ ,  $P = 0.080$ ), educational status ( $\chi^2 = 3.309$ ,  $P = 0.346$ ), co-residence ( $\chi^2 = 1.983$ ,  $P = 0.159$ ), complications ( $\chi^2 = 0.949$ ,  $P = 0.330$ ) and treatment compliance perception ( $\chi^2 = 0.821$ ,  $P = 0.663$ ) [Table 1].

While the control group's self-efficacy score did not change between the first and second interviews ( $T = 0.545$ ,  $P = 0.588$ ), the experimental group's score was significantly higher after the training ( $T = 4.0668$ ,  $P = 0.001$ ) [Table 2].

While the control group's foot care behavior score did not change between the first and second interviews ( $T = 0.920$ ,  $P = 0.362$ ), the experimental

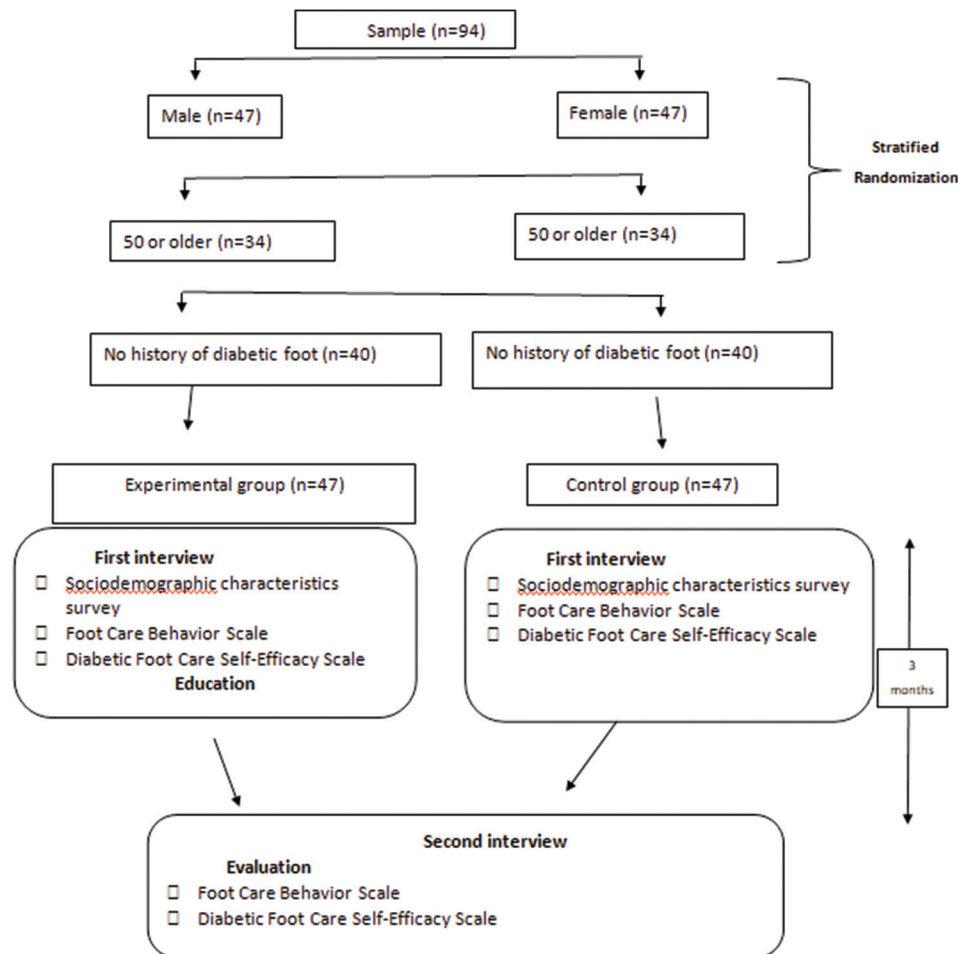
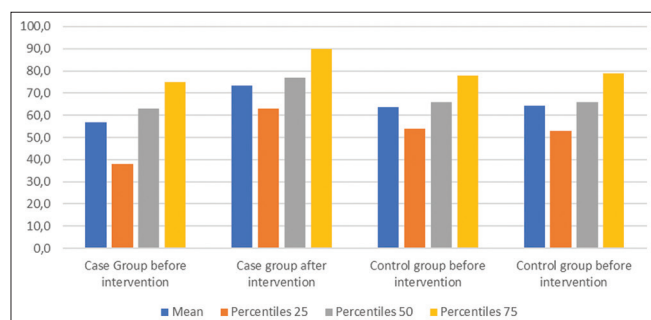
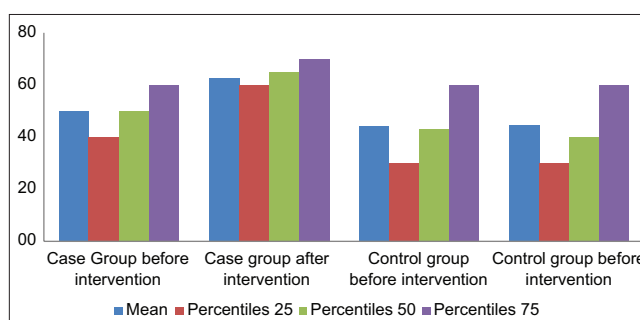


Figure 1: Study Design

**Table 1: The characteristics of the experimental and control groups**

	Control Group <i>n</i> (%)	Experimental Group <i>n</i> (%)	<i>t</i> / $\chi^2$	<i>P</i>
Mean age $\pm$ SD	59.9 $\pm$ 3.6	56.9 $\pm$ 6.3	0.950	0.343*
Age				
$\leq$ 50	13 (50.0)	34 (50.0)	0.001	1.000
$\geq$ 51	13 (50.0)	34 (50.0)		
Gender				
Male	23 (48.9)	24 (51.1)	0.043	0.837
Female	24 (51.1)	23 (48.9)		
History of diabetic foot				
Yes	7 (50.0)	40 (50.0)	0.001	1.000
No	40 (50.0)	40 (50.0)		
Additional chronic disease (hypertension, thyroiditis etc.)				
Yes	36 (76.6)	30 (63.8)	1.831	0.176
No	11 (23.4)	17 (36.2)		
Marital Status				
Married	38 (80.9)	32 (68.1)	2.014	0.156
Not married	9 (19.1)	15 (31.9)		
Employment Status				
Working	2 (22.2)	7 (77.8)	3.072	0.080
Not working	45 (95.7)	40 (85.1)		
Educational Status				
Illiterate	13 (27.3)	8 (17.0)	3.309	0.346
Primary School	28 (59.6)	27 (57.4)		
High School	3 (6.4)	7 (14.9)		
University	3 (6.4)	5 (10.6)		
Co-residence				
Alone	5 (10.6)	10 (21.3)	1.983	0.159
Family	42 (89.4)	37 (78.7)		
Complications (neuropathy, retinopathy, diabetic foot ulcer etc.)				
Yes	38 (80.9)	34 (72.3)	0.949	0.330
No	9 (19.1)	13 (27.7)		
Perception of treatment compliance				
Good	30 (63.8)	34 (72.3)	0.821	0.663
Medium	16 (34.0)	12 (25.5)		
Poor	1 (2.1)	1 (2.1)		
Total	47 (100.0)	47 (100.0)		

\**t*-test, \*\*Chi-square test, SD=standard deviation**Graph 1:** The experimental and control groups' pretest and posttest scores on the Diabetic Foot Care Self-Efficacy Scale**Graph 2:** The experimental and control groups' pretest and posttest scores on the Foot Care Behavior Scale



**Table 2: Comparison of the experimental and control groups' pretest and posttest scores on the Diabetic Foot Care Self-Efficacy Scale**

	Diabetic Foot Care Self-Efficacy Scale		Test value*	P
	Pretest Mean±SD	Posttest Mean±SD		
Control Group (47)	63.60±7.44	64.3±7.32	0.545	0.588
Experimental Group (47)	56.87±2.88	73.3±5.30	4.068	0.001

SD=standard deviation, \*paired *t*-test**Table 3: Comparison of the experimental and control groups' pretest and posttest scores on the Foot Care Behavior Scale**

	Foot Care Behavior Scale		Test value*	P
	Pretest Mean±SD	Posttest Mean±SD		
Control Group (47)	49.78±4.51	62.76±2.88	0.920	0.362
Experimental Group (47)	44.65±8.11	44.38±8.24	8.041	0.001

SD=standard deviation, \*paired *t*-test

group's score was significantly higher after the training ( $T = 8.041$ ,  $P = 0.001$ ) [Table 3].

The changes in the mean and percentiles of the self-efficacy scores of the control and experimental groups were analyzed. The control group's pretest and post-test scores were similar, while the experimental group's post-test scores increased [Graph 1].

The changes between the mean and percentiles of the control and experimental groups' foot care behavior score were analyzed. The control group's pretest and post-test scores were similar, while the experimental group's post-test scores increased [Graph 2].

## DISCUSSION

This is one of the first studies in Turkey that evaluates the effect of an educational program about preventing diabetic foot ulcer complications in patients with type 2 diabetes on diabetic foot care and self-efficacy. Although there is no direct evidence that diabetic ulcer and amputation frequency decreases can be reduced by education alone, it is known that foot care behaviors are important in the prevention of diabetic foot wounds.<sup>[28,31]</sup> According to the literature, with comprehensive lifelong education programs it is possible to control diabetes, reduce complications and develop patients' self-care skills.<sup>[32,33]</sup>

This study found that patients who received education had higher diabetic foot care self-efficacy scores after diabetic foot care training than those who did not. A study of the effectiveness of education on diabetes management found, like this study, that

patients who received appropriate education had higher self-efficacy.<sup>[34]</sup> Beckerle and Lavin's study of type 1 and type 2 diabetes patients ( $N = 57$ ), the study of Lee *et al.* with type 2 diabetes patients ( $N = 440$ ), and the study of Mohamadinejad *et al.* with type 2 diabetes patients in Iran ( $N = 70$ ) found, like our study that patients who received diabetes education had higher self-efficacy scores.<sup>[35,36]</sup> The study of Chin *et al.* carried out in North Taiwan with patients with peripheral neuropathy ( $N = 227$ ), the randomized study of Kır Biçer and Enç carried out with diabetes patients ( $N = 90$ ) and the semi-experimental randomized controlled study of Bahador *et al.* carried out with patients with diabetic foot ulcers ( $N = 60$ ) found similar results to our study, namely, that diabetic foot care training increases the self-efficacy score of patients and significantly reduces complications.<sup>[14,28,31]</sup> A study by Inoue *et al.*<sup>[37]</sup> carried out in Japan in basic care clinics with type 2 diabetes patients ( $N = 326$ ) found that there is a positive relationship between understanding diabetes care and self-efficacy. Education plays an important role in reducing foot ulcers, preventing new foot ulcers, and increasing self-efficacy, and its results are similar to those in the literature.<sup>[28]</sup>

The best way to prevent foot ulcers and complications is to teach diabetes patients about foot care.<sup>[12,38]</sup> Örmən *et al.*<sup>[9]</sup> concluded that the primary ways of preventing diabetic foot ulcers and infections are patient education, early detection of neuropathy, and glycemic control. They emphasized that the most important role in the treatment of diabetic foot infections belongs to the patient. Therefore, it is necessary to inform patients about foot hygiene, proper foot care, and shoe selection.

While the control group's foot care behavior score did not change between the first and second interviews, the experimental group's score was significantly higher after the training. Most of the participants in the experimental group significantly improved their foot care and had fewer new ulcers. Another study with diabetes patients found similar results.<sup>[7]</sup> Bozyer *et al.*<sup>[38]</sup> also found similarly that the incidence of diabetic foot was lower in patients who had good knowledge about a diabetic foot. A three-month follow-up study conducted by Gleeson-Kreig with type 2 diabetics found, like our study, that the mean score of the experimental group increased in the follow-up.<sup>[39]</sup> The studies in the literature suggest that education should be repeated periodically, and materials should be developed in order to change the behaviors of patients.<sup>[32,33,40]</sup> Kır Biçer and Enç found that the biggest change in the behavior of diabetes patients occurs in the first and third months and that only very

little change can be confirmed in the sixth month.<sup>[28]</sup> As a matter of fact, there is a tendency to repeat behaviors in areas with high self-efficacy and to avoid behaviors in areas with low self-efficacy.<sup>[41]</sup> Therefore, it is an important responsibility of health professionals to organize training programs to improve the self-efficacy of patients with diabetes and to transform the knowledge acquired by diabetic patients into behaviors.<sup>[42]</sup>

### Limitations and strengths of the study

The fact that this is a randomized controlled study increases the validity of its evidence. In addition, stratified randomization also controlled variables that could potentially affect the study. The limitation of this study is that it was conducted in hospitals located in one city. The conclusions of the study can thus be generalized only to its own population.

### CONCLUSION

In our study, the experimental group had higher self-efficacy and foot care behavior scores after education. Considering that foot care behaviors effectively prevent diabetic foot, training about self-efficacy and foot care should be given to diabetic patients. This study found that diabetic foot training had an effect on patients' self-efficacy.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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