

Contents lists available at ScienceDirect

Journal of Tissue Viability



journal homepage: www.elsevier.com/locate/jtv

Diabetic foot care behavior and self-efficacy levels in individuals with diabetic foot ulcers in Turkey



Emine Sezgunsay^{a,#}, Murat Urkan^{b,*,1}, Mustafa Deveci^c

^a Izmir University of Economics, Faculty of Health Sciences, Department of Nursing, Izmir, Turkey

^b Acibadem Bodrum Hospital, General Surgery, Mugla, Turkey

^c Private Practice, 2177. Cadde Twins İş merkezi No:10/B D:125 Söğütözü Çankaya, Ankara, Turkey

ARTICLE INFO	A B S T R A C T
Keywords: Diabetic foot Foot ulcer Nursing care Self-care Self-efficacy	Objective: This study aimed to explore the connection between demographic characteristics, diabetes-related knowledge, foot self-care behaviors, and self-efficacy levels in individuals with diabetic foot ulcers. Additionally, it investigated whether there is a correlation between foot care behaviors and self-efficacy levels among these individuals. <i>Methods:</i> This descriptive and cross-sectional study was conducted with individuals who applied to a training and research beginned to a training
	Data were collected through the Patient Identification Characteristics Form, the Diabetes Management Self- Efficacy Scale, and the Foot Self-Care Behavior Scale. Percentage, mean, Mann-Whitney U test, Kruskal-Wallis test, and Spearman correlation analysis were used to analyze the data.
	Results: The mean self-efficacy score among individuals with diabetic foot ulcers was 68.39 ± 14.03 , while the mean foot self-care behavior score was 59.10 ± 10.13 . Previous diabetes education, regular exercise, and educational status significantly influenced scores on both scales. Furthermore, a positive linear relationship was observed between foot self-care behaviors and self-efficacy levels in individuals with diabetic foot.
	<i>Conclusions:</i> To enhance self-erricacy levels and promote foot self-care behaviors in individuals with diabetic foot ulcers, continuous education, and regular follow-up examinations are essential. Providing tailored care based on demographic characteristics and evolving health conditions related to diabetes is expected to reduce complications effectively.

1. Introduction

Diabetes mellitus (DM) is a progressive chronic disease that affects an individual's life by causing acute and chronic complications. The global prevalence of diabetes among adults has been reported to have increased steadily, reaching 8.4 % [1]. Diabetic foot ulcer is a complication that significantly impacts individuals and the healthcare system. It prolongs hospital stays, imposes financial burdens, negatively affects patients' work and social lives, and increases the risks of both mortality and morbidity [2,3]. More than half of all diabetic foot ulcers become infected, significantly increasing the risk of amputation among individuals with diabetes [4]. Key complications of diabetes, such as peripheral artery disease, peripheral neuropathy, nephropathy, and diabetic foot infections, are the leading causes of amputations [3]. Additionally, a history of previously healed diabetic foot ulcers is a major risk factor for recurrence [5]. Early identification of risk factors is essential to preventing diabetic foot ulcers and their complications. Preventive strategies, including proper foot care, effective glycemic control, patient education, and proactive management of identified risks, are critical in reducing the likelihood of recurrent ulcers [6].

In many cases, diabetic foot ulcers arise from inadequate foot care practices, which can lead to infections and, ultimately, amputations [3, 7]. Well-planned, multifaceted patient education, increased awareness and training of healthcare professionals, effective treatment of foot

https://doi.org/10.1016/j.jtv.2025.100885

Received 11 June 2024; Received in revised form 20 December 2024; Accepted 8 March 2025

Available online 10 March 2025

0965-206X/© 2025 The Authors. Published by Elsevier Ltd on behalf of Society of Tissue Viability. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

^{*} Corresponding author. Acibadem Hospitals Group, Acibadem Bodrum Hospital, General Surgery, Ortakent Mah. Gölbaşı Sok. No:11, Bodrum, Muğla, Turkey. *E-mail addresses:* sezgunsay@yahoo.com (E. Sezgunsay), muraturkan@gmail.com (M. Urkan), mdeveci98@gmail.com (M. Deveci).

[#] Present address: Izmir University of Economics, Faculty of Health Sciences, Department of Nursing, Fevzi Çakmak Mah, Sakarya Cad. No:156, Balçova/İzmir/ Turkey.

¹ Present address: Acibadem Hospitals Group, Acibadem Bodrum Hospital, General Surgery, Ortakent Mah. Gölbaşı Sok. No:11, Bodrum/Muğla/Turkey.

ulcers, and regular patient follow-up have been shown to reduce the rate of diabetic foot complications. Experimental outcome studies evaluating patient education in individuals with diabetes demonstrate that such education improves diabetic foot care behaviors and self-efficacy levels, thereby reducing the risk of developing diabetic foot ulcers [8-11]. Daily foot inspection and equipment control such as shoes, appropriate daily foot hygiene, avoiding walking barefoot, trimming toenails, avoiding situations that may cause trauma to the feet, and seeking early professional care for open wounds and lesions on the feet are among the ideal diabetic foot risk management behaviors [12-14]. Individuals living with chronic disease conditions such as diabetes need to possess the necessary knowledge to effectively manage and maintain their care. Guidelines aimed at preventing diabetic foot ulcers emphasize the importance of providing education to enhance individuals' understanding and behaviors related to foot care, as well as promoting adherence to these care recommendations [14,15]."

Individuals faced with the necessity of living with a chronic health condition requiring continuous care, the beliefs in self-efficacy, and outcome expectations are important for coping with this process [16]. Self-efficacy, defined by Bandura as "the belief in one's capabilities to organize and execute the courses of action required to produce given attainments" [17], implies confidence in one's own resources rather than just abilities [18]. The self-efficacy theory suggests that individuals can initiate health service behaviors for themselves when they feel sufficient and secure, and in the context of diabetes, self-efficacy is proposed to be related to improving self-care behavior [17]. Studies report a positive relationship between perceived self-efficacy levels and foot care behaviors in individuals with diabetes and diabetic foot ulcers [19–22]. Earlier studies have observed that educational interventions related to living with diabetes are effective in increasing self-efficacy levels and developing self-care behaviors in individuals [1,9].

Previous studies in the literature have focused on examining the selfefficacy levels and self-care activities of diabetic individuals. The aim of this study is to examine the relationship between the demographic characteristics and knowledge levels about living with diabetes of individuals admitted to the hospital as outpatients for diabetic foot ulcer treatment and their foot care behaviors and self-efficacy levels. Another aim of the study is to investigate whether there is a relationship between the foot self-care behaviors of these individuals with diabetic foot ulcers and their perceived self-efficacy levels.

2. Methods

2.1. Study design and sample

This study, conducted with individuals with diabetic foot ulcers, employed a descriptive and cross-sectional design. The sample size was determined using the known population sampling method formula [Nt2pq/d2(N-1) + t2pq]. The calculation yielded a minimum participant number of 94 with a 95 % confidence interval, 0.5 margin of error, and 0.05 standard deviation.

2.2. Participants and recruitment

The population of the study consisted of individuals who presented as outpatients with complaints of diabetic foot ulcers to the Stoma and Wound Care Center of a training and research hospital in Ankara between October 2019 and October 2020. During this period, out of 123 individuals who presented to the stoma and wound care center with diabetic foot ulcer, 108 who met the inclusion criteria constituted the study sample size. The inclusion criteria were as follows: (a) being between 18 and 70 years of age, (b) being an outpatient diagnosed with DFU, (c) having no verbal, hearing, or mental barriers to communication, and (d) agreeing to participate in the study. Persons experiencing cognitive impairment and individuals with psychiatric diagnoses were excluded. Researchers identified potential participants based on predefined inclusion and exclusion criteria. After obtaining informed consent, face-to-face interviews were conducted with eligible individuals at the Stoma and Wound Care Center.

2.3. Instruments

The data were collected using the Patient Identification Characteristics Form, the Diabetes Management Self-Efficacy Scale, and the Foot Self-Care Behavior Scale.

Patient Identification Characteristics Form: This form was developed by the researchers to collect participants' sociodemographic characteristics and data related to the diagnosis of diabetic foot. The form consists of 17 questions developed based on the literature.

Foot Self-Care Behavior Scale (FSCBS): The original version of the scale was developed by Borges, and its Turkish validity and reliability were established by Bicer and Enc [23,24]. The scale consists of 16 items and uses a five-point Likert scale, where "1 = Never, 2 = Sometimes, 3 = Occasionally, 4 = Often, and 5 = Always" [24]. Scores range from a minimum of 15 to a maximum of 75, and an increase in the score is interpreted as an increase in the individual's effectiveness in foot care behavior. The Cronbach's alpha coefficient of the scale was determined as $\alpha = 0.83$ (n = 90) [24]. In this study, the Cronbach's alpha value of the scale was found to be 0.82.

Diabetes Management Self-Efficacy Scale (DMSES): Developed by Van Der Bijl et al. (1999) to determine diabetic individuals' perceptions of their ability to maintain self-care activities [25]. The Turkish validity and reliability study of the scale were conducted by Kara et al., in 2006 [26]. The scale is a five-point Likert type, and the scoring for responses is "5 = Yes, I'm sure; 4 = Yes; 3 = Neither yes nor no; 2 = No; 1 = No, I'm not sure." In the intercultural adaptation study, the scale was determined to have three factors: Diet & Feet Control (1–9, 11, 13, 14), Medical Treatment/Control (10, 12, 18–20), and Physical Exercise (15–17). The scale consists of a total of 20 items, with scores ranging from a minimum of 20 to a maximum of 100. An increase in the score indicates an increase in the individual's self-efficacy perception. The Cronbach's alpha value of the scale was found to be 0.89 [26]. In our study, the Cronbach's alpha value was determined as 0.91.

2.4. Data collection

The data were collected through face-to-face interviews conducted in the consultation room of the Stoma and Wound Care Center, with each interview lasting 15–20 min. Participants were provided with detailed information about the study's objectives, protocols, and data confidentiality, and they voluntarily agreed to participate. After reading the informed consent form, participants gave their verbal consent. Throughout the process, researchers were available to address any questions or concerns from participants, providing in-person assistance as needed.

2.5. Data analysis

IBM SPSS Statistics program was used for statistical analysis of the data obtained from the study. While the numeric variables were summarized by mean, standard deviation, categorical variables were summarized with numbers and percentages. The normality distribution of the numeric variables was examined by the Kolmogorov-Smirnov test. For data with nonnormal distribution, nonparametric tests were used. For quantitative data, the Mann-Whitney *U* test was used to compare 2 independent groups, and the Kruskal-Wallis test was used in the comparison of more than 2 groups. In case of a significant difference, pairwise comparisons were performed using Tamhane's T2 test. Spearman correlation coefficient was used for correlation between scales. All results were evaluated at a significance level of p < 0.05 with a 95 % confidence interval.

2.6. Ethical aspect of the study

Prior to initiating the study, ethical clearance was obtained from the Gulhane Education and Research Hospital Non-Interventional Research Ethics Committee, in accordance with the guidelines of the Helsinki Declaration (Decision no: 19/337). Institutional approval was also secured from the hospital where data collection would take place. Additionally, permission to use the scale employed in the study was obtained. Prospective participants visiting the outpatient clinic were informed about the study, and those who agreed to participate followed the data collection procedure.

3. Results

3.1. Characteristics of participants

Table 1 presents the participants' demographic and diabetes-related characteristics. The average age of the participants in the study, consisting of 108 individuals with diabetic foot ulcers, was 56.81 ± 8.44 years. In total, 70.4 % (n = 76) were male, 87.0 % (n = 94) were married, 51.9 % (n = 56) had primary school education, and 76.9 % (n = 83) were not employed in any job. Among the study participants, only a minority (n = 11, 10.2 %) reported that their monthly income exceeded their expenses, and 49.1 % (n = 53) stated that they lived with their spouses.

Among the diabetic foot ulcer patients participating in the study, 46.3 % (n = 50) had been diagnosed with diabetes for 10–20 years (Table 1). Additionally, 32 individuals (29.6 %) visited their doctor every three months for diabetes-related reasons. Over 80 % of the participants (n = 82, 75.9 %) reported not engaging in regular exercise, while 41.7 % (n = 45) of individuals were observed to be obese. Half of the individuals stated that they received education on diabetes management after being diagnosed with diabetes (n = 55, 50.9 %), while the other half reported that they did not receive any education.

3.2. Participants' DMSES and FSCBS scores

The average total score on the DMSES for individuals with diabetic foot ulcers was 68.39 \pm 14.03. Specifically, participants scored an average of 40.52 \pm 10.17 on the Diet & Feet Control factor, 19.77 \pm 3.08 on the Medical Treatment/Control factor, and 8.09 \pm 3.14 on the Physical Exercise factor (Table 2). Additionally, the average total FSCBS score for the study participants was 59.10 \pm 10.13.

In the DMSES, which consists of 20 items evaluating individuals' selfefficacy levels, the top three highest-scoring items were related to Medical Treatment/Control, while the lowest-scoring items were associated with Physical Exercise and Diet & Foot Control. In the FSCBS, which consists of 15 items evaluating foot self-care behaviors, the highest-scoring item was 'FSCBS 13. I wear clean, cotton, and soft socks,' while the lowest-scoring item was 'FSCBS 1. I check the temperature of the water when washing my feet' (Table 3).

3.3. Influencing factors of DMSES and FSCBS score among individuals

A statistically significant relationship was identified between the mean total scores of DMSES and factors such as educational level, income status, prior education on diabetes management, regular exercise habits, and frequency of doctor visits among patients diagnosed with diabetic foot ulcers (Table 4). Statistical significance was observed between the mean total scores of FSCBS and factors such as gender, educational level, income status, prior education on diabetes management, regular exercise habits, and frequency of doctor visits among patients with diabetic foot ulcers. Additionally, the study findings revealed a positive correlation between individuals' self-efficacy scores and foot self-care behavior scores (Table 2).

Table 1

Characteristics of individuals (n = 108).

Characteristics	Result ($n = 108$)		
	Mean	Standart Deviation	
Age	56.81	8.44	
Que las	Number (n)	Percentage (%)	
Gender	30	20.6	
Male	76	29.0	
········	, 0	,	
Marital status	04	97.0	
Single	94	87.0 7.4	
Divorced	06	5.6	
Living arrangements			
Living alone	06	5.6	
With spouse	53	49.1	
With spouse and children	39	36.1	
With children	05	4.6	
With parent	05	4.6	
Educational status			
İllitratate	14	12.9	
Elementary school graduate	56	51.9	
Middle school or high school graduate	31	28.7	
University or above	07	6.5	
Employment status			
Working	25	23.1	
Not working	83	76.9	
Income status			
Less than expenses	46	42.6	
Equals expenses	51	47.2	
More than expenses	11	10.2	
Duration of diabetes diagnosis			
1–5 years	12	11.1	
5-10 years	28	25.9	
10-20 years	50	46.3	
20–30 years	11	10.2	
More than 30 years	07	6.5	
Frequency of follow-up examination			
Don't go to the follow-up	33	33.4	
Once a month	05	4.6	
Every two months	03	2.8	
Every three months	32	29.6	
Once a year	16	14.8	
	10	11.0	
Previous education related to diabetes	50	40.1	
NO Ves	55	49.1 50.9	
	55	50.5	
Doing regular exercises	26	04.1	
Walking	26	24.1	
Doin t uo ally exercises	04	13.9	
Body Mass Index	22	01.0	
Normal weight	23 27	21.3	
Obesity	37 45	34.3 41 7	
Morbid obesity	03	2.8	

4. Discussion

In this study, conducted to examine the relationship between the demographic characteristics, foot self-care behaviors, and self-efficacy levels of individuals who presented to the hospital as outpatients for diabetic foot ulcer treatment, a significant relationship was found between some demographic characteristics and foot self-care behaviors and self-efficacy levels. Another finding of the study is the positive correlation between self-efficacy levels and foot self-care behaviors in individuals with diabetic foot ulcers. Similar to our study, many other studies have also reported a positive correlation between diabetic foot self-care behaviors and self-efficacy levels (Table 2) [22,27,28]. Moreover, studies report that individuals with higher levels of self-efficacy

E. Sezgunsay et al.

Table 2

The individuals' DMSES and FSCBS scores and the correlation between the scores of DMSES and FSCBS (n = 108).

Scales		$\textit{Mean} \pm \textit{SD}$		
Diabetes Management Self-Efficacy Scale				
Diet & feet control		40.52 ± 10.17		
Medical treatment/control		19.77 ± 3.08		
Physical exercise		$\textbf{08.09} \pm \textbf{3.14}$		
Total		$\textbf{68.39} \pm \textbf{14.03}$		
Foot Self-Care Behavior Scale		59.10 ± 10.13		
	Correlation Coefficient	p Value		
Diabetes Management Self-Efficacy Scale - Foot Self-Care Behavior Scale	0.533	<0.001		

Table 3

The three highest and lowest-scored items in DMSES and FSCBS (n = 108).

The three highest- scored items	$Mean \pm SD$	The three lowest-scored items	$\textit{Mean} \pm \textit{SD}$
DMSES 12. I think I'm able to take my medicine as prescribed.	4.56 ± 0.60	DMSES 17. I think I'm able to get sufficient physical activities, for example taking a walk or biking	2.20 ± 1.29
DMSES 19. I think I'm able to correct my blood sugar when the blood sugar value is too low.	4.05 ± 0.96	DMSES 15. I think I'm able to take extra physical activities when the doctor advises me to do so.	2.76 ± 1.22
DMSES 20. I think I can check my blood sugar if necessary.	$\textbf{3.92} \pm \textbf{1.26}$	DMSES 1. I think I'm able to follow my diet when I am away from home.	$\textbf{2.95} \pm \textbf{1.15}$
FSCBS 13. I wear clean, cotton, and soft socks.	$\textbf{4.63} \pm \textbf{0.76}$	FSCBS 1. I check the temperature of the water when washing my feet.	3.19 ± 1.58
FSCBS 14. I wear socks that fit my feet snugly but not too tight or too loose.	$\textbf{4.48} \pm \textbf{0.88}$	FSCBS 4. I do not apply cream between my toes.	3.37 ± 1.73
FSCBS 2. After washing my feet, I dry between my toes.	$\textbf{4.40} \pm \textbf{1.50}$	FSCBS 5. I cut my toenails straight.	3.50 ± 1.42

have more positive psychological health and a better quality of life [29, 30]. Studies conducted with diabetic patients suggest that individuals who engage in proper foot self-care behaviors and regularly inspect their footwear are less likely to develop foot ulcers [31]. Considering this information, foot self-care practices are thought to be an important factor in preventing lower extremity amputations in individuals with diabetes. By planning and maintaining the care they will perform, patients can prevent diabetic foot ulcers that may develop as precursors to amputation. These facts highlight the importance of foot self-care for individuals with diabetes and call for the adoption of innovative preventive care approaches, including consideration of the impact of self-efficacy in these practices. The IWGDF Guidance for the prevention of diabetic foot ulcers emphasizes patient education to promote foot self-care behaviors [15]. Understanding the factors that influence self-care behaviors and self-efficacy levels in individuals with diabetic foot ulcers can guide researchers in planning preventive interventions for diabetic individuals within their communities. Numerous studies in the literature report that theoretical and practical training programs are effective in enhancing the foot self-care and self-efficacy levels of individuals with diabetes [10,11,32,33]. It is believed that assessing the current conditions of individuals with diabetic foot ulcers and implementing one of the educational models tailored to their sociocultural context can lead to improvements in their foot self-care behaviors and self-efficacy levels.

Journal of Tissue Viability 34 (2025) 100885

Table 4

Comparison of individual DMSES and FSCBS scores among individuals with different characteristics (n = 108).

	Diabetes Management Self- Efficacy Scale		Foot Self-Care Behavior Scale	
	Mean \pm SD	Test statistics $(z/\chi^2)^a$	Mean \pm SD	Test statistics $(z/\chi^2)^a$
		p Value		p Value
Gender Female	72.46 ± 11.35	z = -1.919	63.46 ± 6.95	z = -2.788
Male	66.68 ± 14.75	p = 0.055	57.26 ± 10.71	p= < 0.005*
Educational status				
Illitratate	$\textbf{64.42} \pm \textbf{11.71}$	$\chi^2 = 18.68$	60.00 ± 9.96	$\chi^2 = 18.082$
Elementary school	64.12 ± 12.13	p = 0.000*	$\textbf{56.30} \pm \textbf{9.84}$	p = 0.00*
Middle school or high school	$\textbf{76.00} \pm \textbf{15.92}$		61.12 ± 9.60	
graduate University or postgraduate	$\textbf{76.85} \pm \textbf{3.23}$		$\textbf{70.71} \pm \textbf{3.63}$	
graduate				
Marital status Married Single Divorced	67.98 ± 13.96 67.12 ± 18.69 76.50 ± 3.83	$\begin{array}{l} \chi^2=4.294\\ p=0.117 \end{array}$	$\begin{array}{c} 59.51 \pm 9.77 \\ 58.37 \pm 14.10 \\ 53.66 \pm 10.11 \end{array}$	$\begin{array}{l} \chi^2=2.082\\ p=0.353 \end{array}$
Employment status Working	5 71.36 ± 15.24	z = -1.050	$\textbf{58.77} \pm \textbf{10.07}$	z = -0.631
Not working	$\textbf{67.50} \pm \textbf{13.62}$	p = 0.294	60.20 ± 10.45	p = 0.528
Income status Less than expenses	$\textbf{65.06} \pm \textbf{14.18}$	$\chi^2 = 12.300$	$\textbf{57.45} \pm \textbf{11.42}$	$\chi^2 = 5.941$
Equal expenses	68.45 ± 12.87	p = 0.002*	59.09 ± 9.14	p = 0.051*
More than expenses	$\textbf{82.09} \pm \textbf{10.79}$	01002	66.00 ± 5.31	
Previous education	n related to diabe	tes		
No	63.16 ± 12.31	z = -3.720	55.62 ± 10.32	z = -3.521
Yes	$\textbf{73.43} \pm \textbf{13.84}$	p= < 0.001*	62.45 ± 8.80	p = 0.000*
Regular exercises Walking	$\textbf{78.26} \pm \textbf{11.85}$	z = -4.282	64.76 ± 7.33	z = -3.290
Don't do any exercises	65.26 ± 13.25	p= < 0.001*	57.30 ± 10.26	p= < 0.001*
Frequency of follow	w-up examination	n		
Don't go to the follow-up	64.27 ± 12.05	$\chi^2 = 13.008$	$\textbf{56.77} \pm \textbf{10.08}$	$\chi^2 = 4.216$
Once a month	60.60 ± 14.25	p = 0.023*	55.00 ± 14.62	p = 0.007*
Every two	$\textbf{72.00} \pm \textbf{01.00}$		52.66 ± 01.52	,
Every three months	$\textbf{75.96} \pm \textbf{14.61}$		64.81 ± 05.86	
Every six months	64.93 ± 15.97		54.06 ± 12.34	
Unce a vear	n/(3 + 10)/9		n(143 + (194))	

 $^{\rm a}\,$ z, Mann-Whitney U test; $\chi^2,$ Kruskal.

Based on the maximum score achievable on the DMSES, the study findings suggest that patients exhibit a moderate level of self-efficacy in managing diabetes. Similarly, Çallı and Kartal (2021) reported moderate self-efficacy levels among individuals in their study [34]. However, some other studies have documented that the self-efficacy levels of individuals with diabetes are low [35,36]. Our study found that the participants' self-efficacy levels were relatively low, which may be attributed to the fact that they had not received structured and periodically reinforced education on managing life with diabetes, as recommended in The IWGDF Guidance, nor had they been exposed to consistent individual care for the regular follow-up of diabetic patients.

The study found that women's foot self-care behavior scores were significantly higher than those of men. Several studies in the literature report a significant relationship between gender and foot self-care behaviors, while others indicate no significant difference [7,27,37–39]. However, even in studies where the difference was not significant, women's foot self-care behavior scores were still reported to be higher than those of men. A possible explanation for this could be that women are more diligent than men in maintaining self-care practices and exhibit higher motivation in this regard.

In the study, a significant difference was found between individuals' educational status and their total scores on the DMSES. Consistent with previous studies, as the educational status of diabetic individuals increases, their self-efficacy scores for diabetes management also improve [27,36,40]. Similarly, it has been found that as educational levels rise, scores on the FSCBS also increase [27,37,41,42]. These findings suggest that individuals with higher education levels may be better able to understand and apply their knowledge, which contributes to higher scale scores. Additionally, it is believed that individuals with higher educational levels possess advanced skills in seeking information, information retrieval, and comprehension, which may further enhance their foot self-care practices and self-efficacy. Another finding observed in the results of this study is that, although individuals' self-efficacy levels for diabetes management were found to be moderate, those who had previously received education on living with diabetes had significantly higher self-efficacy levels and foot self-care behavior scale scores compared to those who had not received such education. This finding suggests that being informed and empowered about diabetes management is associated with greater self-efficacy and improved foot self-care behaviors. This finding also supports the need for individuals with diabetes mellitus to receive not only comprehensive education focused on skill development but also counseling and behavioral intervention programs over a certain period to acquire, utilize, and sustain essential self-management skills. It has been reported in various studies that care and behavior change education provided to individuals with diabetes increases their self-efficacy perceptions [16,36,41,43]. However, patients with diabetes need counseling and behavioral skill-building interventions that include practical problem-solving techniques and coping skills to overcome barriers associated with a complex and long-term regimen [35]. Through education and counseling provided to individuals, they acquire skills to actively participate in their own care and treatment processes, effectively manage challenges, and enhance their quality of life. The findings of this study also support the idea that conducting follow-up examinations for individuals with diabetic foot ulcers under a personalized plan increases the patient's awareness. The study measured that there was a significant difference between the frequencies of attending diabetes-related regular follow-up examinations and self-efficacy and foot care behaviors. Individuals who go for follow-up examinations every three months have higher average scores for both self-efficacy levels and foot self-care behavior compared to other groups. Studies in the literature report that individuals who go for regular follow-up examinations every 3 or 6 months have significantly better foot care behaviors than those who do not go for regular check-ups [40,44]. Regular follow-up examination appointments increase diabetic individuals' adherence to treatment and the education provided during these re-examinations plays an important role in increasing awareness about living with diabetes and foot care.

In the study, it was observed that individuals who engage in regular exercise have significantly higher self-efficacy levels and foot self-care behavior scale scores compared to those who do not engage in regular exercise (Table 4). Our findings align with previous research that has explored the impact of exercise on individuals' self-efficacy levels [40, 45]. It is well-established that regular physical exercise helps individuals

regulate their blood glucose levels and prevent diabetes-related complications. Consequently, individuals may perceive themselves as better able to manage their own care, which, in turn, could enhance their self-efficacy perceptions.

4.1. Limitations of the study

One of the limitations of this research is having a relatively small sample size and being conducted in a single center. Another limitation is that the participants' diabetic foot care behaviors were evaluated solely based on their verbal statements.

5. Conclusions

The study found that self-efficacy levels in individuals with diabetic foot ulcers are influenced by factors such as the individual's level of education, income status, receiving previous education related to diabetes, engaging in regular exercise, and frequency of follow-up examination. Foot self-care behaviors among the individuals, in addition to the factors affecting self-efficacy levels, were also observed to be influenced by the gender variable. The study also found a positive linear correlation between self-efficacy levels and foot self-care behaviors in individuals. Based on these results, it is recommended to organize and maintain educational programs for individuals with diabetic foot ulcers that encompass all dimensions of diabetic life to establish self-efficacy and improve foot self-care behaviors. Providing regular follow-up examinations for individuals enables the evaluation of the effectiveness of education and planned treatments, allowing for additional interventions to be implemented as needed.

In efforts to improve individuals' self-efficacy and foot self-care behaviors to prevent diabetic foot ulcers, it is crucial to consider the influence of factors such as education level and socioeconomic status on intervention outcomes. This study provides a foundation for future research to explore the impact of structured, systematic educational programs on self-efficacy and foot self-care behaviors.

Author contributions

E.S. and M.D. conceptualized the study design and methodology. E.S and M. U. collected and analyzed data and prepared the first draft of the manuscript. All authors contributed to interpretation of the results and provided critical revisions to the manuscript. All authors read and approved the final version submitted for publication.

Conflict of interest

The authors declare that they have no conflicts of interest.

The manuscript titled "Diabetic foot care behavior and self-efficacy levels in individuals with diabetic foot ulcers in Turkey" has been read and approved by all authors. All authors meet the authorship criteria. All rights owners are listed as authors. This study has not been published or submitted elsewhere, any language for publication. It is not currently under consideration for publication by another journal.

Acknowledgments

We would like to express our gratitude to Stoma and Wound Care Center for providing us with the opportunity to conduct this study, and to the individuals who participated in the study by agreeing to respond to the questionnaires.

References

 Hicks CW, Selvarajah S, Mathioudakis N, et al. Burden of infected diabetic foot ulcers on hospital admissions and costs. Ann Vasc Surg 2016;33:149–58. https:// doi.org/10.1016/j.avsg.2015.11.025.

- [2] Uçkay I, Gariani K, Pataky Z, Lipsky BA. Diabetic foot infections: state-of-the-art. Diabetes Obes Metabol 2014 Apr;16(4):305–16. https://doi.org/10.1111/ dom.12190.
- [3] Sen P, Demirdal T, Emir B. Meta-analysis of risk factors for amputation in diabetic foot infections. Diabetes Metab Res Rev 2019 Oct;35(7):e3165. https://doi.org/ 10.1002/dmrr.3165.
- [4] Selva Olid A, Solà I, Barajas-Nava LA, Gianneo OD, Bonfill Cosp X, Lipsky BA. Systemic antibiotics for treating diabetic foot infections. Cochrane Database Syst Rev 2015 Sep 4;2015(9):CD009061. https://doi.org/10.1002/14651858.
- [5] Armstrong DG, Swerdlow MA, Armstrong AA, Conte MS, Padula WV, Bus SA. Fiveyear mortality and direct costs of care for people with diabetic foot complications are comparable to cancer. J Foot Ankle Res 2020 Mar 24;13(1):16. https://doi.org/ 10.1186/s13047-020-00383-2.
- [6] Qin Q, Oe M, Nakagami G, et al. The effectiveness of a thermography-driven preventive foot care protocol on the recurrence of diabetic foot ulcers in lowmedical resource settings: an open-labeled randomized controlled trial. Int J Nurs Stud 2023 Oct;146:104571. https://doi.org/10.1016/j.ijnurstu.2023.104571.
- [7] Pourkazemi A, Ghanbari A, Khojamli M, Balo H, Hemmati H, Jafaryparvar Z, et al. Diabetic foot care: knowledge and practice. BioMed Central Endocrine Disorders 2020 Dec;20:1–8. https://doi.org/10.1186/s12902-020-0512-y.
- [8] Dorresteijn JA, Kriegsman DM, Assendelft WJ, Valk GD. Patient education for preventing diabetic foot ulceration. Cochrane Database Syst Rev 2012 Oct 17;10: CD001488. https://doi.org/10.1002/14651858.CD001488.pub4.
- [9] Liang R, Dai X, Zuojie L, Zhou A, Meijuan C. Two-year foot care program for minority patients with type 2 diabetes mellitus of Zhuang tribe in Guangxi, China. Can J Diabetes 2012;36(1):15–8. https://doi.org/10.1016/j.jcjd.2011.08.002.
- [10] Nekouei M, Tehrani FJ, Vasli P, Nasiri M. The effect of seven-step educational strategy on knowledge of diabetic foot ulcer prevention, critical thinking and selfefficacy of nursing students: a randomized controlled trial. Nurse Educ Today 2024 Jun 1;137:106164. https://doi.org/10.1016/j.nedt.2024.106164.
- [11] Dündar C, Akıncı GE. Knowledge and practice of foot care in diabetic inpatients: a descriptive cross-sectional study. Erciyes Medical Journal 2017 Dec 1;39(4):160–4. https://doi.org/10.5152/etd.2017.17023.
- [12] Bonner T, Foster M, Spears-Lanoix E. Type 2 diabetes-related foot care knowledge and foot self-care practice interventions in the United States: a systematic review of the literature. Diabet Foot Ankle 2016 Feb 17;7:29758. https://doi.org/10.3402/ dfa.v7.29758.
- [13] Manickum P, Mashamba-Thompson T, Naidoo R, Ramklass S, Madiba T. Knowledge and practice of diabetic foot care - a scoping review. Diabetes Metab Syndr 2021 May-Jun;15(3):783–93. https://doi.org/10.1016/j.dsx.2021.03.030.
- [14] Tan T, Shaw EJ, Siddiqui F, Kandaswamy P, Barry PW, Baker M. Inpatient management of diabetic foot problems: summary of NICE guidance. British Medikal Journal 2011 Mar 23:342. https://doi.org/10.1136/bmj.d1280.
- [15] Bus S, Van Netten S, Lavery L, Monteiro-Soares M, Rasmussen A, Jubiz Y, et al. International Working Group on the Diabetic Foot. IWGDF guidance on the prevention of foot ulcers in at-risk patients with diabetes. Diabetes Metab Res Rev 2016 Jan;32(Suppl 1):16–24. https://doi.org/10.1002/dmrr.2696.
- [16] Erol Ö, Yanık YT. Evaluation of self-efficacy levels of individuals with type 2 diabetes. Journal of Anatolia Nursing and Health Sciences 2016;19(3). https://doi. org/10.17049/ahsbd.22818.
- [17] Bandura A. Self-efficacy. In: Ramachaudran VS, editor. Encyclopedia of human behavior, vol. 4. New York: Academic Press; 1994. p. 71–81.
- [18] Yildirim F, Ilhan IO. Genel Özyeterlilik Ölçeği Türkçe Formunun Geçerlilik ve Güvenilirlik Çalişmasi [The validity and reliability of the general self-efficacy scale-Turkish form]. Türk Psikiyatri Derg 2010;21(4):301–8. Winter, Turkish. PMID: 21125505, https://www.turkpsikiyatri.com/PDF/C21S4/04.pdf. 31st Agust 2023.
- [19] Johnston-Brooks CH, Lewis MA. Self-efficacy impacts self-care and HbA1c in young adults with type I diabetes. Psychosom Med 2002;64(1):43–51. https://doi.org/ 10.1097/00006842-200201000-00007.
- [20] Aljasem LL, Peyrot M, Wissow L, Rubin RR. The impact of barriers and self-efficacy on self-care behaviours in type 2 diabetes. Diabetes Educat 2001;27(3):393–404. https://doi.org/10.1177/014572170102700309.
- [21] Bahador RS, Afrazandeh SS, Ghanbarzehi N, Ebrahimi M. The impact of threemonth training programme on foot care and self-efficacy of patients with diabetic foot ulcers. J Clin Diagn Res: J Clin Diagn Res 2017 Jul;11(7):IC01. https://doi. org/10.7860/JCDR/2017/29025.10261.
- [22] Ahmad Sharoni SK, Abdul Rahman H, Minhat HS, Shariff-Ghazali S, Azman Ong MH. The effects of self-efficacy enhancing program on foot self-care behaviour of older adults with diabetes: a randomised controlled trial in elderly care facility, Peninsular Malaysia. PLoS One 2018 Mar 13;13(3):e0192417. https://doi.org/ 10.1371/journal.pone.0192417.
- [23] Borges WJ, Ostwald SK. Improving foot self-care behaviors with pies sanos. West J Nurs Res 2008;30(3):325–41. https://doi.org/10.1177/0193945907303104.
- [24] Biçer EK, Enç N. Validity and reliability of the Turkish adaptation of the foot selfcare behavior scale. Diyabet, Obezite ve Hipertansiyonda Hemşirelik Forumu. 2014;6(2):35–9. https://www.tdhd.org/assets/uploads/dergiler/2014-2_ANA_ METIN.pdf.

- [25] Bijl JV, Poelgeest-Eeltink AV, Shortridge-Baggett L. The psychometric properties of the diabetes management self-efficacy scale for patients with type 2 diabetes mellitus. J Adv Nurs 1999 Aug;30(2):352–9. https://doi.org/10.1046/j.1365-2648.1999.01077.x.
- [26] Kara M, Van Der Bijl JJ, Shortridge-Baggett LM, Asti T, Ergunay S. Cross-cultural adaptation of the diabetes management self-efficacy scale for patients with type 2 diabetes mellitus: scale development. Int J Nur Stud. 2006;43:611–21. https://doi. org/10.1016/j.ijnurstu.2005.07.008.
- [27] Duran MÇ, Tosun AS. Diabetes burden and self-efficacy levels as determinants of foot care behaviors in older adults: descriptive comparative study. Türkiye Diyabet ve Obezite Dergisi 2023;7(1):41–51. https://doi.org/10.25048/tudod.1199550.
- [28] Huda N, Sukartini T, Pratiwi NW. The impact of self-efficacy on the foot care behavior of type 2 diabetes mellitus patients in Indonesia. Jurnal Ners 2019;14(2): 181–6. https://doi.org/10.20473/jn.v14i2.16741.
- [29] Jiang R, Ta X, Xu M, Luo Z, Du Y, Zhong X, et al. Mediating role of depression between diabetes management self-efficacy and diabetes self-care behavior among elderly type 2 diabetes mellitus patients in China. Psychol Res Behav Manag 2023 Dec;31:1545–55. https://doi.org/10.2147/PRBM.S396916.
- [30] Wu SFV, Huang YC, Lee MC, Wang TJ, Tung HH, Wu MP. Self-efficacy, self-care behavior, anxiety, and depression in Taiwanese with type 2 diabetes: a crosssectional survey. Nurs Health Sci 2013;15(2):213–9. https://doi.org/10.1111/ nhs.12022.
- [31] Westby M, Norman G, Vedhara K, Game F, Cullum N. Psychosocial and behavioural prognostic factors for diabetic foot ulcer development and healing: a systematic review. Diabet Med 2020 Aug;37(8):1244–55. https://doi.org/ 10.1111/dme.14310.
- [32] Yıldırım Ayaz E, Dincer B, Oğuz A. The effect of foot care education for patients with diabetes on knowledge, self-efficacy and behavior: systematic review and meta-analysis. Int J Low Extrem Wounds 2022 Sep;21(3):234–53. https://doi.org/ 10.1177/15347346221109047.
- [33] Goodall RJ, Ellauzi J, Tan MK, Onida S, Davies AH, Shalhoub J. A systematic review of the impact of foot care education on self efficacy and self care in patients with diabetes. Eur J Vasc Endovasc Surg 2020 Aug 1;60(2):282–92. https://doi. org/10.1016/j.ejvs.2020.03.053.
- [34] Çalli D, Kartal A. The relationship between self-efficacy of diabetes management and well-being in patients with type 2 diabetes. Niger J Clin Pract 2021;24(3): 393–9. https://doi.org/10.4103/njcp.njcp_280_18.
- [35] Al-Khawaldeh OA, Al-Hassan MA, Froelicher ES. Self-efficacy, self-management, and glycemic control in adults with type 2 diabetes mellitus. J Diabetes Complications 2012;26(1):10–6. https://doi.org/10.1016/j. idiacomp.2011.11.002.
- [36] Arslan B, Özdelikara A. The effect of self-efficacy level on quality of life in patients with type-2 diabetes. Türkiye Diyabet ve Obezite Dergisi 2023;7(1):30–40. https:// doi.org/10.25048/tudod.1255709.
- [37] Solan YM, Kheir HM, Mahfouz MS, Al-Faify AA, Hakami DT, Al Faifi MA, et al. Diabetic foot care: knowledge and practice. J Endocrinol Metab 2016;6(6):172–7. https://doi.org/10.14740/jem388e.
- [38] Alhuqayl AA, Alaskar MS, Alsahli FM, Alaqil SA. Awareness of foot care among diabetic patients. International Journal of Medicine in Developing Countries 2019; 3(2):154–8. https://doi.org/10.24911/IJMDC.51-1540846403.
- [39] Magbanua E, Lim-Alba R. Knowledge and practice of diabetic foot care in patients with diabetes at Chinese General Hospital and Medical Center. J ASEAN Fed Endocr Soc 2017;32(2):123–31. https://doi.org/10.15605/jafes.032.02.05.
 [40] Keskin Kiziltepe S, Koc Z, Kavalali Erdogan E, Saglam Z. Determination of self-
- [40] Keskin Kiziltepe S, Koc Z, Kavalali Erdogan E, Saglam Z. Determination of selfefficacy levels of diabetic individuals. New Trends and Issues Proceedings on Advances in Pure and Applied Sciences 2019;11:55–70. https://doi.org/10.18844/ gjpaas.v0i11.4313.
- [41] Li R, Yuan L, Guo XH, Lou QQ, Zhao F, Shen L, et al. The current status of foot self-care knowledge, behaviours, and analysis of influencing factors in patients with type 2 diabetes mellitus in China. Int. J. Nurs. Sci. 2014 Sep 1;1(3):266–71. https://doi.org/10.1016/j.ijnss.2014.05.023.
 [42] Colak B, Duran R, Ece I, Yormaz S, Zaland AW, Taşdelen E, et al. Measurement of
- [42] Colak B, Duran R, Ece İ, Yormaz S, Zaland AW, Taşdelen E, et al. Measurement of diabetic patients' knowledge about diabetic foot wound and evaluation of foot care practices. Turk J Diab Obes 2020;4(1):22–9. https://doi.org/10.25048/ tudod.628593.
- [43] Abrar EA, Yusuf S, Sjattar EL, Rachmawaty R. Development and evaluation educational videos of diabetic foot care in traditional languages to enhance knowledge of patients diagnosed with diabetes and risk for diabetic foot ulcers. Primary care diabetes 2020 Apr 1;14(2):104–10. https://doi.org/10.1016/j. pcd.2019.06.005.
- [44] Yücel F, Sunay D. Assessment of knowledge, attitudes, and behaviours of diabetic patients about diabetic foot and foot care. Ankara Medical Journal 2016;16(3): 270–84. https://doi.org/10.17098/amj.53438.
- [45] Küçük S, Uludaşdemir D, Karşıgil P, Güven İ. Determination of healthy lifestyle behaviors in type 2 diabetes and diabetes self-efficiency. Turkish Journal of Diabetes and Obesity 2023 Aug 8;7(2):112–21. https://doi.org/10.25048/ tudod.1299744.