

EVALUATION OF DIABETIC FOOT SELF-CARE IN PEOPLE WITH DIABETES MELLITUS

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Abstract. This study evaluates the knowledge, habits and practical behaviour of diabetic foot self-care in people with diabetes mellitus, with a focus on ulcer prevention. Diabetic foot self-care in people with diabetes mellitus is an important element of feet health care and nurturing. Peripheral neuropathy, ischemia and feet deformities significantly increase the risk of ulcers and infections, especially when patients do not notice injuries or do not apply preventive care. Active and appropriate foot self-care helps maintain feet health and prevent feet problems, such as ulcers. The study included 128 respondents who are 18 years old and older, with diabetes mellitus and diabetic foot, as well. Data were collected using a structured questionnaire developed by the researchers of this study, which was based on the „Nottingham Assessment of Functional Footcare”, and processed using mathematical, graphical and descriptive analysis.

Keywords: diabetes mellitus, diabetic foot, diabetic foot ulcer, self-care

INTRODUCTION

Diabetes mellitus (hereinafter referred to as DM) is one of the leading causes of lower limb amputations in the United States of America and Europe. The development of diabetic foot ulcers (hereinafter referred to as DFU) is usually driven by a number of interrelated risk factors, including peripheral ischemia, neuropathy, and foot deformities (Yazdanpanah et al., 2024). According to Matijevich et al. (2024), it is estimated that approximately 34% of people with DM will develop a foot ulcer during their lifetime, and the risk of ulcer recurrence is particularly high, i.e., approximately 40%, of which as many as 30% recur within the first 6 months after initial healing.

The course of the disease and the development of complications of DM are influenced by behavioural, demographic, biological and social factors. Diabetic foot (hereinafter referred to as DF) is considered one of the most common long-term complications of DM, and DFU is its most severe and life-quality deteriorating expression (Costa et al., 2024). Studies by Moghaddam Ahmadi et al. (2024) show that the risk of mortality within 5 years from the first diagnosis of DFU in individuals with DM reaches 43–55%, which emphasizes the need to better understand, manage and early prevent risk factors associated with DFU prevention.

Peripheral neuropathy caused by DM results in reduced pain and sensory perception in the foot, which often leads to patients not noticing or evaluating injuries and often ignoring even obvious injuries, which increase the risk of foot ulcers and infections (Jumain & Rasiman, 2024). Although the International Foundation of DM estimates that 40 to 60 million people worldwide suffer from DFU, it is important to interpret these numbers with caution due to possible differences in prevalence depending on monitoring methods and different definitions of ulcers (Nawaz et al., 2024).

The main barriers to preventive care for DF are insufficient knowledge about foot care, low sensitivity to the risk of ulcers, foot care practices not discussed with specialists or not applied properly, financial difficulties, lack of motivation and self-confidence, and fear of recognizing individual risk factors (Sirait et al., 2024). Patient education, like strengthening foot hygiene skills and awareness of appropriate footwear, early signs of foot damage and wound care recommendations, has been shown to be the most effective tool to reduce the recurrence of DF and the risk of amputations (Untari et al., 2024). Properly organized preventive education can help prevent up to 85% of DF-related amputations, therefore early risk identification and timely intervention are critically important (Shani & Kaya, 2024).

Considering the growing prevalence of DM worldwide and the increasing burden of complications, it is necessary to emphasize the attention of patients and healthcare professionals to DM self-care and systematically strengthen preventive education, especially in DFU risk groups (Lee et al., 2024; Kaushal et al., 2024). Patients with DM need to know in which cases it is necessary to immediately contact a healthcare institution, how to recognize threatening symptoms and how to reduce the risk of foot damage through daily habits in order to adapt better to the disease and prevent complications (Shani & Kaya, 2024).

The object of the research: diabetic foot self-care for people with diabetes mellitus.

The aim of the research: to evaluate diabetic foot self-care in individuals with diabetes mellitus.

Research tasks:

1. To identify the habits and main information sources about foot self-care that affect the health of patients with diabetic foot.

2. To assess the level of self-care efforts of patients with diabetic foot.

3. To identify the main self-care mistakes of patients with diabetic foot.

Research methods: Scientific Literature Analysis; Structured Survey; Mathematical Calculation and Graphical Descriptive Analysis of the obtained data.

ANALYSIS OF SCIENTIFIC LITERATURE

DM patients should carefully care for and examine their feet to prevent the development of DF and possible defects. These patients should report foot problems not only when they are injured or bleeding, but also when symptoms or signs of foot ulcers are detected, including cracks, colour and temperature changes in the skin of the feet (Untari et al., 2024). Since DM patients cannot always attend health care facilities, regular availability of general practice nurses at home would help to effectively monitor and reduce DM complications, such as DFU. These professionals should educate DM patients to increase patient knowledge of foot care and reduce the morbidity of DF. Any visual and comprehensive foot care booklets would help to improve patient self-care too (Shani & Kaya, 2024).

Properly fitting footwear is an essential element in the prevention of DFU, as it reduces inflammation and the formation of calluses (Yazdanpanah et al., 2024). Regardless of whether there is an ulcer or not, patients with DM should monitor themselves for the possibility of ingrown toenails, bleeding or redness when removing shoes and socks (i.e. any footwear), and symptoms of ulceration that may be caused by wrong footwear (Untari et al. 2024). Orthopaedic footwear should be a priority for individuals with DM: they should be encouraged to wear them all day, and especially if foot deformities are detected, they should always wear orthopaedic footwear that matches the shape of their foot and fits properly (Hazbiu et al., 2024). Hence, proper footwear is important to maintain foot health and prevent injuries. Untari et al. (2024) note that patients with DF should avoid walking barefoot, try to wear shoes not only outdoors, but also indoors and after bathing, and should choose extremely comfortable and safe footwear, as well.

According to Hazbiu et al. (2024), only one-third of individuals at risk of DFU actually follow proper foot care instructions. Moisturizing the feet and examining the feet daily can reduce the risk factors for developing foot ulcers. A study by Turner et al. (2024) revealed that up to half of patients with DFU do not participate in regular foot care activities, including trimming their toenails. And according to Untari et al. (2024), trimming nails is a common practice to shorten toenails, but for the prevention of DFU, nails are specifically cut straight, i.e., not round, in order to prevent ingrown nails. Patients who are unable to properly trim their nails at least once a week should be referred to a podiatrist.

The reduction in the incidence of DFU may be associated with education that includes topics of importance to the patient, such as preventive foot care, self-control, and glycaemic control (Yazdanpanah et al., 2024). Strategies to promote the DFU health care plan are currently being proposed, involving the latest technologies that allow monitoring of the use of prescribed appropriate footwear or adherence to other aspects of the care plan. Integrating these data into a remote patient monitoring system provides objective insights that promote patient engagement in DFU care, including individualized patient-structured education and reinforcement of self-care practices (Matijevich et al., 2024). The management of DF is highly dependent on patient engagement and foot self-care behaviours, such as regular foot self-monitoring, foot skin care, adherence to recommended footwear, prompt consultation with a healthcare professional for any pre-ulcerative lesions, optimal foot and skin care, and optimal diabetes self-control requirements (Zhu et al., 2024). According to Swaminathan et al. (2024), patient-centred outcomes, including wound healing rate, amputation rate, quality of life, and healthcare resource use, provide invaluable insights into the effectiveness of DF management approaches.

METHODOLOGY

Three main research methods were chosen to carry out the study:

1. Scientific source analysis. Scientific publication databases, like EBSCO Publishing, MDPI, NCBI PubMed and ResearchGate, were used for scientific source analysis. The used scientific articles and other publications were in English and at least from 2023. Material was searched and analysed using keywords of the topic, such as diabetes mellitus, diabetic foot, diabetic foot ulcer and diabetic foot self-care, as well. Furthermore, the most relevant and important information describing and investigating 30 scientific articles related to DF and its symptoms, DFU risk factors, DF problems, DF care principles were selected and reviewed in the theoretical aspect. These analysed scientific sources helped not only to understand the research problem, relevance and significance, but also to predict further sequence of the research and the necessary research instruments.

2. Questionnaire survey. In order to evaluate the respondents' sociodemographic indicators and indicators related to diabetes mellitus, DF and its ulcer profile, based on scientific literature and similar studies conducted by researchers, an original questionnaire was developed. Questions included the respondents' demographic data, duration of DM disease, DF type, ulcer characteristics, medications, blood sugar levels, unhealthy habits and sources of information about DF prescription. In order to assess the respondents' foot care knowledge and practice, the "Nottingham Functional Foot Care" (hereinafter referred to as NAFF) questionnaire was used which was developed by researchers from the University of Nottingham, the University of Lincoln, etc. in 2008, and revised in 2015. NAFF is a self-assessment instrument designed to assess the foot care behaviour of people with diabetes. This instrument contains of 28 items designed to assess how people adhere to the recommended foot care behaviour. The questions cover important aspects of foot self-care, such as daily foot washing/cleaning, use of moisturizer, change of socks, and daily foot and shoe evaluation. Response options for this instrument are presented on a four-point scale from "rarely" to "often." Each statement is scored from 0 to 3. The sum of the statement scores is then calculated, with a higher sum score indicating better foot self-care (Sipilä et al., 2023). The maximum possible score is 78. Patients who scored:

- o more than 70 points - have a good foot care knowledge and practice,

- o 50-70 points - have an average knowledge and practice of foot care,
- o less than 50 points - have a poor knowledge and practice of foot care.

The publicly available and accessible NAFF has been widely published in scientific journals and is suitable for both scientific research and clinical purposes. The questionnaire was developed for use in health care and rehabilitation institutions, and its psychometric properties have been determined. Permission from the authors is not required in order to use this questionnaire, but the source must be indicated.

3. Mathematical, graphical and descriptive analysis of the obtained data. Descriptive data were used in the data analysis in order to provide frequency, percentage and standard deviation. Microsoft Office Excel 2016 was used for mathematical and graphical analysis and for descriptive analysis. The obtained data were presented in diagrams and tables, emphasizing the essential results.

The organization of the study can be divided into 3 main stages (Figure 1):

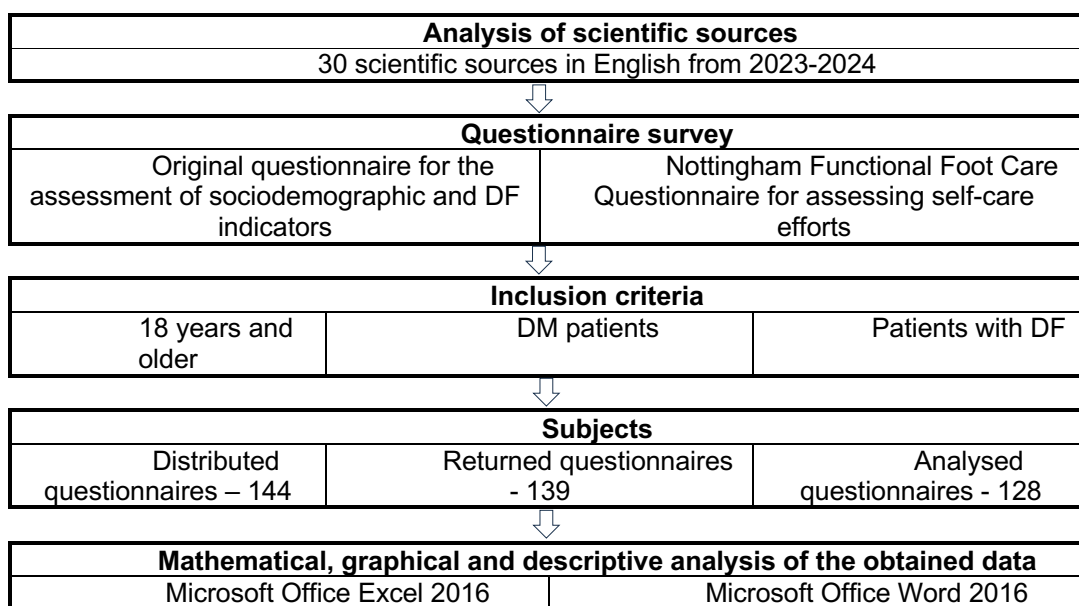


Figure 1. **Research Organization Chart**

Potential survey participants were introduced to the rules for filling out the questionnaire, the idea and purpose of the study, and the possibility of withdrawing from the study at any time. They were assured of their anonymity and confidentiality in advance, and the principle of presenting the study results in a summarized form was explained to them.

RESULTS

The data provided by the respondents show that only a small part of the respondents were aged 18-29. The vast majority of respondents with DM and DF were between 30-59 years old, and only about 15% of all respondents were over 60 years old. Moreover, when examining the distribution of respondents by gender, it is clearly seen that more than half of the respondents were men, and almost 40% were women. Interestingly, the results obtained on the marital status of the respondents specified that most people with DM and DF have a significant other, i.e., they are engaged or married, and almost a third are widowed or single. Hence, the characteristics of the demographic indicators of all respondents participating in the study noted that this is a fairly standard target group of people with DM and DF. According to Turner et al. (2024), older people most often suffer from DF, while according to Basiri et al. (2024), men are more likely to encounter this problem, and Costa et al. (2024) emphasize that it is common for such patients to be lonely and reluctant to socialize.

Most authors focus on the analysis of certain habits of patients with DM and DF, such as smoking, nutrition, physical activity, etc., and what contribution their environment makes to the acquisition and improvement of patients' knowledge about DF care. In turn, the study participants were also asked about their current situation with smoking habits. Surprisingly, but majority of those surveyed have never smoked, but a third currently either had or still have a smoking habit, i.e., a fifth used to smoke, and almost 8% of people with DM and DF still smoke even when they are sick. Moreover, the analysis of the results showed that more than half of those with DM and DF usually follow the nutritional recommendations, almost a quarter - sometimes. Only almost a tenth of the respondents said that their eating habits are always balanced, and 3.9% do not follow any healthy eating habits at all, though they suffer from DM and DF.

Further analysis of the results revealed that almost half of the respondents sometimes perform daily foot exercises lasting at least 30 minutes, and almost a third of DM and DF patients – most often. Furthermore, analysis reviewed the sad side: only almost a tenth of the respondents noted that they always devote time to foot exercises every day, and almost a fifth of the respondents never perform the necessary daily foot exercises. When analysing the research data, it is necessary to take into account the essential information sources that people with DM and DF pay most attention to for their care: almost the

absolute majority of respondents identified a nurse-diabetologist, podiatrist and other people with DM as their main information sources. Slightly more than half of the respondents rely on the help of a doctor and the media, less than half - accumulate knowledge with the help of family and relatives or use the services of a diabetes school. And the smallest part of the respondents, i.e., a third, was dominated by the information provided by those closest to them - family and friends (Table 1).

Table 1

Characteristics of respondents' health-affecting habits and information sources		
Indicator	Characteristics	Percentage
Smoking habits	Yes, have	7.8%
	Yes, had	20.3%
	No, never had	71.9%
Dietary habits	Never	3.9%
	Always	8.6%
	Sometimes	23.4%
	Often	64.1%
Feet exercise	Always	9.4%
	Never	18.8%
	Often	28.9%
	Sometimes	43.0%
Information sources	Friends and peers	28.1%
	Diabetes school	39.8%
	Family and relatives	40.6%
	Media (i.e., internet, television, radio, press)	50.8%
	Doctor	60.2%
	Other people with diabetes mellitus	86.7%
	Podiatrist	90.6%
	Nurse-diabetologist	97.7%

In transition to the analysis of the NAFF questionnaire results, it is important to note that individuals with DM and DF had to mark one appropriate option for each of the 28 statements. The questionnaire covers important areas of foot care, such as daily foot washing/cleaning, use of moisturizer, change of socks, and daily foot and shoe examination.

The analysis of the respondents' foot examination revealed not very encouraging results. Almost half of the respondents admitted that they examine their feet 2-6 times a week which is extremely rarely compared to DF patients. One third of the patients examine their feet at least once a day. The least frequently, i.e., at least once a week, foot care is performed by almost 4% of the respondents. Unfortunately, slightly more than one fifth of the respondents check their feet more than once a day, as should be usual for people with DM and DF (Table 2). Hence, patients with DM and DF do not devote enough time to daily foot examination.

Table 2

Foot examination	
Frequency	Percentage
Once a week or less	3.9%
More than once a day	22.7%
Once a day	29.7%
2-6 times a week	43.8%

The respondents' answers can be used to decide how regularly people with DM and DF use a moisturizing foot cream. Surprisingly, a striking trend is that more than half of the respondents admitted that they never use moisturizing foot cream, and one fifth of respondents use it only approximately once a month. It is necessary for such patients to use a moisturizing foot cream daily, but only a little more than a tenth of them do so. Another equal number of respondents use the cream at least once a week (Table 3). This indicator shows that most patients with DM and DF do not really understand and/or do not practice daily or frequent use of moisturizing foot cream.

Table 3

Use a moisturizing foot cream	
Frequency	Percentage
Daily	11.7%
Once a week	11.7%
Once a month	19.5%
Never	57.0%

Analysis of a frequency of how often people with DM and DF change their socks and tights reviewed a tendency that not all patients with this type of condition change their socks/tights frequently on a daily basis. This is done by slightly more than a fifth of the respondents. However, a third of all study participants admit that they practice changing their

socks/tights daily. Another third admitted that they change their socks/tights only 4-6 times a week, but almost a fifth of patients change them extremely rarely – less than 4 times a week (Table 4). This shows that people with DM and DF do not change their socks and tights with the appropriate frequency.

Table 4

Changing socks/tights	
Frequency	Percentage
Less than 4 times a week	19.5%
More than once a day	21.9%
4-6 times a week	28.9%
Daily	29.7%

Most of the statements in the NAFF questionnaire (12 in total) were rated by patients by choosing “never”, “rarely”, “sometimes” or “often”. It is no secret that patients with DM and DF need to check their shoes frequently, both when putting them on and taking them off. However, the results revealed that almost half of the respondents never do this. Although those with DM and DF should indeed check their shoes frequently in both cases, only a little more than a fifth of the respondents do the check before putting them on, and only almost a tenth – after taking them off. Furthermore, individuals with DM and DF really need to check their feet for dryness frequently after washing them. Unfortunately, only half of the respondents indicated that they actually do this often.

Patients with DM and DF need to know and practice that they should never wear shoes without socks/tights and walk barefoot both at home and outdoors. The study revealed that majority of patients never wear shoes without socks and do not walk barefoot outdoors, and a third of them – never walk barefoot around the house, as well. On the other hand, the results showed that there are patients with DM and DF who often violate these recommendations, e.g., just over 6% of informants wear shoes without socks, almost a fifth walk around the house barefoot, and no more than a tenth – walk barefoot outdoors.

Furthermore, it is a must to emphasize that patients with DM and DF should never use a hot water heater, keep their feet near a fire, or put their feet on radiators. However, the results revealed a somewhat different situation whereas only a half of the subjects never use a heater or put their feet near a radiator, and only a third never put their feet near a fire. Moreover, the largest part of the respondents, i.e., almost 40%, do it sometimes. It is noteworthy that there are patients who practice actions that are unfavourable for their condition, e.g., use a hot water heater, put their feet on a radiator, or keep their feet near a fire.

Furthermore, patients with DM and DF cannot use callus removers, but they use them still. Though, if a blister, abrasion, cut or burn appears they should use a dry bandage. Surprisingly, a half of the respondents who participated in the study admitted that they never use dry bandages on blisters or other skin lesions. Unfortunately, only 1% of the study participants often use a dry bandage on their blisters and only 4% on other skin lesions. It should also be noted that callus removers are often used by almost a tenth, sometimes - a little more than a third, and rarely - by the majority of patients with DM and DF. Hence, a tendency shows that people with DM and DF do not actually apply the appropriate practice because not every one of them know that callus removers cannot be used, and if necessary, they should wear dry bandages.

One of the most important aspects of self-care for the foot in DM and DF is the choice of appropriate footwear. These patients should understand and know that with DF they should never wear flip-flops without a clasp, but rather choose shoes with laces, Velcro or straps, and choose sneakers more often for footwear, completely abandon the wearing of pointed-toe shoes, flip-flops or mules, and wearing synthetic fibre socks. Hence, it turned out that not all participants in the study follow this footwear selection practice. Analysis of results, clearly evidence that only less than half of the respondents never choose to wear flip-flops, and about a third of the respondents wear them sometimes. Meanwhile, when it comes to wearing sneakers, the results are somewhat better - the vast majority of those with DM and DF usually or sometimes wear exactly such footwear, while a little more than a tenth do not choose sneakers at all, and only less than a quarter wear them sometimes.

Unfortunately, a sad situation was reflected in the analysis of shoes with laces, Velcro or straps - not a single respondent indicated that this is the type of footwear they choose most often. Majority of respondents said that they never or sometimes choose footwear with such fastenings, although they are most recommended for this type of patient. On the other hand, further analysis shows more positive results: most DM and DF patients refused and never wear pointed-toe shoes or wear them just occasionally.

Finally, when analysing the frequency of wearing synthetic fibre socks among DM and DF patients, it became clear that answers were distributed in two ways: when half of the respondents never or rarely wear such socks, while the remaining subjects wear synthetic fibre socks sometimes or most of the time (Table 5).

Table 5

Rating of respondents' statements from “often” to “never”				
Statement \ Variant, pct.	Never	Rarely	Sometimes	Often
Shoe checking while putting on	46.9%	7.0%	25.0%	21.1%
Shoe checking while taking off	46.1%	25.0%	19.5%	9.4%

Checking the dryness of the feet after washing/cleaning	11.7%	14.8%	23.4%	50.0%
Wearing shoes without socks/tights	64.8%	11.7%	17.2%	6.3%
Walking barefoot indoors	30.5%	35.2%	17.2%	17.2%
Walking barefoot outdoors	62.5%	17.2%	8.6%	11.7%
Using a hot water heater	43.0%	25.8%	21.9%	9.4%
Keeping feet near the fire	31.3%	16.4%	39.8%	12.5%
Keeping feet on the radiator	46.1%	31.3%	13.3%	9.4%
Use of callus removers	14.1%	41.4%	35.2%	9.4%
Applying a dry bandage to a blister	55.5%	24.2%	19.5%	0.8%
Applying a dry bandage to a cut, scrape, or burn	60.2%	20.3%	15.6%	3.9%
Wearing flip-flops without a clasp	43.0%	29.7%	6.3%	21.1%
Wearing sneakers	11.7%	23.4%	6.3%	58.6%
Wearing shoes with laces, Velcro, or straps	68.0%	21.9%	10.2%	-
Wearing pointed-toe shoes	71.9%	4.7%	14.8%	8.6%
Wearing flip-flops or mules	85.2%	11.7%	2.3%	0.8%
Wearing synthetic socks	15.6%	43.0%	37.5%	3.9%

When assessing the overall NAFF questionnaire score, i.e., the patient's level of foot care, it is possible to achieve a good (from 70 points), average (50-70 points) or poor (up to 50 points) level. After calculating the individual total NAFF questionnaire scores of each of the 128 respondents, their results were divided into the levels provided for by the instrumentation. Based on the data obtained, it can be stated that the majority of respondents with DM and DF take average care of their feet, a third – poorly, and only 7% of the total number of people participating in the study have a good level of foot care (Table 6).

Such results clearly indicate that it is necessary to take urgent educational measures related to improving knowledge and skills in practicing good DF care in patients with DM.

Table 6

Overall foot care results according to the NAFF questionnaire

Care	Percentage
Poor foot care	32.8%
Average foot care	60.2%
Good foot care	7.0%

Summarizing the self-care efforts of DM and DF patients, it can be stated that the most common mistakes associated with average or poor foot care are: not spending enough time on daily foot examination; not examining shoes before and after wearing them; not using a moisturizing foot cream daily or at least frequent; not changing socks or tights regularly; choosing inappropriate footwear; walking barefoot; not using dry bandages in case of foot injuries, and instead - frequent use of callus removers.

CONCLUSIONS

- Only a very small proportion perform the necessary daily foot exercises and consistently follow healthy eating habits, although the most patients with diabetic foot do not smoke. The main sources of information about foot self-care are the diabetes nurse, podiatrist and other people with diabetes mellitus.
- A very small proportion of patients with diabetic foot have a good level of self-care efforts, the vast majority are average, and even a third are poor in that.
- Patients with diabetic foot do not spend enough time on daily foot and shoe examinations, do not use moisturizing foot cream daily or at least often, do not change socks daily, do not always choose the right footwear or prefer to walk barefoot, and do not choose dry bandages for foot lesions, but instead use callus removers more often.

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