

# KNOWLEDGE, SELF-CARE AND RISK FOR ULCERATION IN THE LOWER LIMBS OF PEOPLE WITH DIABETES MELLITUS IN A MUNICIPALITY IN THE ZONA DA MATA REGION OF PERNAMBUCO



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## ABSTRACT

The objective of this study was to identify knowledge about DM, self-care and the risk of developing lower limb ulcers (LLLL) in people assisted by primary health care in Vitória de Santo Antão-PE. This was a cross-sectional, descriptive, exploratory, quantitative study, carried out from August 2023 to January 2024, through two questionnaires (Date-Q and Clinical evaluation form in lower limb for the prevention of diabetic foot). The study had a sample of 81 participants, where it was noted that 92.4% of the interviewees were unaware of the function of the glycated hemoglobin test, as well as the expected value for it. Regarding self-care, 79% did not wash/dry their feet correctly and 55.6% did not have the habit of examining them daily. 60.5% of the interviewees had some level of risk for the development of ulcers in lower limbs and, of these, 46.9% had risk 2, which is associated with the presence of Loss of Plantar Sensitivity (PSP) along with the presence of signs and symptoms that are related to Peripheral Arterial Obstructive Disease. The lack of knowledge about the self-management of the disease and its complications, the presence of deficits in foot self-care and the risk of developing ulcerative lesions in the MMI identified in this study signal the need for educational measures aimed at improving knowledge, self-care and reducing the risk of complications resulting from the disease.

**Keywords:** Diabetes mellitus. Self-care. Knowledge. Diabetic foot.

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## INTRODUCTION

Increased life expectancy, sociocultural changes, and habits such as the consumption of high-calorie diets and sedentary lifestyle have contributed to the growth of chronic diseases, including Diabetes Mellitus (DM) (Bertoluci et al., 2021). In 2017, 8.8% of the world's population aged 20 to 79 years lived with DM, and this number is estimated to exceed 628.6 million by 2045 (*International Diabetes Federation* [IDF], 2017; Bertoluci et al., 2022).

DM is a public health problem that can cause microvascular (retinopathy, neuropathy, and nephropathy) and macrovascular (heart disease, stroke, and amputations) complications, generating high costs for health systems (Bertoluci et al., 2022; Ferreira et al., 2021). It is an endocrine-metabolic syndrome characterized by hyperglycemia due to deficiency in the production and/or action of insulin (IDF, 2023). The Brazilian Diabetes Society (SBD) classifies DM into four main types: type 1 DM, type 2 DM, gestational DM, and other types (Bertoluci et al., 2022).

DM1 affects about 5 to 10% of people with DM and results from the destruction of pancreatic beta cells, usually mediated by the autoimmune system, which leads to a severe deficiency in insulin secretion. T2DM is characterized by insulin resistance and partial deficiency of insulin secretion by pancreatic beta cells and is the most prevalent type, affecting about 90% of people with DM (Rodacki, Teles, Gabbay, Montenegro & Bertoluci, 2023). GDM refers to hyperglycemic changes, which begin during pregnancy, and result from varying degrees of carbohydrate intolerance (Zajdenverg et al., 2023). The classification of other types of DM takes into account clinical characteristics that include a series of variables such as degree of obesity, time of onset of the disease, family history, among others (Bertoluci et al., 2022).

As mentioned earlier, it is known that prolonged glycemic uncontrol can cause chronic micro- and macrovascular lesions, as well as irreversible nerve damage (IWGDF, 2023). Thus, factors such as the duration of DM and glycemic uncontrol influence the prognosis of the disease (American Diabetes Association [ADA], 2023). In this sense, the presence of risk factors in people with DM can lead to complications, such as Diabetic Peripheral Neuropathies (NPD) and diabetic foot ulcerations (UPD) (Bertoluci et al., 2022; Schaper et al., 2023).

According to the American Diabetes Association (ADA), in 2023, about 50% of Diabetic Peripheral Neuropathies (DPN) arise asymptotically and affect 78% of people

with DM (ADA, 2023). It should be noted that UPDs generate high costs to health systems and result from NPD in association or not with Peripheral Arterial Disease (PAD), which emerge as the main causes of hospitalizations in people with DM, which can evolve with lower limb infections (LLM) and culminate, in more severe cases, with amputations and deaths (Zörrer et al, 2022; Schaper et al., 2023). Clinically, DPN generates loss of protective sensitivity (PSP), resulting in loss of sensation of the feet, and may course together with impaired mobility and the appearance of foot deformities (Bertoluci et al., 2022; IDF, 2023). Such aspects contribute to the emergence of foot injuries from minor traumas, due to the use of inappropriate footwear and the lack of self-care for the feet (Schaper et al., 2023). Regarding PAD, it is known that it affects 50% of people with DM, is directly associated with atherosclerotic disease and consists of a condition that hinders the natural healing process, and may evolve with an unfavorable clinical outcome, such as in cases of infectious and/or ischemic gangrene, which frequently require amputations (Schaper et al., 2023).

Thus, it is essential that there are health efforts in the sense that the assessment and screening of risk for ulcers in lower limbs should be implemented as a prevention strategy in people with DM (ADA, 2023). The identification of neuro-vascular complications, such as sensory alteration, decreased pedal pulses, deformities, skin changes, and extrinsic factors, such as the use of inappropriate footwear, is essential in the prevention of UPDs (Bertoluci et al., 2022). Neurological examination of the feet, including sensitivity assessment, should be performed by the nurse in PHC for screening and early diagnosis of NPD (Bertoluci et al., 2022).

It is also necessary that people with DM should be instructed about foot care and trained to perform self-care autonomously, including daily inspection, hydration, and proper nail trimming (Bertoluci et al., 2022; ADA, 2023; Schaper et al., 2023). To this end, it is essential to promote educational strategies that expand knowledge about the disease, its complications, and the importance of self-care, favoring adherence to treatment and adequate control of DM (Bertoluci et al., 2022; ADA, 2023).

It is emphasized that the participation of family members in this foot care process is important as a strengthening of the support network for people with DM and, essentially, in cases where these people have visual difficulties or physical and/or cognitive limitations that affect their ability to perform the assessment and perform care (ADA, 2023). Thus, information about the disease, its complications, and the strategies that need to be adopted

for successful therapeutic care should also cover family members and/or any support networks that this person has (Bertoluci et al., 2022).

In view of the above, the present study aimed to identify knowledge about DM, self-care practiced, and the risk for the development of ulcerations in the lower limbs of people with DM attended by Primary Health Care in the city of Vitória de Santo Antão-PE. This study enabled the construction of a situational diagnosis of people with DM who have risk factors for the development of ulcers in the lower limbs and can support the development and implementation of intervention strategies both in health education and in clinical practice, which are aimed at the early identification of risks so that clinical outcomes do not evolve with the appearance of ulceration.

## **METHODOLOGY**

A cross-sectional, descriptive exploratory study, with a quantitative approach, was carried out from August 2023 to January 2024 in 10 Basic Health Units (UBS) distributed between urban (7 units) and rural areas (3 units) belonging to the municipality of Vitória de Santo Antão, located in the Zona da Mata in the state of Pernambuco. The selection of the participating units was based on the criterion of those that had a specific day during the week for the Hiperdia program, which aimed to monitor people with DM and SAH.

The study population consisted of people assisted by the FHUs with DM, and the sample size calculation was performed using the G\*Power software, version 3.1.9.7, taking into account a power of 80% and a significance level of 5%, resulting in a minimum sample of 80 participants. People of both sexes, over 18 years of age, with a diagnosis of DM were included. On the other hand, exclusion criteria were those who had cognitive deficiencies capable of compromising the veracity of the answers.

The selection of participants occurred through an active search during the days of medical consultations and in the meetings of the Hiperdia group, previously established by the health unit. In this process, 84 people who met the inclusion criteria were approached, however, 3 of them chose not to participate due to the time expected for data collection. Data collection took place in an environment free of stressors, aiming to ensure the confidentiality of the information provided and avoid external interference in the answers, lasted an average of 30 minutes and only began after the person agreed to participate in the research, by reading and signing the Informed Consent Form.

Two instruments were used for data collection, the first being the Diabetes Education Questionnaire (Date-Q), translated and validated for Brazil in 2021, which aims to assess the knowledge related to DM of people affected by the disease through five domains: physical exercise, healthy eating, psychosocial well-being, self-management of the disease, and long-term complications. The instrument consists of 20 statements, which can be marked as true, false or I don't know; for each correct answer, the value of one point is assigned where the higher the score, the higher the level of knowledge about the disease (Félix et al; 2021).

The second instrument used is a clinical evaluation form of the lower limbs for the prevention of diabetic foot, with the aim of early detection of the risk of ulceration in the lower limbs, to assess self-care related to the disease and to guide people with DM regarding the care to be taken with the feet. It is subdivided into four phases. In the first phase, questions related to general anamnesis were addressed, with questions that addressed sociodemographic and clinical variables. In the second phase, a motor evaluation was carried out through gait presented by the person with DM and then the specific clinical examination of the feet began, through the application of: test tube with cold/heated water, toothpick and cotton on the dorsum of the foot (for the evaluation of thermal, painful and tactile superficial sensitivity); Semmes-Weinstein Monofilament 10g (for the evaluation of tactile sensitivity and functional status of peripheral nerves; 128Hz tuning fork (for the evaluation of vibratory sensitivity and neurological reflex hammer (for the evaluation of the Achilles reflex). Once this was done, the clinical examination of the feet was completed with palpation of the posterior and pedal tibial pulses, to investigate their presence, amplitude, and quality, allowing a vascular evaluation. Through these evaluations, it was possible to identify the risk for the development of ulcerations in the lower limbs of people with DM, being classified as 0 (no Loss of Plantar Protective Sensitivity (PSP), no Peripheral Arterial Obstructive Disease (PAOD) and no deformities), 1 (presence of PSP + deformities), 2 (presence of PSP + PAOD) and 3 (presence of ulcers and previous amputations). The investigation on adherence to self-care practices was carried out in the third phase and the guidance on foot care was given in the last stage of the instrument. In all, the instrument had 74 questions and 10 orientations (Mello et al., 2017). It is noteworthy that the data from all phases of the aforementioned instruments were collected by the researcher in charge, who was trained to do so.

After data collection, a database was built using a spreadsheet in Excel for Windows-2010. Subsequently, the data were exported to the R software, version 3.4, through which statistical analysis was conducted using the R language.

According to resolution 466/12 of the National Health Council, this project, with CAAE number: 68756523.1.0000.9430, received approval from the Ethics Committee for Research Involving Human Beings of the Academic Center of Vitória of the Federal University of Pernambuco (CEP-CAV-UFPE).

## RESULTS AND DISCUSSION

The present study had a sample of 81 people with DM, among whom the majority (71.6%) were female, self-declared themselves brown (46.9%), had incomplete elementary education (59.3%) and income equivalent to 1 minimum wage (49.4%), with the predominant occupation (33.3%) being "home"; The age of the participants ranged from 22 to 83 years, with a mean of 58 years, with a standard deviation of 12. The other sociodemographic data are described in Table 1.

**Table 1:** Sociodemographic profile of people with DM, in the municipality of Vitória de Santo Antão, Pernambuco, 2024. (n=81)

Variables	n (%)
<b>Gender</b>	
Female	58 (71,6%)
Male	23 (28,4%)
<b>Race</b>	
Brown	38 (46,9%)
White	31 (38,3%)
Negress	12 (14,8%)
<b>Schooling</b>	
Illiterate	7 (8,6%)
Incomplete Elementary School	48 (59,3%)
Complete Elementary School	3 (3,7%)
Incomplete High School	3 (3,7%)
Complete High School	12 (14,8%)
Superior	8 (9,9%)
<b>Occupation</b>	
From home	27 (33,3%)
Retired	22 (27,1%)
Farmer	8 (9,9%)
Seamstress	2 (2,5%)
Student	2 (2,5%)
Self-employed	4 (4,9%)
Other*	16 (19,3%)
<b>Income</b>	
1 minimum wage	40 (49,4%)
>1 minimum wage	17 (21%)
<1 minimum wage	24 (29,6%)



**Legend:** \*Others include: Ambulant; Trucker; Caregiver; Unemployed; Physical Educator; Manicure; Pensioner; Taxi driver; Watchful.

**Source:** Study data, 2024.

According to data from the Brazilian Institute of Geography and Statistics (IBGE), updated in December 2023, the Brazilian population is composed of 203,080,756 inhabitants, 51.5% of whom are female, 45.3% declared themselves brown and 60.1% lived on up to one minimum wage per capita per month in 2022, converging with the sociodemographic data identified in this survey. (IBGE, 2023).

Regarding the clinical and therapeutic aspects of the people investigated in this study, it was observed that the vast majority (95.1%) had a diagnosis of DM2, 74.1% were undergoing drug treatment with the use of oral antidiabetic drugs, and 30.9% had DM for more than 10 years (Table 2):

**Table 2:** Clinical and therapeutic profile of people with DM in the municipality of Vitória de Santo Antão, Pernambuco. (n=81)

Variables	n (%)
<b>Type of treatment</b>	
Diet	10 (12,3%)
Oral drugs	60 (74,1%)
Insulin	3 (3,7%)
Insulin, diet	1 (1,2%)
Insulin, oral drugs	7 (8,6%)
<b>Type of diabetes</b>	
DM1	4 (4,9%)
DM2	77 (95,1%)
<b>Duration of illness</b>	
> 10 years	25 (30,9%)
< 10 years	56 (69,1%)

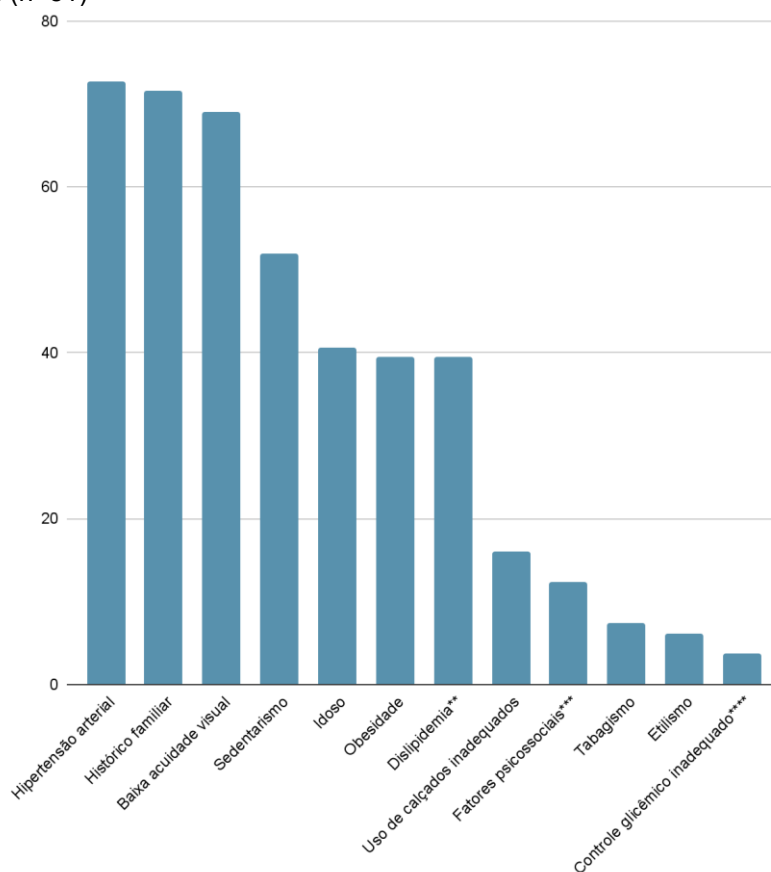
**Source:** Study data, 2024.

Data from the SBD indicate that DM2 is the most common form found in the Brazilian population and corresponds to 90% of DM cases in our country, being responsible for high morbidity and mortality rates and high costs to the Unified Health System (Bertoluci et al., 2022). Considering that most of the interviewees have type 2 of the disease, the indicated drug treatment consists exactly of the use of oral antidiabetics associated with food planning and regular physical exercise (ADA, 2023).

Also with regard to the clinical aspects, it was possible to observe the following risk factors for the development of foot ulcerations in the people investigated: inadequate

glycemic control, age, dyslipidemia, obesity, sedentary lifestyle, smoking, alcoholism, low visual acuity, psychosocial factors, and the use of inappropriate footwear (Graph 1). Similar to the present study, another Brazilian study, carried out with the objective of describing the risk factors for the development of foot ulcers in people with DM, identified that the use of inappropriate footwear and the presence of systemic arterial hypertension were also prevalent risk factors in the sample studied (Ferreira et al., 2023). The other risk factors related to the development of foot ulcers identified in this study and their respective frequencies are described below (Graph 1):

**Graph 1:** Risk factors for the development of foot ulcers presented by people with DM\*, Vitória de Santo Antão, Pernambuco. (n=81)



**Legend:** \*: Diabetes Mellitus; \*\*: Hypercholesterolemia, hypertriglyceridemia and low High Density Lipoprotein (HDL); \*\*\*: Denial of the disease, low social level, living alone; \*\*\*\*: glycated hemoglobin >7.0% in 3 consecutive exams.

**Source:** Study data, 2024.

It is noted that Systemic Arterial Hypertension (SAH) was identified in 72.8% of the sample, followed by family history of DM (71.6%), low visual acuity (69.1%), sedentary lifestyle (51.9%), age over 60 years (40.7%), obesity (39.5%), dyslipidemia (39.5%). In this regard, it is known that population aging, associated with sedentary lifestyle and



consequent obesity (body mass index  $>30$  kg/m<sup>2</sup>), favors the appearance of Chronic Non-Communicable Diseases (NCDs) such as DM and SAH (IDF, 2023). Because they are, in most cases, insidious diseases and without alarming clinical manifestations, the diagnosis can be delayed, which often results in the diagnosis together with the existence of some chronic complication already installed (ADA, 2023). In a study carried out in Brazil, it was identified that 80% of people with DM had associated SAH, thus contributing to the increase in the appearance of chronic complications of both diseases (Tonani, Sousa, Cesaro, Almeida & Fontana, 2024).

Still regarding the predominant risk factors, low visual acuity was identified in 69.1% of the interviewees. In this regard, it should be noted that low visual acuity precedes the onset of diabetic retinopathy (DR), a chronic microvascular complication of DM, which can lead to blindness, when associated with factors such as: lack of glycemic control, smoking, dyslipidemia, uncontrolled Systemic Arterial Hypertension (SAH), age over 60 years, among others (Bertoluci et al., 2022; ADA, 2023). It is worth noting that, when observing the risk factors for the development of DR, it is verified that most of them are modifiable and, consequently, blindness can be largely prevented through measures that involve self-monitoring of blood glucose and the adoption of healthy lifestyle habits, which include: meal planning, regular practice of physical exercise, and correct use of drug therapy (Galvão et al., 2021). Another important point to be highlighted is the fact that low visual acuity can lead to difficulties in self-care, especially with regard to foot care, since it is recommended to inspect them daily, looking for abnormalities, lesions, onychomycosis, among others (Schaper et al., 2023).

The use of inappropriate footwear and/or the fact that people walk barefoot, found in 16% of the participants, points to another relevant aspect related to the prevention of the appearance of lesions in the lower limbs. It is known that such practices are the main cause of trauma to the feet, which can progress to the appearance of foot ulcerations and clinically evolve to diabetic foot, when there is also PSP and/or PAD (Schaper et al., 2023). To this end, it is recommended to wear appropriate footwear regardless of where the user is – inside or outside the home. It is also noteworthy that shoes must be wide and accommodate the entire foot, in order to prevent biomechanical changes in the feet or their structures (Schaper et al., 2023).

Regarding the percentage frequency found in this study (7.4%) of smokers, it should be noted that, although lower in relation to the other risk factors identified, it is important

considering that recent evidence indicates that smoking directly influences the body's ability to regulate glycemic levels, in addition to significantly increasing the risk of chronic complications. such as cardiovascular diseases, kidney failure, and blindness, in addition to contributing significantly to the appearance of new cases of T2DM (Aarsand et al., 2023). In view of this, the IDF (2023) makes a recent appeal to world governments for political measures to discourage smoking to be implemented in all public spaces and also emphasizes that health professionals must motivate and guide people with DM to quit tobacco (Aarsand et al., 2023).

Assessing the knowledge presented by people with DM about their own disease is essential for the recognition of which knowledge-related aspects need to be prioritized by health education strategies (Rocha, Guaraldo & Brito, 2021). Thus, the knowledge identified in people with DM is detailed in Table 3:

**Table 3:** Knowledge of the interviewees about DM\*, according to the Diabetes Education Questionare- Date-Q, Vitória de Santo Antão, Pernambuco. (n=81)

STATEMENTS	MISSED	DIDN'T KNOW	HIT
<b>EXERCISE</b>			
1 Strength training (using elastic bands or weights) can help strengthen your muscles and lower your blood sugar. (TRUE)	3,7%	4,9%	91,4%
2 Exercise is a good way to help control your blood sugar. (TRUE)	3,7%	3,7%	92,6%
3 You're exercising at the right intensity when your heart rate is in the desired range and you're short of breath. (FALSE)	3,7%	4,9%	91,4%
<b>DIET</b>			
4 Industrialized or processed foods (such as canned soup and frozen food) are healthy food choices for every day. (FALSE)	1,2%	0,0%	98,8%
5 Eating foods with fiber (vegetables, whole grains, beans) helps control diabetes because it lowers blood sugar, bad cholesterol, and blood pressure. (TRUE)	7,4%	4,9%	86,4%
6 Healthy eating for diabetes includes eating more plant-based foods. For example: fruits, vegetables, whole grains and legumes. (TRUE)	2,5%	1,2%	96,3%
<b>PSYCHOSOCIAL WELL-BEING</b>			
7 Being aware of your feelings and asking for help and support can prevent you from becoming overwhelmed by having diabetes. (TRUE)	2,5%	1,2%	96,3%
8 Receiving support from your family and friends is a good way to help you cope with stress. (TRUE)	3,7%	1,2%	95,1%
<b>SELF-MANAGEMENT OF THE DISEASE</b>			
9 Two hours after eating a meal, your blood sugar level should be higher than 160 mg/dL. (FALSE)	39,5%	27,2%	33,3%
10 The results of your glycated hemoglobin (HbA1C) blood	6,2%	86,2%	8,6%

test show your average blood sugar level over the past year. (FALSE)

11	Skippping breakfast and eating a hearty dinner helps prevent high and low blood sugar levels. (FALSE)	8,6%	2,5%	87,7%
12	Your blood sugar level may be higher or lower than normal when you have a cold or flu. (TRUE)	19,8%	35,8%	44,4%
13	You should check your feet for blisters, sores or ulcers only before exercise. (FALSE)	9,6%	6,2%	85,2%
14	Depression does not affect the control of your diabetes. (FALSE)	48,1%	24,7%	27,2%
15	If your sugar level is too low, you should eat chocolate as a fast-acting carbohydrate. (FALSE)	53,1%	23,5%	23,5%
16	If you take insulin or certain oral diabetes medications (tablets such as glibenclamide), you have a better chance of lowering your blood sugar. (TRUE)	6,2%	3,7%	90,1%
17	Keeping your glycated hemoglobin (HbA1C) low (less than 7%) will help control your blood sugar. (TRUE)	9,9%	86,4%	3,7%

#### COMPLICATIONS

18	If your diabetes is not well controlled, your blood vessels and nerves can become damaged. (TRUE)	0,0%	1,2%	98,8%
19	Inadequate sleep or sleep apnea is common in type 2 diabetes and can worsen your health. (TRUE)	18,5%	35,8%	45,7%
20	When living with diabetes, it is important to control blood pressure and cholesterol to prevent complications. (TRUE)	1,2%	2,5%	96,3%

**Source:** Study data, 2024.

It was noted that some aspects presented higher rates of errors or "I don't know" answers, namely: questions related to the self-management of the disease, such as the expected value for glycated hemoglobin, as well as the function of this test (Q17 with 96.3% and Q10 with 92.4%); the expected value for postprandial blood glucose (Q9 with 66.7%); adequate management of hypoglycemia (Q15 with 76.6%); glycemic alterations resulting from factors extrinsic to DM, such as depression (Q14) with 72.8% and illness due to infectious processes (Q12) with 55.6%.

Other studies, which aimed to identify the knowledge of people with DM, presented results similar to those found by this study, where the highest rates of ignorance are related to the expected value and function of the glycated hemoglobin test. Thus, it was noted that Q17 (keeping your glycated hemoglobin low, less than 7%, will help control your blood sugar level) and Q10 (The results of your glycated hemoglobin blood test show your average blood sugar level in the last year) that bring statements about the Glycated Hemoglobin (HbA1C) test were the questions with the highest percentages of "I don't

know" answers (86.2%), evidencing itself as the main aspect of the instrument that incites an educational intervention (Vieira, 2023; Souza, Farfel, Jaluul, Queiroz & Nery, 2020).

It should be noted that the HbA1c test is a reliable way to assess glycemic behavior and reflects the average blood glucose levels in the last three months (Bertoluci et al., 2022). Thus, knowing the parameter of normality of HbA1c is important for people with DM, as it allows them to self-assess their own glycemic control in the last three months, and provides the opportunity for early recognition of the need for therapeutic readjustment and effective self-management of their condition (Moça, et al., 2024). Maintaining HbA1c at adequate values, below 7%, is a robust indicator in reducing chronic complications associated with DM, and popularizing this knowledge is essential for people to become familiar with this value and to identify variations in their blood tests early, which may result in a faster search for therapeutic interventions aimed at lowering HbA1c rapidly (Rodacki et al., 2023; ADA, 2023).

Regarding the knowledge that the interviewees had about the normal parameters for postprandial blood glucose (2 hours after the meal), it was possible to observe that 39.5% said the following statement was true: "two hours after eating a meal, your blood sugar level should be higher than 160 mg/dl" (Q9), and 27.2% did not know whether such a statement was true or false. This fact demonstrates that they do not have adequate knowledge about this issue, since, according to international and national recommendations, the expected postprandial blood glucose for people with DM should be less than 160 mg/dl (Bertoluci et al., 2022; IDF, 2023). It should be noted that glycemic self-monitoring allows the user to be able to outline strategies to achieve good glycemic control in view of the identified values, which can include everything from food planning to the adjustment of the proposed drug therapy (Golbert et al., 2020).

Regarding the immediate care to be implemented in the face of acute complications arising from DM, such as hypoglycemia, it was observed that 53.1% of the interviewees believe that chocolate is a fast-acting carbohydrate capable of reversing hypoglycemia and 23.5% do not know if the statement "If your sugar level is too low, you should eat chocolate as a fast-acting carbohydrate" is true or false. In this regard, it is known that hypoglycemia, defined as the low concentration of glucose in the bloodstream (<70 mg/dL) should be treated immediately with the intake of 15g of simple carbohydrate, of rapid absorption, the most indicated being: a tablespoon of sugar diluted in 200ml of water, 100ml of non-diet

soda, 100ml of fruit juice or two sachets of pure honey, under penalty of culminating in irreversible neurological damage (Campos, 2023; Rodacki et al., 2023).

It should be noted that, after ingesting the 15g of simple carbohydrate, you should wait 15 minutes and proceed with a new capillary glucose check to confirm the increase in the glycemic level or not (Rodacki et al., 2023). Thus, it is noteworthy that chocolate or cookies, as they are complex carbohydrates, are not a good choice for rapid reversal of hypoglycemia, in addition to having a greater predisposition to the appearance of rebound hyperglycemia, due to the existence of proteins and fats in their compositions (Campos, 2023; Rodacki et al., 2023). Considering that hypoglycemia is the most frequently observed acute condition in people with DM, it is essential that knowledge about the parameters of normality of blood glucose, the signs and symptoms of hypoglycemia, its confirmation through glycometry, as well as the indispensable care for its treatment be widely provided and discussed, so that people internalize knowledge and apply it daily in their reality and self-management of their disease (Müller, Costa, Vasconcelos, Santos & Soares, 2024).

In the present study, it was also identified that the relationship between glycemic alterations resulting from factors or aspects external to DM (depression, illness due to infections and sleep apnea) is another point in which the interviewees presented high percentages of error or lack of knowledge. Thus, regarding the relationship between depression and DM control, it was observed in Q14 (Depression does not affect the control of your diabetes) that 48.1% of the participants believed that depression did not affect DM control and 24.7% did not know whether or not depression could affect DM control. Thus, it is necessary to discuss that, according to Rodacki, Teles, Gabbay, Montenegro and Bertoluci (2023), the existence of psychiatric comorbidities in people with DM, such as depression, has been associated with non-adherence to drug treatment, culminating in inadequate glycemic control and the appearance of chronic complications arising from DM. Thus, it is recommended, with a strong level of evidence, that the screening and treatment of depression in people with DM should be carried out early in clinical practice so that such psychiatric comorbidity does not impair glycemic control and has repercussions by accelerating the appearance of chronic complications (Rodrigues, Malerbi, Pecoli, Forti & Bertoluci, 2023; Rodacki et al., 2023).

Also with regard to the glycemic repercussions resulting from events external to DM, 19.8% said that the statement "your blood sugar level may be higher or lower than normal when you have a cold or flu" was false, while 35.8% did not know whether this statement

was true or false. Thus, it is verified that in periods when people with DM are affected by infectious diseases, in general, there may be a greater release of hormones such as adrenaline and cortisol, which have repercussions on the action of insulin, resulting in glycemic variations, most commonly in hyperglycemia (Bertoluci et al., 2021). It is worth noting that, in view of this statement, 44.4% of the interviewees were aware of this possibility of glycemic variation resulting from infectious processes.

On the other hand, it was observed that a significant portion (98.8%) of the interviewees demonstrated knowledge about the non-use of processed foods as a healthy food choice for every day (Q4) and the importance of glycemic control to prevent complications involving blood vessels and nerves (Q17). Considering that healthy eating practices can help in glycemic control and, consequently, prevent the emergence of complications of the disease, the present research presented data that converge with other studies that also indicate that people with DM have higher percentage rates of knowledge about food planning and its importance, as well as the importance of adequate glycemic control for the prevention of complications of the disease (Barbosa et al., 2022; Lima et al, 2023).

In view of what was discussed about the knowledge of people with DM in this study, it is recognized that the lack of knowledge about DM and the damage that the condition can cause, when not managed properly, can negatively influence the way they perform self-care (Mendonça, et al., 2021). Thus, it is emphasized that the mastery of knowledge about DM by the user empowers him to assume an active posture in the management of his own condition, enabling him to incorporate daily self-care practices, which promote glycemic control and reduce the risk of developing chronic complications, such as lower limb ulcerations (ADA, 2023).

In this sense, when investigating the self-care activities practiced by people with DM related to foot care, it was noteworthy that: 79% did not wash and dry their feet properly (daily, with soap and water, drying them, with a soft, dry towel and without rubbing the skin and also drying between the toes); 67.9% did not follow the recommendations for proper nail trimming (cutting straight nails with round-tipped scissors) and for foot hydration (they did not use moisturizer on their feet daily, preserving the interdigital spaces); 56.8% removed cuticles with pliers and cut ingrown toenails and/or calluses, and 55.6% did not perform daily foot inspection in search of blisters, calluses, wounds, redness or any other alteration (including the soles of the feet and between the toes) (Table 4).



**Table 4:** Adherence to foot self-care activities of people with DM\*, Vitória de Santo Antão, Pernambuco. (n=81)

	QUESTION	YES (%)	NO (%)
1	Do you examine your feet daily for blisters, calluses, wounds, redness or any other change, including on the soles of your feet and between your toes?	44,4	55,6
2	Do you wash your feet every day with soap and water and then wipe your feet and between your toes with a soft, dry towel, without rubbing your skin?	21	79
3	Remove cuticles with pliers, cut ingrown nails or calluses?	56,8	43,2
4	Do you cut straight nails with rounded-tipped scissors?	32,1	67,9
5	Do you use moisturizer on your feet daily (never between your toes)?	32,1	67,9
6	Do you wear clean, comfortable wool or cotton socks and no seam?	76,5	23,5
7	Do you walk barefoot or in flip-flops with straps between your toes?	27,2	72,8
8	Do you wear shoes that are tight or uncomfortable for your feet?	19,8	80,2
9	Do you examine your shoes and shake them before wearing them?	88,9	11,1
10	Do you pay attention to where you walk to avoid foot injuries?	88,9	11,1

**Legend:** DM\*: Diabetes Mellitus.

**Source:** Study data, 2024.

In view of these results, it should be noted that inappropriate conduct in foot care can lead to foot injuries, which can evolve clinically with the appearance of infectious processes and poor healing and result in a diabetic foot (Zörrer et al, 2022; Schaper et al., 2023). Thus, it is essential to highlight that the correct washing and drying of the feet is the initial step for foot self-care, thus being an essential practice for the hygiene and prevention of onychomycosis or interdigital mycoses, which are the gateway for infection-causing microorganisms (Lima et al., 2023). Special attention should be paid during foot hydration, which should happen daily, so that the moisturizer does not run into the interdigital spaces, favoring the proliferation of fungi in the area (Schaper et al., 2023; Toledo & Ferreira, 2024).

In the meantime, daily foot self-examination becomes an indispensable practice for primary prevention, as it enables the early detection of any changes that may evolve with the loss of plantar sensitivity, if not treated quickly, in addition to allowing the user to recognize signs that may precede ulcerations, such as the presence of blisters, calluses,



wounds, redness, or any other alteration that affects the back, sole, nails, or interdigital spaces (Toledo & Ferreira, 2024; Lima et al., 2023; Felix, et al., 2023). In addition, it is recommended that the nails be cut straight, using scissors with rounded tips, and that the removal of cuticles, ingrown nails and calluses be performed, when necessary, only by a specialized professional for this purpose (Toledo & Ferreira, 2024)

Among the self-care activities with the feet that the participants performed in higher percentages, the following stand out: examining the shoes before wearing them (88.9%), paying attention to the places where they walked in order to prevent foot injuries (88.9%), not wearing shoes that caused discomfort (80.2%), not walking barefoot (72.8%) and wearing clean socks, comfortable and seamless (76.5%), preventing the appearance of foot deformities. Adherence to such foot self-care practices indicates that people with DM adhered to some preventive measures, which are also crucial in the prevention of foot ulcerations, but were resistant to other practices that are also indispensable for the prevention of foot complications, such as diabetic foot (Toledo & Ferreira, 2024).

In this regard, it is worth noting that diabetic foot, resulting from lack of metabolic control, lack of knowledge about foot care and non-adherence to recommended therapy, is the most common, expensive, serious and avoidable complication of DM, where factors such as not performing daily foot self-examination associated with inadequate hygiene, use of inappropriate footwear and inadequate nail trimming accentuate and cooperate with the emergence of this complication (Lima, et al., 2023; de Almeida, et al., 2023). In view of this, health education aimed at the prevention of diabetic foot should mainly cover the assessment and appropriate management of risk factors, daily observation of the feet, detection of loss of protective sensation in the feet, and early recognition of the presence of signs that indicate peripheral arterial disease (Bertoluci et al., 2022; ADA, 2023).

Thus, according to the guidelines of the Manual on Diabetic Foot of the Ministry of Health, Primary Health Care (PHC) should assume responsibility for foot assessment, through clinical and neurological examination of the feet, including the execution of risk stratification for PSP, and, based on this, the establishment of the frequency of follow-up and guidance for foot self-examination (IDF, 2023). During the clinical examination of the lower limbs, carried out in this study, it was identified that: 74.1% of the participants had thin and shiny skin, 65.4% hair rarefaction, 50.6% dystrophic nails, 48.1% foot clefts, 44.4% dry skin and 42% had warm feet to the touch. It is noteworthy that such clinical findings correspond to the risk factors for vascular alterations that contribute to the

appearance of foot ulcers in people with DM, with foot fissures already considered preulcerative lesions (Isabel, Maria, Suely & Maria, 2023).

In the neurological evaluation of the feet to investigate thermal sensitivity, performed by applying cold/heated water in a glass test tube, it was identified that 28.3% of the participants had some abnormality, 23.4% decreased and 4.9% had no thermal sensitivity. The same percentage rate (28.3%) was observed for the loss of pain sensitivity, which was performed by means of a toothpick prick on the dorsum of the foot. Regarding tactile sensitivity – using cotton on the dorsum of the foot, it was found that 23.5% of the participants had reduced sensitivity and 13.6% had no sensitivity. The evaluation of pressure perception was performed with the aid of the Semmes-Weinstein Monofilament, with the 10g nylon filament, where 24.7% presented alterations in both feet and 4.9% presented alterations only in the right foot. In the evaluation of vibratory sensitivity – with a tuning fork of 128Hz – it was seen that 12.3% had the reflex abolished and 21% reduced, in both lower limbs. Finally, in relation to the presence of the Achilles reflex, it was identified that 70.4% of the participants had a decreased Achilles reflex and regarding the presence of the pedal and posterior pulses, it was seen that in 7.4% of the participants it was not possible to palpate the posterior pulse in any of the lower limbs and in 8.6% it was not possible to palpate the pedal pulse.

By performing these clinical examinations, it becomes possible to screen people with DM for the risk of developing ulcerations, classifying this risk according to the signs and symptoms presented by the user during the examination. It is necessary to highlight that, according to the IWGDF (2023), the absence of signs and symptoms during the examination does not exclude the existence of disease, since the individual may still have an asymptomatic neuropathy. Thus, it is of paramount importance that the clinical examination of the feet is periodically performed by the PHC nurse, as a way to detect such risk early and implement care that reverses or delays the appearance of foot ulcerations (Schaper et al., 2023).

In this context, it is pointed out that prolonged states of hyperglycemia contribute to the impairment of three main mechanisms responsible for the formation of ulcerative lesions in the lower limbs, namely: the installation of diabetic neuropathy, the presence of ischemia due to peripheral arterial obstructive disease, and the presence of associated infectious processes (Santos et al, 2022; Bertoluci et al., 2022). Such factors, when evaluated together, through clinical and neurological examination of the feet, indicate the

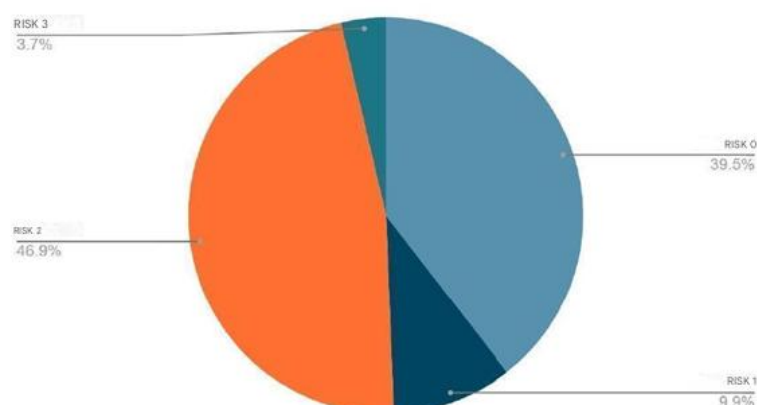
risk for the development of ulcerative lesions in the lower limbs to which the user is exposed. Graph 2, presented below, demonstrates the risks identified for the development of ulcerative lesions in the participants of this study and it is highlighted that most of the interviewees (60.5%) presented some level of risk for such a complication and of these, 46.9% had risk 2, which is associated with the presence of Loss of Plantar Sensitivity (PSP) together with the presence of signs and symptoms that are related to Peripheral Arterial Obstructive Disease. The classification of risk 2 results from the presence of two or more insensitive areas during the evaluation of the sensitivity of pressure perception, carried out with the aid of the Semmes-Weinstein Monofilament, with the 10g nylon filament, carried out at 4 different points in the plantar region (Isabel et al., 2023; Rodacki et al., 2023).

**Graph 2:** Risk Classification for the development of Diabetic Foot in people with DM, Vitória de Santo Antão, Pernambuco. (n=81)

RISK	DEFINITION
0	WITHOUT PSP* WITHOUT DAOP** NO DEFORMITIES
1	PSP + DEFORMITIES
2	PSP + DAOP
3	ULCER PREVIOUS AMPUTATION

\* PSP: Loss of Plantar Protective Sensitivity;

\*\* PAOD: Peripheral Arterial Obstructive Disease.



According to the recommendations of the IWGDF (2023), people with DM who were not at risk in the last exam (Risk 0), in our study 39.5% of the participants, need to undergo the clinical and neurological examination of the feet annually, while those who presented risk 1, in our study 9.9%, the exam should be performed every six months. For people who presented risk 2 (46.9%) – the majority of the population in our study – it is recommended to perform the test quarterly (every 3 months) and, finally, for those who presented risk 3 (3.7%) it is recommended to perform the test monthly (Schaper et al., 2023). Studies point to data similar to that found in our study regarding the percentages of people without risk for the development of ulcerations (39.5%), where the percentages found for risk 0 were 47.9% and 51% (Silva, Vieira, Gomes & Barbosa., 2020; Pinto et al., 2023). On the other hand, the results of this research differ from other studies when compared to risks 1 and 2, mainly, the studies by Silva, Vieira, Gomes and Barbosa (2020), Pinto et al. (2023) and Zörrer et al. (2022), bring significant percentages regarding risks 0 and 1, while the present study shows risk 2 (46.9%) and risk 0 (39.5%).

Considering that the performance of risk stratification for ulceration provides subsidies to the health professional on what are the priority care and information that each user with DM needs, this should be widely performed in the practice of health services, especially at the gateway of these people to the health system, in Primary Care. Therefore, nurses need to be able from the technical-scientific point of view to perform the clinical and neurological examination of the feet of people who have DM and still need to place this as a priority in the nursing consultations performed, so that the recommended periodicity, depending on the identified risk, is followed. In this regard, it is observed that investment in training and retraining of nurses can contribute to them feeling empowered and carrying

out the screening and the necessary interventions, resulting from the identification of risk, with safety and excellence (Felix et al, 2021).

In view of the above, there is an urgent need for effective action by the professionals who make up primary health care, especially nurses, in the early identification, referral of people with DM who present risks for the development of ulcerations and also in the implementation of educational strategies, which aim to provide technical, scientific and practical support to people so that they recognize the importance of self-care with the feet. In this way, it is expected that people with DM can be motivated and reproduce an active posture of self-care, aiming, in addition to prevention and health promotion, at a significant reduction in the risks of ulcerative complications in the lower limbs.

The limitations of this study include the cross-sectional design of the study, which does not allow inferring causality, but helps in the formulation of hypotheses for future studies. Another limitation found is related to the fact that it was not possible to access all municipal health units, in view of the lack of prior organization of the units, with regard to the scheduling of people with DM on specific days.

On the other hand, the construction of a situational diagnosis of people with DM who have risk factors for the development of ulcers in the lower limbs is evidenced as contributions to Nursing, which allows intervention strategies aimed at this public to be formulated and implemented, with the aim that the clinical outcomes do not evolve to the appearance of ulcerations. In addition, the data from this study, related to knowledge about DM and self-care practiced, can support assertive health education initiatives, taking into account the most critical points, which people with DM have greater difficulties in the aforementioned items, in addition to allowing the incorporation of immediate measures, such as the execution of the clinical and neurological examination of the feet, in clinical practice.

## **CONCLUSION**

In the search for the identification of knowledge about DM, self-care practiced and the risk for the development of ulcerations in the lower limbs of people with DM, it was observed that, among the items related to knowledge, those with the highest percentage rates of error or lack of knowledge in the sample studied consisted of: standard of normality of the glycated hemoglobin test, as well as the function of such examination; expected value for postprandial blood glucose; adequate management of hypoglycemia and

glycemic alterations resulting from factors extrinsic to DM, such as depression and illness due to infectious processes. These data point to the aspects that people presented the most difficulty in and that, therefore, need to be addressed, as a priority, by health education strategies, so that they are coherent with the needs of the people with DM identified.

Regarding self-care, it was found that most of the participants did not wash and dry their feet properly, did not have the habit of examining them daily, did not follow the recommendations for proper nail cutting and foot hydration, removed cuticles with pliers and cut ingrown toenails and/or calluses. Thus, it is emphasized that inappropriate conducts in the care of the feet can lead to injuries to them, which can evolve clinically with the appearance of infectious processes and poor healing and result in a diabetic foot. Thus, it is essential that all foot care, involving daily inspection, washing, drying, hydration, proper nail trimming and management of calluses or other changes are performed autonomously, consciously and responsibly so that any changes are quickly detected and treated so that the risk of ulceration is minimized or nullified.

Regarding the identification of the risk for the development of ulcerations in the lower limbs, it was seen that most of the interviewees presented some level of risk for such a complication and, of these, a significant portion was affected by level 2 of risk for ulceration. It is noteworthy that risk 2 already encompasses the loss of plantar sensitivity associated with the presence of signs and symptoms that are related to peripheral arterial obstructive disease. Thus, it is necessary to emphasize that the clinical management of glycemic control is essential for these people who present risk 2 not to evolve quickly with the appearance of foot injuries, resulting from possible chronic complications already installed. It is also important to repeat the clinical and neurological examination of the feet, performed by a competent professional and with the recommended periodicity according to the level of risk identified in each person.

Considering that performing risk stratification for ulceration provides support to nurses about what care and priority information each user with DM needs, it should be widely performed in the practice of health services, especially at the gateway of these people to the health system, in Primary Care. Therefore, it is up to primary care nurses to carry out the clinical evaluation of the lower limbs so that educational measures, both for people with DM and for family members, can be structured, with the objective of improving knowledge about the disease and consequently improving self-care, reducing the rate of

complications resulting from the disease and the onerous costs related to hospitalizations and treatment.

Therefore, nurses need to be able from the technical-scientific point of view to perform the clinical and neurological examination of the feet of people with DM and they also need to place this as a priority in the nursing consultations performed, so that the recommended periodicity, due to the identified risk, is followed. Investments in training and retraining of nurses can contribute significantly to their safe and effective screening and necessary interventions.

Finally, it is reinforced that health actions aimed at people with DM should aim at: expanding the understanding of DM, as a way to improve the levels of knowledge about the disease; the daily incorporation of the guidance received, especially with regard to self-care with the feet; the strengthening of the management of their clinical conditions, as autonomous and proactive beings in the management of their disease and the effectiveness in clinical practice of screening the risk for the development of ulcerative lesions in the lower limbs and necessary referrals.



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