

EVALUATION OF THE FEET OF PEOPLE WITH DIABETES MELLITUS AND RISK OF COMPLICATIONS

Avaliação dos pés de pessoas com diabetes mellitus e risco de complicações

Evaluación de los pies de las personas con diabetes mellitus y riesgo de complicaciones

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ABSTRACT

Objective: To assess the risk of lower limb complications in people with diabetes mellitus. **Methods:** descriptive, cross-sectional study conducted with 74 people enrolled in a Family Health Strategy unit of a municipality in southern *Minas Gerais*. We used an instrument containing sociodemographic data, clinical history and physical examination of the feet with neurological and vascular assessment. **Results:** it was found that 68.9% of participants have never had their feet evaluated by a health professional and that 29.7% of participants are at risk for the development of injuries (grade 1, 2 or 3). **Conclusion:** risk factors for lower limb complications in people with diabetes can be detected by appropriate assessment, constituting an important tool for stimulating self-care and preventing complications.

Descriptors: Nursing, Diabetes mellitus, Diabetes complications, Diabetic foot, Chronic disease.

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RESUMO

Objetivo: Avaliar o risco de complicações em membros inferiores de pessoas com diabetes *mellitus*. **Métodos:** estudo descritivo, transversal, realizado com 74 pessoas de uma unidade de Estratégia Saúde da Família de um município do sul de Minas Gerais. Utilizou-se um instrumento contendo dados sociodemográficos, história clínica e exame físico dos pés com avaliação neurológica e vascular. **Resultados:** evidenciou-se que 68,9% dos participantes nunca tiveram seus pés avaliados por um profissional de saúde e que 29,7% dos participantes estão em risco para o desenvolvimento de lesões (grau 1, 2 ou 3). **Conclusão:** fatores de risco para complicações em membros inferiores de pessoas com diabetes podem ser detectados por meio da avaliação adequada, constituindo uma importante ferramenta para estímulo do autocuidado e prevenção de complicações.

Descritores: Enfermagem, Diabetes mellitus, Complicações do diabetes, Pé diabético, Doença crônica.

RESUMEN

Objetivo: Evaluar el riesgo de complicaciones de las extremidades inferiores en personas con diabetes mellitus. **Método:** estudio descriptivo, transversal realizado con 74 personas en una unidad de Estrategia de Salud Familiar de un municipio en el sur de Minas Gerais. Utilizamos un instrumento que contiene datos sociodemográficos, historia clínica y examen físico de los pies con evaluación neurológica y vascular. **Resultados:** se encontró que un profesional de la salud nunca evaluó sus pies al 68.9% de los participantes y que el 29.7% de los participantes está en riesgo de desarrollar lesiones (grado 1, 2 o 3). **Conclusión:** los factores de riesgo de complicaciones de las extremidades inferiores en personas con diabetes pueden detectarse mediante una evaluación adecuada, lo que constituye una herramienta importante para estimular el autocuidado y prevenir complicaciones.

Descritores: Enfermería, Diabetes mellitus, Complicaciones de la Diabetes, Pie diabético, Enfermedad crónica.

INTRODUCTION

Diabetes Mellitus (DM) represents a public health challenge and can lead to chronic micro and macrovascular complications, and the Diabetic Foot is among the most frequent complications and has the greatest socioeconomic impact for patients, their families and society.¹

Diabetic foot is characterized by the presence of infection, ulceration and / or damage to deep tissues related to neurological changes and peripheral vascular disease in the lower limbs.²

The presence of the diabetic foot may be able to compromise the quality of life of people due to the difficulty of carrying out activities of daily living and work activities, in addition to recurrent hospitalizations, which can evolve to amputation of the limb, thus causing serious economic impacts at the individual and family level, as well as for public health.³⁻⁵

In this context, preventive actions are essential to reduce amputation rates, costs and, consequently, provide increased survival for people with diabetic foot. For this, health measures are essential to ensure early diagnosis, timely treatment of DM, and control of risk factors.⁶⁻⁷

At the level of primary care, effective prevention and health promotion activities in the short or long term are

strategies with the greatest impact for the prevention of DM and its possible complications.

Therefore, the central characteristic that nurses have in the care of people with DM stands out, due to the bond established with these people, built by their accessible and daily presence to the population, by the care actions in the clinical evaluation and by the educational processes. When interpreting health needs, they can propose changes in habits and attitudes of adherence to treatment more effectively, in a continuous process of incorporating knowledge, promoting self-care and changing actions.⁴⁻⁸

Given the above, this study aimed to assess the risk of complications in the lower limbs of people with DM.

METHODS

This is a cross-sectional, descriptive study with a quantitative approach. From the population, consisting of 336 people with DM enrolled in a Family Health Strategy (FHS), located in a city in the south of Minas Gerais, a convenience sample was selected, composed of 74 people, who met the following criteria eligibility: age 18 years or older, diagnosed with DM.

Data were collected from June 2017 to June 2018, through individual interviews at the participant's home or at the FHS. For that, an instrument developed by one of the authors was used, containing sociodemographic variables (age, sex, marital status, education, color, religion, work situation, family income), clinical information and physical examination of the feet with inspection and neurological and vascular evaluation. For neurological evaluation, the following tests were performed:

Evaluation of tactile sensitivity with 10g Semmes-Weinstein monofilament, which was applied three times, perpendicularly, at six points on each foot, namely: first, third and fifth digits plantar, first, third and fifth heads of metatarsals to plant; the perception of protective sensitivity was considered absent if two responses were incorrect from the three applications at two or more points.¹

- Assessment of dorsal vibratory sensitivity: with the participant seated, a 128 Hz tuning fork was used, perpendicularly, in the distal phalanx of the hallux; the test is positive (altered) if the patient responds incorrectly (person loses the sensation of vibration while the examiner still perceives the tuning fork vibrating), in at least two of three applications, and negative (normal) with two of the three correct answers.¹

- Assessment of the Achilles tendon reflex: it was performed through percussion with the reflex hammer in the Achilles tendon with the participant kneeling on a chair; the test was considered altered when the reflex plantar flexion of the participants' feet was absent or decreased.¹

- In the category of vascular evaluation, posterior pedicle and tibial pulses were identified by palpation. This examination was considered normal, that is, without signs

of neuropathy, when the pulses were wide and symmetrical, and altered when they were reduced or absent.¹

At the end, the risk classification for complications in the lower limbs was performed, which was obtained based on the clinical history and the results of the neurological tests, as well as on the vascular evaluation.¹

Thus, the participants obtained the following risk classification: 0 (without loss of protective sensitivity of the feet - PSP, without peripheral arterial disease PAD), 1 (PSP with or without deformity), 2 (PAD with or without PSP), 3 (history of ulcer or amputation). According to the risk classification, the participants were instructed regarding the care and the frequency of new assessments.¹

The data were organized in the *Microsoft Excel* program and analyzed using descriptive statistics, using measures of central tendency, variability and frequency distribution.

The research was approved by the Research Ethics Committee of the Federal University of Alfenas (UNIFAL-MG), under number CAAE55493516.8.0000.5142, respecting ethical principles.

RESULTS

Regarding sociodemographic characteristics, it was observed that 48 (64.9%) participants were female, with an average age of 64.95 (SD = 11.89), 51 (68.9%) were married, 38 (51.4%) had incomplete elementary education, 44 (59.5%) subjects were white. In addition, 61 (82.4%) participants were Catholic, 49 (66.2%) were retired and 57 (77%) reported having a family income of one to two minimum wages (**Table 1**).

Table 1 - Sociodemographic characterization of people with diabetes mellitus. Alfenas, MG, Brazil, 2018

Variables	N (%)	Average (SD)*	Min	Max
Age range				
18 to 29 years	1 (1,4)	64,95 (11,89)	16	91
30 to 59 years	21 (28,4)			
60 to 79 years	45 (60,8)			
80 years and over	7 (9,5)			
Sex				
Women	48 (64,9)			
Male	26 (35,1)			
Marital Status				
Single	7 (9,5)			
Widow	13 (17,6)			
Married	51 (68,9)			
Divorced	3 (4,1)			
Schooling level				
Illiterate	4 (5,4)			
Incomplete primary education	38 (51,4)			
Complete primary education	10 (13,5)			
Incomplete high school	3 (4,1)			
Complete primary education	10 (13,5)			
Incomplete high school	3 (4,1)			
Complete high school	10 (13,5)			
Incomplete higher education	3 (4,1)			

Complete higher education	6 (8,1)
Color	
White	44 (59,5)
Non-white	8 (10,8)
Brown-skinned	22 (29,7)
Religião	
None	1 (1,4)
Catholic	61 (82,4)
Evangelic	11 (14,9)
Spiritist	1 (1,4)
Work situation	
Employer	2 (2,7)
Salaried	2 (2,7)
Self-employed	7 (9,5)
Rtired/ Pensioner	49 (66,2)
Does not work	14 (18,9)
Family Income	
Less than 1 salary	2 (2,7)
From 1 to 2 salaries	57 (77,0)
From 3 to 4 salaries	13 (17,6)
Greater than or equal to 5 salaries	2 (2,8)

*SD: standard deviation.

According to **Table 2**, the majority of respondents, which corresponds to 43 (58.1%) had a diagnosis of DM less than 10 years ago, 51 (68.9%) reported not having their feet examined by health professional and 54 (27.0%) did not self-examine their feet. Only 11 (14.9%) people had a history of previous foot ulceration and five (6.8%) had a history of amputation, and seven (9.5%) participants reported having low visual acuity.

Regarding the physical examination of the feet, it was observed that 33 (44.6%) participants had motor deformities; 38 (51.4%) had dry skin and 24 (32.4%) had calluses. As for the trimming of nails, most participants performed the technique correctly, that is, 47 (63.6%) people reported performing the straight cut. It was noted that nine (12.2%) participants in the present analysis had lower limb injuries at the time of the assessment (**Table 2**).

Table 2 - Clinical characterization of people with diabetes mellitus. Alfenas, MG, Brazil, 2018

Variables	N (%)
Time of discovery of diabetes mellitus	
Up to 10 years	43 (58,1)
10 to 19 years	12 (16,2)
20 years or more	19 (25,7)
Assessment of feet by health professional	
No	51 (68,9)
Yes	23 (31,1)
Self-examination of the feet regularly	
No	20 (27,0)
Yes	54 (73,0)
History of previous foot ulceration	
No	63 (85,1)
Yes	11 (14,9)
History of amputation	

No	69 (93,2)
Yes	5 (6,8)
Low visual acuity that makes self-inspection of the feet difficult	
No	67 (90,5)
Yes	7 (9,5)
Motor deformities (hallux valgus, claw fingers, Charcot arthropathy)	
No	41 (55,4)
Yes	33 (44,6)
Dry Skin	
No	36 (48,6)
Yes	38 (51,4)
Calluses	
No	50 (67,6)
Yes	24 (32,4)
Interdigital injury	
No	70 (94,6)
Yes	4 (5,4)
Nail removal	
Straight	47 (63,6)
Rounded	27 (36,4)
Presence of ulcers in the lower limbs	
No	65 (87,8)
Yes	9 (12,2)

Regarding the sensitivity evaluation with the 10 gram Semmes-Weinstein monofilament, vibratory sensitivity with 128 Hz tuning fork and evaluation of the Aquileu tendon reflex, there were no changes among the majority of participants, with no great differences between the right foot and left. With regard to vascular evaluation, it was shown that the right and left posterior and left tibial pulses were present in most participants. Regarding the risk classification for complications in the lower limbs, it was found that 52 (70.3%) patients were classified as risk grade 0, nine (12.1%) with grade 1, two (2.7%) with grade 2 and, 11 (14.9%) with grade 3 (Table 3).

Table 3 - Classification of the degree of risk of complications in the lower limbs. Alfenas, MG, Brazil

Variables	N (%)
(0) Without LOPS* and without PAD*	52 (70,3)
(1) LOPS with or without deformity	9 (12,1)
(2) PAD with or without LOPS	2 (2,7)
(3) History of previous ulcer or amputation	11 (14,9)

*LOPS: Loss of Protective Sensitivity; PAD: Peripheral Arterial Disease

DISCUSSION

The highest percentage of women in this study, representing 64.9% of the total number of people interviewed, is in line with other studies⁹ These results may be associated with several reasons, such as, for example, stress, obesity, genetic factor, metabolic disorders during the gestational period, physical inactivity, poor diet, climacteric, in addition to the greater demand for

services.¹⁰⁻¹¹

Still, when comparing the results of this study with the findings in the literature, it was observed the existence of convergent results, emphasizing that most of the participants were older than 60 years, were married, white and had low education.^{9,12-13}

Cross-sectional study conducted with 385 patients with DM in Taiwan, western Asia revealed that high age and low education are significantly associated with less knowledge about the warning signs of diabetic foot deterioration,¹³ which in turn can lead to a delay in treatment and the appearance of serious complications. Although, most of the study participants with incomplete elementary education claimed to perform self-examination of the feet, it was shown that the less education the person has, the lower their self-care will be.¹¹

Still, with regard to sociodemographic variables, the higher frequency of low income (1 to 2 minimum wages) is in line with other studies.¹⁴⁻¹⁶ The low socioeconomic level is associated with a greater risk of foot ulceration, since it is a limiting factor for the adequate treatment of DM, such as the purchase of adequate foods and with menu variability for better adherence to the diet, obtaining medications and treatments. not granted by the Unified Health System and purchase of appropriate shoes for injury prevention.¹⁶

With regard to clinical characteristics, the highest percentage of people with DM less than 10 years old (58.1%), corroborates with data from another investigation,¹⁷ and on the other hand, it diverges from other studies in which the diagnosis above this predominated. period.¹⁸⁻¹⁹

The time of diagnosis of DM is related to the manifestations and complications associated with the diabetic foot,^{4,20} such as the perception of impaired vibration and changes in position awareness.²⁰ Although the time of diagnosis of 10 years has not compromised the sensitivity of these people, according to the Ministry of Health,¹ 5% of people diagnosed with DM less than 10 years ago and 5.8% of those diagnosed more than 10 years ago have foot wounds.

The non-performance of the feet assessment of people with DM by a health professional, evidenced by 68.9% of the participants in this study, is a worrying factor, since this increases the probability of amputation by 3.39 times.²¹ However, this gap in health care for people with DM is even more evident in other regions of the country, as can be seen in a study carried out with 137 people with diabetic foot admitted to a hospital in Recife, in which 81.2% of patients undergoing amputation stated that they had never undergone a foot evaluation by a professional.²¹

Regarding the self-examination of the feet, it was observed that the majority of respondents regularly evaluate their feet (73%). This demonstrates the ability of people to be active agents in their own care, through the acquisition of knowledge and skills. Regular inspection of the feet prevents a series of complications from DM. Therefore,

it is essential that the patient with DM understands the importance of his role as a self-care agent, in order to ensure proper self-assessment of the feet.

Although a small percentage of the participants in this study have a history of ulceration (14.9%), it is important to note that the previous presence of this type of injury classifies the patient as grade 3 with regard to the risk of new ulcers in the feet. However, in other studies, even lower rates are found.^{19,21}

In the present investigation, the minority of participants had a history of amputation (6.8%), similar to the values found in another analysis (7.8%).²¹ However, it should be noted that cases of amputation are twice as frequent in people with DM, when compared to non-diabetic people, since most of them are associated with the previous occurrence of ulcers.²² In addition, a study carried out in a hospital revealed that the fact that people with diabetic foot present with previous amputation, increases 4 times plus the chances of a new episode occurring.²¹ Given the above, it is evident that amputations, history of bypass use, as well as ulcerations classify DM as grade 3, that is, high risk, in addition to representing indicative of disease progression.¹

With regard to visual acuity, it was noted that low acuity can make it difficult to self-inspect the feet, which can cause difficulty in controlling DM.¹ Thus, the preserved visual acuity evidenced among most participants may have contributed positive way, for the inspection of the feet.

Literature suggests that deformities in the feet are present in about 36 to 75% of patients diagnosed with DM. It is known that chronic conditions of hyperglycemia generate end products of advanced non-enzymatic glycation (AGEs) and their receptors in collagen-rich structures, increasing the susceptibility of the musculoskeletal system to deformities.²³ However, the small rate of claw or hammer finger deformity identified in the present study is similar to international case-control studies.²⁰

With regard to the integrity of the skin, it is important to note that dry skin increases susceptibility to fissure, which results in loss of the protective barrier and, in turn, can lead to infectious conditions.²⁴

Callosity is one of the most prevalent deformities²¹ in the feet of people with DM and are more common in areas of high pressure and often caused by the use of inappropriate footwear.¹ The calluses associated with other deformities contribute to increased pressure and trauma, with repercussions in subcutaneous hemorrhage and appearance of ulcers, with prevention, timely diagnosis and early intervention being of great value.²⁵

The presence of interdigital mycosis is related to a higher risk of ulceration and a higher rate of amputations.¹⁶ Fungal lesions act as a gateway for acute infections. Although easily detected by evaluating the feet, this type of infection is common in the population with DM and can be treated in primary health care.¹

As for nail trimming, the results of the present study are in line with another study,¹⁷ which showed a higher percentage of the execution of the correct technique, that is, the straight cut. It is worth mentioning that improperly cutting the toenails can result in onychocriptosis, with consequent local trauma and risk of infection.¹

It is important to highlight that ulcers have as risk factors the loss of protective sensitivity, deformities in the feet and trauma. Furthermore, it is a risk factor for amputations, considering that 85% of lower limb amputations in people with DM are the result of ulcerations.¹

Regarding the risk classification for complications in the lower limbs, 29.7% of people with diabetes mellitus are at risk for the development of injuries, that is, risk 1, 2 or 3, which is in line with another study.²⁴

The evaluation of the feet together with risk classification allows stratifying people with DM at low or high risk for complications in the lower limbs and, thus, defines the periodicity of the reassessment and supports the planning of actions in order to minimize the risk factors, prevent ulcers, and consequently, reduce the number of amputations.

Thus, it is up to health professionals, especially nurses, the technical and scientific knowledge of this problem, in order to offer excellent care with a person-centered approach, from a broad view that involves the social, economic context, cultural that the individual lives, in addition to considering aspects related to the capacity for self-care, adherence, empowerment and health education.

Finally, the results of this study demonstrate the relevance of primary health care in view of the need to expand basic actions aimed at assisting people with DM. In this sense, low complexity actions, when performed properly and by trained professionals, can contribute to the prevention of lower limb complications in people with DM.

The study has some limitations regarding the use of a cross-sectional approach, not being able to identify associations between risk factors and the development of complications in the feet of people with DM. Therefore, the results of this investigation cannot be generalized to populations with DM from other realities.

CONCLUSIONS

The results made it possible to identify that the study population had risk factors for complications in the lower limbs and also deficits in self-care, although most of the participants obtained a grade 0 in the risk classification of foot ulcers. Therefore, the evaluation of the feet and the risk classification of people with DM regarding the risk of possible complications is a key strategy for the approach and treatment of diabetic foot in primary health care, since it allows the identification of changes and subsidies defining the best counseling, treatment and follow-up conduct.

Thus, it is evident the need to conduct actions to raise

the awareness of health professionals about the need to assess the diabetic foot in an appropriate way and to enable the diagnosis in a timely manner, considering that due to diabetic neuropathy, the patient often does not notice the changes, and professional analysis is of great value. In this way, it would be possible to avoid lengthy treatments and reduce the occurrence of more serious consequences of the disease.

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