

RISK FACTORS FOR LOWER-EXTREMITY ULCERATION AND AMPUTATION IN PATIENTS WITH DIABETES MELLITUS

Fatores de risco para ulceração e amputação de extremidades inferiores em portadores de diabetes mellitus

Factores de riesgo de ulceración y amputación de extremidades inferiores en pacientes con diabetes mellitus

Original Article

ABSTRACT

Objective: To analyze the risk factors for lower-extremity ulceration and amputation in patients with diabetes mellitus. **Methods:** Quantitative cross-sectional study conducted in 2013 with 92 individuals with diabetes attending a Family Health Care Center in Maceió, Alagoas, Brazil, through interviews and clinical examination of the feet. The following variables were assessed: sociodemographic characteristics (gender, age group, skin color, marital status, education and income) and additional risk factors for diabetic foot (clinical data, lifestyle and foot self-care practices). Chi-squared test with Yates' correction, G Test and Fisher's Exact test were used to check for association between variables considering a significance level of 5% ($p < 0.05$). **Results:** The sample included 92 patients with diabetes mellitus: 71.7% (66) were women and the predominant age group was 60-79 years – 48.0% (44). There was a prevalence of 95.6% (88) of individuals at risk for ulceration and 4.4% (4) were at risk for amputation. Regarding the risk of ulceration, 64.1% (59) were classified as risk 0 (lowest risk). **Conclusion:** There was a higher prevalence of patients at lower risk for ulceration and amputation. The inappropriate use of shoes stands out as the most common risk factor and tobacco use appears as a risk factor with significant statistical association.

Descriptors: Diabetes Mellitus; Diabetic Foot; Risk Factors.

RESUMO

Objetivo: Analisar os fatores de risco para ulceração e amputação de extremidades inferiores em portadores de diabetes mellitus. **Métodos:** Estudo transversal, quantitativo, realizado em 2013, com 92 indivíduos diabéticos, cadastrados em uma Unidade de Saúde da Família em Maceió, Alagoas, Brasil, através de entrevistas e avaliação clínica dos pés. Investigaram-se as seguintes variáveis: características sociodemográficas (sexo, faixa etária, cor da pele, estado civil, escolaridade e renda) e fatores de risco complementares para o pé diabético (dados clínicos, estilo de vida e prática de autocuidado com os pés). Para identificar a associação entre as variáveis, utilizaram-se os testes Qui-quadrado com correção (Yates), Teste G e Exato de Fisher, sendo considerado o nível de significância de 5% ($p < 0,05$). **Resultados:** A amostra contemplou 92 portadores de diabetes mellitus, sendo 71,7% (66) do sexo feminino, com faixa etária predominante de 60-79 anos - 48,0% (44). Observou-se prevalência de 95,6% (88) com risco para ulceração e 4,4% (4) com risco para amputação. Com relação ao risco de ulceração, 64,1% (59) foram classificados em risco 0 (menor risco). **Conclusão:** Encontrou-se maior prevalência de pacientes em menor risco para ulceração e amputação. Destaca-se o uso inadequado dos calçados como o fator de risco mais comum e o uso do tabaco como fator de risco com associação estatística significativa.

Descritores: Diabetes Mellitus; Pé Diabético; Fatores de Risco.

Thaysa Alves Tavares⁽¹⁾
Luana Jeniffer Souza Farias da
Costa⁽²⁾
Maria Lucelia da Hora Sales⁽²⁾
Marilucia Mota de Moraes⁽²⁾

1) Federal University of Pernambuco
(Universidade Federal de Pernambuco -
UFPE) - Recife (PE) - Brazil

2) Alagoas State University of Health
Sciences (Universidade Estadual de
Ciências da Saúde de Alagoas - UNCISAL)
- Maceió (AL) - Brazil

Received on: 02/15/2016
Revised on: 04/05/2016
Accepted on: 05/11/2016

RESUMEN

Objetivo: Analizar los factores de riesgo de ulceración y amputación de extremidades inferiores en pacientes con diabetes mellitus. **Métodos:** Estudio transversal y cuantitativo realizado en 2013 con 92 individuos diabéticos de una Unidad de Salud de la Familia de Maceió, Alagoas, Brasil a través de entrevistas y evaluación clínica de los pies. Se investigaron las siguientes variables: características socio demográficas (el sexo, la franja de edad, el color de la piel, el estado civil, la escolaridad y la renta) y factores de riesgo complementarios para el pie diabético (los datos clínicos, el estilo de vida y la práctica del auto cuidado con los pies). Para la identificación de la asociación entre las variables se utilizó las pruebas Chi-cuadrado con corrección (Yates), la prueba G y el Exacto de Fisher considerando el nivel de significación del 5% ($p < 0,05$). **Resultados:** La muestra fue de 92 pacientes con diabetes mellitus, siendo el 71,7% (66) del sexo femenino y predominio de la franja de edad entre 60-79 años - el 48,0% (44). Se observó la prevalencia del 95,6% (88) para el riesgo de ulceración y el 4,4% (4) para el riesgo de amputación. Respecto al riesgo de ulceración, el 64,1% (59) se clasificó en riesgo 0 (menor riesgo). **Conclusión:** Se encontró mayor prevalencia de pacientes con menos riesgo de ulceración y amputación. Se destaca el uso inadecuado de calzados como el factor de riesgo más común y el uso del tabaco como factor de riesgo con asociación estadística significativa.

Descriptor: Diabetes Mellitus; Pie Diabético; Factores de Riesgo.

INTRODUCTION

With the actual aging of the population, chronic noncommunicable diseases have had a progressive increase in their incidence. Thus, diabetes mellitus (DM) has become one of the main conditions that have stood out because of its magnitude and severity^(1,2), constituting a major public health problem worldwide⁽³⁾.

Currently, it is estimated that the world population with diabetes is 387 million, likely to reach 471 million in 2035. In Brazil, in 2014, it was registered the prevalence of 11.9 million people with diabetes, aged 20 to 79 years, with a prediction of 19.2 million for the year 2035⁽⁴⁾.

Diabetes mellitus is a disease of heterogeneous etiology, characterized by hyperglycemia resulting from the lack of insulin action due to a deficiency in the production of this hormone, resistance to its action, or both^(4,5). It composes a heterogeneous group of metabolic diseases associated with complications, dysfunction or failure of different organs, and can affect particularly the renal, cardiovascular, neurological and ophthalmic systems⁽⁶⁾. This disease requires a more comprehensive evaluation and its analysis should be extended to the investigation of its complications

and possible variables of incapacity, including the diabetic foot^(1,2).

The expression “diabetic foot” is used when the patient with diabetes presents alterations that can occur in isolation or in association in the feet and lower limbs, which may constitute neurological, infectious, orthopedic and vascular modifications⁽⁷⁾. This is a complication that can result in amputation of the affected limb, whose onset has multifactorial causes, among which, the sensorimotor and autonomic neuropathy represents the greatest risk factor⁽⁸⁾. Among the complications of diabetes, the diabetic foot is a chronic complication, considered the most severe and related to the highest socioeconomic impact^(5,9). It represents a significant cost to health services, often related to prolonged hospital stays, direct cost with amputation and ulcer healing⁽⁹⁾.

As previously mentioned, the vulnerability to diabetic foot occurs mainly because of peripheral neuropathy, which can be divided into sensory neuropathy, leading to gradual loss of tactile and pain sensitivity in the foot; motor neuropathy, which generates bone deformities due to atrophy of the interosseous muscle, causing an abnormal plantar pressure; autonomic neuropathy, in which the sympathetic nerves are injured, reducing the vascular tone, hindering the local circulation and nutrition of tissues^(2,6,7,9). Besides neuropathy, another factor triggered by diabetes is the arterial disease, manifested by atherosclerosis or arterial ischemia, reducing blood flow required for proper tissue perfusion. This factor, in conjunction with some trauma, results in ulcers, which will have its healing process impaired and can lead to gangrene in the presence of infection^(6,10).

Associated risk factors for diabetic foot, other than neuropathy, vascular disease and infection, include poor glycemic control, tobacco use, comorbidities (such as systemic arterial hypertension), time period from the diagnosis of diabetes over 10 years, use of inadequate footwear, inappropriate nail cutting, and previous ulcers and amputations, which classify the patient at a higher risk^(7,11).

For evaluation of the diabetic patient, it is initially necessary to conduct a detailed interview and clinical examination of the foot, where one can view the presence of infections, corns, cracks, bone deformities, nail cutting, previous amputations, ulcers, and reduction or absence of pedal pulses^(4,7,8,12), followed by the evaluation of the cutaneous plantar sensitivity, performed with use of the monofilament Semmes-Weinstein (10g)^(4,5,7,10). Another factor to be considered is the assessment of signs of peripheral arterial disease, through palpation of posterior tibial and dorsalis pedis pulses, which are classified as “present” or “absent”, suggesting vascular compromise, when nonpalpable⁽¹²⁾.

The most cost-effective way to prevent foot complications in patients with diabetes, such as ulceration and amputation, consists in the identification of risk factors and interruption of their progression^(6,7). The health professionals' practices should optimize preventive actions, such as conducting regular tests for risk stratification, promoting health and healthier lifestyle, health education with emphasis on the conscious self-care, identification of the population at risk, and propedeutic interventions as early as possible, in order to decrease the prevalence of amputations^(2,6).

Health promotion is defined as the individual's ability to modify the determinants of health for the benefit of one's quality of life⁽¹³⁾. Although the health team is accountable for guiding, raising awareness and motivating people about changes towards self-care improvement, people with diabetes need to adhere to and employ the information received, generating a higher level of functional independence and changes in lifestyle⁽¹⁴⁾.

In this perspective, a study held in the East region of Belo Horizonte observed that the participation of users in short- and long-term educational practices shows favorable results for the control of diabetes mellitus and its complications⁽¹⁵⁾.

It is known that holistic care to patients with diabetes is challenging, especially in support of changes in lifestyle habits, because these are very attached to their conditions and social interactions⁽⁷⁾. It is essential the work of a multidisciplinary team, acting together to face the challenges and, so, in this way the health team and the community create a bond of responsibility, facilitating the monitoring of individuals for the prevention of diseases⁽⁷⁾.

The present study is justified by the importance, for professionals and patients with diabetes mellitus, to know the predisposing factors for ulceration and amputation of the lower extremities. It is believed that the identification of these factors will guide the health team interventions, pointing out the development of preventive actions at the primary care level. Therefore, the aim of this study was to analyze the risk factors for ulceration and amputation of the lower extremities in patients with diabetes mellitus.

METHODS

This is a cross-sectional, quantitative study, developed with diabetic patients registered in the area 26 of a Family Health Unit, located in Trapiche da Barra neighborhood, in the city of Maceió, Alagoas, Brazil, conducted in the period from May to October 2013.

The diabetic population registered in the area was composed of 118 individuals, 92 of which participated in the

study, while 26 were excluded, according to the exclusion criteria.

The inclusion criteria contemplated patients with diabetes mellitus, registered in the area 26, aged 18 years or above, presenting their cognitive and communication abilities preserved; the study excluded those who did not attend the appointments of the HiperDia Program on collection days, or were not found in their residence during three attempted visits on alternate days at different times, as well as patients who had changed address or died (information obtained from medical records and/or family members).

The patients were individually invited to participate in the study, received clarifications about the objectives and procedures of the research and, after acceptance, signed the Informed Consent Form.

The data collection procedure was performed at the health care unit on the days of HiperDia consultation (consultation focused on assistance to patients with hypertension and diabetes), on a weekly basis, on the morning shift, being interviewed four new patients, on average, while the remaining patients were captured during home visits on alternate days and shifts, varying the daily quantitative, depending on the availability of individuals. The interview was conducted in reserved sites, comfortable to the participants, minimizing the risk of embarrassment.

The interviews and the clinical examination were performed by two duly trained researchers, using a validated instrument⁽⁶⁾, adapted by the authors of this study. There was initially the assessment of sociodemographic and clinical data, lifestyle and foot self-care practices; soon after, the clinical examination of the feet was performed, in order to observe factors that lead to ulcers and amputations, neuropathy evaluation using the Semmes-Weinstein monofilament (10g), and evaluation of signs of peripheral arterial disease.

In the sociodemographic aspects, the marital status category named "with partner" included the patients who reported being married or in a stable union, while "no partner" comprised those who reported being single, widowed or divorced. In lifestyle practices, the consumption of alcohol and/or tobacco was investigated. As for the clinical aspects, the study assessed the presence of self-reported comorbidities that could indicate diabetes complications, such as systemic arterial hypertension, myocardial infarction and stroke⁽⁵⁾.

The foot self-care practices performed by the patients were evaluated, questioning the habit of walking barefoot. In the inspectional foot examination, the researchers checked for the presence of fungal infections in nails or interdigital areas, and in the footwear used during the

interview. The footwear was categorized into adequate or inadequate, being considered appropriate the footwear that provided internal comfort, had ideal size and adjustable closure (Velcro or shoelaces), covered toes and heel, and was made of soft leather or canvas⁽¹¹⁾.

For evaluation of neuropathy, the 10-g Semmes-Weinstein monofilament was applied in six plantar areas: first, third and fifth toes, metatarsals at an angle of 90°, with sufficient force to bend it, and one-second duration between the applications. The individual, keeping eyes closed, was asked about the perception of touch, and two negative responses was considered consistent with loss of sensitivity. After application in 10 individuals, the monofilament was put at rest for a 24-hour period, to prevent decalibration, thus minimizing misdiagnosis^(6,10).

The researchers also observed the presence of ulcers or ulcers scars (confirmed by the patient's report), previous amputations and bone deformities - hallux valgus, claw

toes, hammertoes, muscle atrophy, bony prominences, overlapping fingers, and others that generate abnormal foot pressures⁽⁷⁾.

In the analysis of signs of peripheral arterial disease, palpation of the dorsalis pedis and posterior tibial pulses was conducted, being classified as palpable or not palpable; negative response to palpation of the two pulses in the same member indicated signs of vascular compromise.

After the analysis of risk factors, the feet of patients were categorized into degrees of risk for ulceration and amputation⁽⁷⁾. The variables used for risk stratification are described in Chart I.

For the present study, the risks have been subdivided from 0 to 3 as risks for ulceration, and from 3A to 3E as risks for amputation. Regarding the risk for ulceration, the lower risks were classidied as 0 and 1, while higher risk were classidied as 2 and 3. The risk for amputation is subdivided into lower risk (3A and 3B) and greater risk (3C, 3D and 3E)⁽⁷⁾.

Chart I - Classification of the feet of patients with diabetes mellitus into degrees of risk for ulceration and amputation.

Degree of risk	Sensitivity	Deformities / hyperkeratosis	Ulcers
0	Present	Absent	Absent
1	Absent	Absent	Absent
2	Absent	Present	Absent
3	Absent	Present or Absent	Healed
3A	Superficial ulcer with or without superficial infection		
3B	Deep ulcer, without infection and not affecting bone		
3C	Deep infection (cellulitis, abscess, tendinitis, synovitis, osteomyelitis)		
3D	Necrosis or localized gangrene		
3E	Necrosis or extensive gangrene		

Source: Adapted from the Brazilian Society of Angiology and Vascular Surgery 2001⁽⁷⁾ and Wagner Classification⁽⁷⁾.

The information collected was stored using the software Microsoft Excel 2013, and was subsequently analyzed with use of BioEstat program, version 5.0. To identify the association between the variables, the following tests were adopted: Chi-squared with correction (Yates), G test and Fisher's Exact test, with bivariate analysis between the independent variables and the dependent variable (lower and higher risk for ulceration and for amputation), considering the significance level of 5% ($p < 0.05$).

The study was approved by the Research Ethics Committee of the Alagoas State University of Health Sciences, under protocol no. 2034. All information remained confidential, without identification of patients, and under the responsibility of the researcher.

RESULTS

The assessed population of patients with diabetes mellitus totaled 92 subjects, 66 women and 26 men. The sociodemographic characteristics found in the population are described in percentages in Table I.

Given the displayed in Table I, it stands out the higher prevalence of diabetic female subjects, predominant age group 60-79 years, and patients with less than four years of formal education.

Table II shows the distribution of the population studied, according to the risk rating for ulceration and amputation⁽⁷⁾.

Of the 92 patients studied, it was observed that 95.6% ($n=88$) were classified at risk for ulcers; of these, 64.1%

Table I - Distribution of patients with diabetes mellitus according to sociodemographic characteristics. Maceió, Alagoas, 2013.

Sociodemographic characteristics	Total (92)	
	n	%
Gender		
Female	66	71.7
Male	26	28.3
Marital status		
With partner	37	40.2
No partner	55	59.8
Age range (years)		
18-39	6	6.5
40-59	38	41.3
60-79	44	48.0
80 or above	4	4.3
Self-reported skin color		
White	13	14.1
Black	32	34.8
Brown	47	51.1
Education level		
< 4 years	66	71.7
4 to 7 years	15	16.3
8 or more	11	12.0
Income		
< 1 minimum wage	9	9.8
> 1 minimum wage	20	21.7
1 minimum wage	63	68.5

Table II - Percentage of patients with diabetes mellitus, according to degree of risk for ulceration and amputation. Maceió, Alagoas, 2013.

Risk degrees	Total (92)	
	n	%
Ulceration		
Degree 0	59	64.1
Degree 1	14	15.2
Degree 2	3	3.3
Degree 3	12	13.0
Amputation		
Degree 3A	4	4.4
Degree 3B	0	0
Degree 3C	0	0
Degree 3D	0	0
Degree 3E	0	0

(n=59) were at risk 0, representing the majority of the individuals analyzed. On the risk for amputation, there was a prevalence of 4.4% (n=4) with risk 3A, and no patients were classified into categories 3B to 3E.

Regarding the risk rating for ulceration, 88 patients were identified, of which 82.9% (n=73) were at lower risk (0 and 1) for ulcers, while 17.0% (n=15) were found at greater risk (2 and 3).

It was identified in the study population the presence of additional risk factors for complications in the lower extremities, which are described in Table III.

Given these findings, it stands out the presence of 81.5% (n=75) of patients with hypertension associated with diabetes. Failure to palpation of posterior tibial and dorsalis pedis pulses in the same member occurred in 19.6% (n=18) of the patients studied. Inadequate footwear in use at the

Table III - Distribution of patients with diabetes mellitus according to the main additional risk factors for diabetic foot. Maceió, Alagoas, 2013.

Additional risk factors for diabetic foot	Total (92)	
	n	%
Time period from DM diagnosis		
Up to 10 years	64	69.6
More than 10 years	28	30.4
Comorbidities		
SAH		
Yes	75	81.5
No	17	18.5
Stroke		
Yes	8	8.7
No	84	91.3
AMI		
Yes	5	5.4
No	87	94.6
Alcohol consumption		
Yes	14	15.2
No	78	84.8
Tobacco consumption		
Yes	12	13.0
No	46	50.0
Ex-smoker	34	37.0
Footwear used at the moment		
Adequate	12	13.0
Inadequate	80	87.0
Walks barefoot		
Yes	36	39.1
No	56	60.9
Presence of mycosis in nails/toes		
Yes	19	20.6
No	73	79.4
Pulse alteration		
Yes	18	19.6
No	74	80.4

DM: Diabetes Mellitus; SAH: Systemic Arterial Hypertension; AMI: Acute Myocardial Infarction.

Table IV - Distribution of patients with diabetes mellitus according to the main variables assessed and the classification of risk for ulceration. Maceió, Alagoas, 2013.

Characteristics	Classification of risk for ulceration				Total (88)		p value
	Higher risk (15)		Lower risk (73)		n	%	
	n	%	n	%			
Time period from DM diagnosis							
Up to 10 years	8	53.3	53	72.6	61	69.3	0.2170 [#]
More than 10 years	7	46.7	20	27.4	27	30.7	
Comorbidities							
SAH							
Yes	12	80.0	59	80.8	71	80.7	0.9923 [#]
No	3	20.0	14	19.2	17	19.3	
AMI							
Yes	0	0.0	5	6.8	5	5.7	0.5883 [#]
No	15	100.0	68	93.1	83	94.3	
Stroke							
Yes	2	13.3	5	6.8	7	7.9	0.5965 [#]
No	13	86.7	68	93.1	81	92.0	
Alcohol consumption							
Yes	3	20.0	10	13.7	13	14.8	0.6878 [#]
No	12	80.0	63	86.3	75	85.2	
Tobacco consumption							
Yes	2	13.3	10	13.7	12	13.6	0.0106 [*]
No	12	80.0	32	43.8	44	50.0	
Ex-smoker	1	6.7	31	42.5	32	36.4	
Footwear used at the moment							
Adequate	2	13.3	9	12.3	11	12.5	0.9814 [#]
Inadequate	13	86.7	64	87.7	77	87.5	
Walks barefoot							
Yes	4	26.7	32	43.8	36	40.9	0.3454 ^o
No	11	73.3	41	56.2	52	59.1	
Presence of mycosis in nails/toes							
Yes	6	40.0	12	16.4	18	20.4	0.0721 [#]
No	9	60.0	61	83.6	70	79.6	
Pulse alteration							
Yes	5	33.3	12	16.4	17	19.3	0.1556 [#]
No	10	66.7	61	83.6	71	80.7	

[#]Fisher's Exact Test; ^{*}G Test; ^oChi-squared test. DM: Diabetes Mellitus; SAH: Systemic Arterial Hypertension; AMI: Acute Myocardial Infarction.

moment of the interview reached a rate of 87.0% (n=80) in the study population.

A bivariate analysis of the association between the frequency of higher and lower risk for ulceration in feet of DM patients and their sociodemographic, clinical, lifestyle, self-care practices, dermatological and vascular characteristics was performed, as described in Table IV. It is noteworthy that no patients were found with higher risk for amputation; therefore, it was not possible to perform a bivariate analysis for risk of amputation, being restricted to ulceration.

According to Table IV, significant association was found only in relation to tobacco use and the risk for ulcers (p=0.010).

The bivariate analysis with socioeconomic data brought no significant association.

DISCUSSION

Regarding the sociodemographic characteristics, it was possible to observe a higher prevalence of female diabetic patients (71.7%) in this study, which was also found in other

studies^(6,16-18). This may be related to the fact that women have a longer life expectancy than men, managing to reach adulthood and aging⁽¹⁹⁾, being more concerned about their health, looking for the primary health care service, viewing preventive measures, unlike the male population, which demands mostly the tertiary service, and when there is the onset of pathological complications^(20,21).

The Brazilian Society of Diabetes⁽¹⁰⁾ refers to the age group 60-69 years as the one with the highest prevalence of diabetes, which agrees with the findings in this study; Similar results were found by other authors^(18,22,23).

The low education level of individuals constitutes an additional risk factor for non-adherence to self-care practices and remains a major challenge for the health teams⁽²⁴⁾. In addition to the high prevalence of diabetics with low education level identified in the current study, other authors⁽²⁵⁾ bring similar results, with a prevalence of 40.5% of illiterate diabetic patients, and an international study⁽²³⁾ points the prevalence of 60.0% diabetics with up to 5 years of study, 25.0% of these being illiterate.

In this study, as concerns the economic aspects, a larger proportion of the population was found living with only the minimum wage (68.5%). It is essential to emphasize the importance of the diabetics' level of knowledge and their economic conditions to increase their level of capability regarding practices to prevent complications⁽²⁴⁾; with this aim, the health team must corroborate with educational measures relating to the treatment, directed at the patient and relatives as well.

Family participation, in the context of patients with chronic diseases, is paramount, comprising attention for support regarding the dietary changes, physical exercise practice, blood glucose monitoring, adherence to treatment and foot care practices, especially for patients unable to care for themselves^(26,27).

In the current study, the prevailing self-reported skin color was brown (51.1%), followed by black (34.8%). The Brazilian Society of Diabetes⁽¹⁰⁾ touts important differences in the prevalence of diabetes according to countries and ethnic groups. In this sphere, it is worth clarifying that, in addition to genetic susceptibility, there is the influence of external factors, such as lifestyle and dietary patterns.

For stratification by degree of risk for ulceration and amputation, the high prevalence of patients with low or no risk for ulceration (82.9%) was a positive factor identified in this study. A research⁽¹⁷⁾ with a common goal brought a prevalence of 56.0% of diabetic patients at risk 0 for ulceration, with 16.0% of individuals classified at degree risk 3. In Ribeirão Preto, a similar study⁽²⁴⁾ also showed a high prevalence of diabetics at risk 0 for ulcers (79.8%), with 14.0% at risk 3. It is worth clarifying, however, that, even

though the patients investigated in this study were classified into low degrees of risk for ulceration and amputation, they presented inadequate foot self-care and lifestyle, in addition to low education level, thereby contributing to the onset of major chronic complications.

The time period after diabetes diagnosis is an important factor for the increased risk of foot complications, where time period above 10 years constitutes an additional risk factor for the onset of diabetic foot⁽⁶⁾. The data obtained in this study found that a majority of patients had a time period from diagnosis less than 10 years; however, there was no significant association between the time elapsed from diagnosis and the prevalence of risk for ulceration.

Hypertension has a high prevalence in patients with diabetes, being a risk factor for cardiovascular diseases and microvascular impairment, leading to the onset of retinopathy and nephropathy⁽²⁸⁾. This fact agrees with the findings of this survey, in which 81.5% of diabetic patients had hypertension as comorbid condition, presenting themselves at risk for the emergence of major diabetes complications, as found in another study⁽²⁶⁾.

An important risk factor for diabetic foot is tobacco, because its presence raises the incidence of macrovascular alterations liable to increase the onset of ulcers, and also compromises their diagnosis when these are already present, resulting in the emergence of complications such as infection, gangrene, and even amputation^(26,29,30). It stands out, in this study, the significant association between tobacco use and the risk for ulceration, though, among 88 individuals found at risk for ulcers, 50.0% of the population reported not using tobacco and 36.4% reported being ex-smokers for a period longer than six months. Thus, the association may have occurred indicating that the non-smoking habit constitutes a preventive factor to the onset of ulcers.

The presence of mycosis in the interdigital and subungual spaces acts as a gateway for infections, which are one of the main factors leading to amputation of lower limbs⁽¹⁾. Researches evidence significant prevalence of interdigital mycoses^(6,31). This type of dermatologic disorders represents a high risk factor for complications in diabetic foot, requiring evaluation and continuous monitoring by health professionals, acting with preventive measures, treatment and monitoring of injuries, aiming at their healing and reintegration of the epithelial tissue⁽²⁵⁾.

In conducting the assessment of pulses alterations through palpation, 19.6% of patients showed abnormalities in posterior tibial and dorsalis pedis pulses on the same limb, which were nonpalpable, suggesting vascular compromise. Vascular disorders are regarded one of the main determinants of onset of ulcers and difficulties in the healing process, evolving to amputation⁽⁵⁻⁷⁾.

Another factor related to the emergence of ulcers and subsequent extremities amputation in diabetic patients is the presence of inadequate foot self-care habits, like the use of improper footwear, increasing the external risk for foot injuries and emergence of corns^(7,32). In this study, 87.0% of individuals were observed using inadequate footwear at the moment of the interview.

The findings brought by the authors, in conjunction with those found in other studies described herein, have demonstrated the need for evaluation of health teams, in order to propose measures for more effective interventions as regards the needs and vulnerabilities of diabetic individuals. It is thus highlighted the importance of continuity on the assessment of risk factors for ulceration and amputation, and improvement in quality of care for the diabetic population, with expansion of interventions and programs that mainly focus the encouragement of health promotion practices and healthier lifestyles^(7,32,33).

This study had some limitations that should be considered, like the study universe that allowed the consideration of results related to a single group of diabetic patients, even though it is emphasized that the findings corroborate those of similar studies, thus strengthening the data obtained. Other limiting factor was the loss of individuals in the sample for non-attendance to the consultations, being hindered the meeting with them in the household. Thus, it is necessary the continuous planning of actions that contribute to the prevention of complications and to improvement in the quality of life of these individuals.

CONCLUSION

There was a higher prevalence of patients at lower risk for ulceration and amputation of the lower extremities, being detected tobacco use as a risk factor with statistical significance, and the use of inappropriate footwear as the most prevalent additional risk factor.

ACKNOWLEDGEMENT

To the Research Support Foundation of the State of Alagoas - FAPEAL; to the Alagoas State University of Health Sciences; to the Virgem dos Pobres III Health Unit and to the patients.

REFERENCES

1. Santos ICRV, Carvalho EF, Souza WV, Albuquerque EC. Factors associated with diabetic foot amputations. *J Vasc Bras*. 2015;14(1):37-45.
2. Santos ICRV, Sobreira CMM, Nunes ENS, Morais MCA. Prevalência e fatores associados a amputações por pé diabético. *Ciênc Saúde Coletiva*. 2013;18(10):3007-14.
3. Magalhães AT, Silva BAK, Ribeiro JA, Aguiar JF Bisneto, Pereira LPI, Machado NV, et al. Avaliação do risco de desenvolver diabetes mellitus tipo 2 em população universitária. *Rev Bras Promoç Saúde*. 2015;28(1):5-15.
4. Sociedade Brasileira de Diabetes. Diretrizes da Sociedade Brasileira de Diabetes 2015-2016. São Paulo: AC Farmacêutica; 2016.
5. Ministério da Saúde (BR), Secretaria de Atenção à Saúde, Departamento de Atenção Básica. Estratégias para o cuidado da pessoa com doença crônica: diabetes mellitus. Brasília: Ministério da Saúde; 2013.
6. Bortoletto MSS, Haddad MCL, Karino ME. Pé diabético, uma avaliação sistematizada. *Arq Ciênc Saúde Unipar*. 2009;13(1):37-43.
7. Caifa JS, Castro AA, Fidelis C, Santos VP, Silva ES, Sitrângulo CJ Jr. Atenção integral ao portador de pé diabético. *J Vasc Bras*. 2011;10(4 Supl 2):1-32.
8. Escola de Saúde Pública do Estado de Minas Gerais. Curso de Atualização Profissional em Manejo Clínico do Pé Diabético. Minas Gerais: Secretaria de Estado de Saúde de Minas Gerais; 2010.
9. Oliveira AF, Marchi ACB, Leguisamo CP, Baldo GV, Wawginiak TA. Estimativa do custo de tratar o pé diabético, como prevenir e economizar recursos. *Ciênc Saúde Coletiva*. 2014;19(6):1663-71.
10. Sociedade Brasileira de Diabetes. Diretrizes da Sociedade Brasileira de Diabetes 2013-2014. São Paulo: AC Farmacêutica; 2014.
11. Ochoa-Vigo K, Pace EA. Pé diabético: estratégias para prevenção. *Acta Paul Enferm*. 2005;18(1):100-9.
12. Armstrong DG, Boulton AJM, Albert SF, Frykberg RG, Hellman R, Kirkman MS, et al. Comprehensive Foot Examination and Risk Assessment. *Diabetes Care*. 2008;31(8):1679-85.
13. Szwarcwald CL, Souza PR Júnior, Damacena GN, Almeida WD, Malta DC, Stopa SR, et al. Recommendations and practice of healthy behaviors among patients with diagnosis and diabetes in Brazil: National Health Survey (PNS), 2013. *Rev. Bras. Epidemiol*. 2015;18(Supl 2):132-45.
14. Cubas MR, Santos OM, Retzlaff EMA. Pé diabético: orientações e conhecimentos sobre cuidados preventivos. *Fisioter Mov*. 2013;26(3):647-55.

15. Maia MA, Reis IA, Torres HC. Relationship between the users' contact time in educational programs on diabetes mellitus and self-care skills and knowledge. *Rev Esc Enferm USP*. 2016;50(1):59-64.
16. Dourado MA, Santos ICRV. Adesão aos cuidados de prevenção do pé diabético. *Revista Estima*. 2015;13(4):1-6.
17. Audi EG, Moreira RC, Moreira ACMG, Pinheiro EFC, Mantovani MF, Araújo AG. Avaliação dos pés e classificação do risco para pé diabético: contribuição da enfermagem. *Cogitare Enferm*. 2011;16(2):240-6.
18. Rodrigues DF, Brito GEG, Sousa NM, Rufino TMS, Carvalho TD. Prevalência de Fatores de Risco e Complicações do Diabetes Mellitus Tipo 2 em Usuários de uma Unidade de Saúde da Família. *Rev Bras Ciênc Saúde*. 2011;15(3):277-86.
19. Instituto Brasileiro de Geografia e Estatística. Síntese de Indicadores Sociais. Rio de Janeiro: IBGE; 2013.
20. Cotta RMM, Batista KCS, Reis RS, Souza A, Dias G, Castro FAF, Alfenas RCG, et al. Perfil socio-sanitário e estilo de vida de hipertensos e/ou diabéticos, usuários do Programa de Saúde da Família no município de Teixeira, MG. *Ciênc Saúde Coletiva*. 2009;14(4):1251-60.
21. Batista MCR, Priore SE, Rosado LEFPL, Tinôco ALA, Franceschini SCC. Avaliação dos resultados da atenção multiprofissional sobre o controle glicêmico, perfil lipídico e estado nutricional de diabéticos atendidos em nível primário. *Rev Nutr*. 2005;18(2):219-28.
22. Santos ICRV, Nunes ENS, Melo CA, Farias DG. Amputações por pé diabético e fatores sociais: implicações para cuidados preventivos de enfermagem. *Rev Rene*. 2011;12(4):684-91.
23. Hernández FM, Reza CG, Martínez VG, Guadarrama FC. Cuidado de los pies en usuarios que viven con diabetes en el estado de México: bases para la sistematización de la asistencia de enfermeira. *Enferm Foco (Brasília)*. 2011;2(1):23-7.
24. Pace AE, Foss MC, Ochoa-Vigo K, Hayashida M. Fatores de risco para complicações em extremidades inferiores de pessoas com diabetes mellitus. *Rev Bras Enferm*. 2002;55(5):514-21.
25. Araújo MFM, Gonçalves TC, Damasceno MMC, Caetano JA. Aderência de diabéticos ao tratamento medicamentoso com hipoglicemiantes orais. *Esc Anna Nery Rev Enferm*. 2010;14(2):361-7.
26. Karino ME, Pace AE. Risco para complicações em pés de trabalhadores portadores de diabetes mellitus. *Ciênc Cuid Saúde*. 2012;11(Supl):183-90.
27. Pace AE, Nunes PD, Ochoa-Vigo K. O conhecimento dos familiares acerca da problemática do portador de diabetes mellitus. *Rev Latinoam Enferm*. 2003;11(3):312-9.
28. Moreschi C, Rempel C, Carreno I, Silva DS, Pombo CNF, Cano MRL. Prevalência e perfil das pessoas com diabetes cadastradas no Sistema de Informação da Atenção Básica (SIAB). *Rev Bras Promoç Saúde*. 2015;28(2):184-90.
29. Alonso-Fernández M, Mediavilla-Bravo JJ, López-Simarro F, Comas-Samper JM, Carramiñana-Barrera F, Mancera-Romero J, et al. Evaluation of diabetic foot screening in Primary Care. *Endocrinol Nutr*. 2014;61(6):311-7.
30. Chan ACRV, Lima PF, Chaves JBC, Raymundo CS. Incidência de amputação em membros inferiores associada a diabetes mellitus. *Saúde Colet (Barueri Impr)*. 2009;6(33):222-6.
31. Queiróz IWO, Gonçalves O, Faria CCC, Dias JML. Análise dos fatores desencadeantes do pé diabético em uma Unidade de Atenção Primária à Saúde. *Perquirere*. 2012;9(1):70-80.
32. Oliveira PS, Bezerra EP, Andrade LL, Soares MJGO, Costa MML. Fatores de risco para complicações decorrentes do Diabetes Mellitus. *Rev Enferm UFPE*. 2013;7(8):5265-73.
33. Stopa SR, César CL, Segri NJ, Goldbaum M, Guimarães VM, Alves MC, et al. Self-reported diabetes in older people: comparison of prevalences and control measures. *Rev Saúde Pública*. 2014;48(4):554-62.

First author's address:

Thaysa Alves Tavares
 Universidade Federal de Pernambuco - UFPE
 Hospital das Clínicas
 Travessa Professor Moraes Rego, 1235
 Bairro: Cidade Universitária
 CEP 50670-901- Recife - PE - Brasil
 E-mail: alves.thaysa@yahoo.com.br

Mailing address:

Luana Jeniffer Souza Farias da Costa
 Universidade Estadual de Ciências da Saúde de Alagoas - UNCISAL
 Rua Jorge de Lima, 113
 Bairro: Trapiche da Barra
 CEP: 57010-300- Maceió - AL - Brasil
 E-mail: lua-souza@hotmail.com