# Risk stratification for diabetic foot occurrence: association between risk factors and clinical change

## *Estratificação do risco para ocorrência do pé diabético: associação entre fatores de risco e alterações clínicas*

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**ABSTRACT**

The aim of this study was to assess the association of risk factors for the occurrence of diabetic foot with the presence of clinical changes and the degree of risk stratification. This is a cross-sectional study, carried out between August 2018 and April 2019 with 284 patients monitored by the Family Health Strategy in a municipality in the state of Maranhão. Most were classified as grade 0 (74.1%), followed by grade 3 (11.9%) for diabetic foot. Those with inadequate and sedentary diets were twice as likely to have altered tibial and pediatric pulse, respectively. In addition, sedentary individuals were three times more likely to have absent sensitivity. It was concluded that the risk factors favored the occurrence of clinical changes, so its early identification is important to improve the prognosis and quality of life of patients, as they are related to the development of the diabetic foot.

**Keywords**: Diabetes Mellitus. Diabetic foot. Risk factors.

**RESUMO**

O objetivo deste estudo foi avaliar a associação dos fatores de risco para ocorrência do pé diabético com a presença de alterações clínicas e o grau estratificação de risco. Trata-se de um estudo transversal, realizado entre agosto de 2018 e abril de 2019 com 284 pacientes acompanhados pela Estratégia Saúde da Família em um município do Estado do Maranhão. A maioria foi classificada com grau 0 (74,1%), seguido do grau 3 (11,9%) para o pé diabético. Aqueles com alimentação inadequada e sedentários tiveram duas vezes mais chances de ter pulso tibial e pedioso alterados, respectivamente. Além disso, os sedentários apresentaram três vezes mais chance de ter sensibilidade ausente. Concluiu-se que os fatores de risco favoreceram a ocorrência de alterações clínicas, assim é importante sua identificação precoce para melhorar o prognóstico e a qualidade de vida dos pacientes, pois estão relacionados ao desenvolvimento do pé diabético.

**Palavras-chave:** Diabetes Mellitus. Fatores de risco. Pé diabético.

## INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disorder with a slow and progressive evolution, characterized by a persistent hyperglycemia that can be marked by resistance, decrease or deficiency of insulin in exercising the appropriate metabolic effects in the body[1]. A study states that about 9.3% of the world population between 20 and 79 years old has a diagnosis of DM, and in individuals over 65 this number reaches approximately 27.8%. Annual health expenditures with this disease are estimated at US$ 760 billion, of which 50% are for diabetic complications[2].

Diabetic foot is one of the main complications of DM and has the greatest socioeconomic impact, as it is related to higher treatment expenses, prolonged hospitalizations, physical and social disabilities; in addition to the fact that it is the most significant cause of amputations. It is an injury that occurs in the feet due to the association of clinical factors, such as peripheral neuropathy, peripheral vascular disease, feet deformity, unsatisfactory glycemic control, obesity, advanced age, time of diagnosis and Systemic Arterial Hypertension (SAH). Life habits also contribute to the occurrence of this disorder, such as smoking, alcoholism, physical inactivity, lack of healthy eating practices and poor hygiene and foot care[3].

In the presence of peripheral neuropathy, the patient with DM is exposed to a greater risk of developing foot injuries, as it is characterized by the progressive degeneration of nerve fibers in the peripheral axons, resulting in loss of sensation[4]. An associated risk factor is peripheral arterial disease, which consists of occlusion or narrowing of the arteries of the lower extremities by atherosclerotic processes[5].

Deformity is another risk factor associated with peripheral neuropathy for the occurrence of diabetic foot, as the increase in bony prominences can cause skin rupture due to plantar pressures, such as claw toe, hammer toe, hallux vagus and Charcot arthropathy. This implies the need for greater care to prevent complications[6,3].

These complications are directly related to the time of diagnosis of the disease and inadequate glycemic control, as hyperglycemic spikes for long periods affect the nerves and peripheral vessels, in addition to increasing the chance of amputations[7]. Therefore, to obtain the appropriate glycemic control, the patient must acquire new habits, such as physical exercise and a healthy diet, monitored by professional supervision[8,9].

In this perspective, one way to calculate the overall risk that diabetic patients present for developing foot injuries and projecting their risk over time is through risk stratification. This is a measure adopted by the Ministry of Health aiming to reduce and prevent the occurrence of complications.[3] Thus, knowing the associated factors that increase the risk of diabetic foot may be a step to be taken by professionals in the Basic Health Units

(UBS) to stratify this risk and assist in planning the actions to be performed by the nursing team.

Furthermore, the assessment of patients' feet with DM is essential and should be a routine of care, so that healthcare professionals can intervene appropriately, by early identifying risk factors and encouraging patients to be protagonists of self-care and for their own general well-being[10].

Therefore, this study aimed to assess the influence of risk factors on the occurrence of clinical changes in the feet of patients with type 2 Diabetes Mellitus and their association with risk stratification.

**METHODS**

This is a cross-sectional, descriptive, analytical study, carried out from August 2018 to April 2019, with 284 patients with type 2 Diabetes Mellitus monitored by the Family Health Strategy (FHS) in a municipality in the state of Maranhão.

In order to estimate the sample size, a formula was used to calculate an infinite population, considering the following parameters: 95% confidence level (Zα = 1.96), 6.7% sample error and prevalence of event 50%[11]. As the risk factors had different prevalence, it was decided to adopt a conservative value for the prevalence of event. Based on these values, the minimum sample size established was 200, although the study had a sample of 284 people. The subjects were captured through a consecutive (naturalistic) sampling process, that is, as they accepted to participate and met the inclusion criteria[12].

The study included patients of both sexes, aged over 18 years who had a confirmed medical diagnosis of Type 2 Diabetes Mellitus. Those with cognitive impairment affecting participation in the interview and those diagnosed with Hansen's Disease were excluded, since it is a pathology that can be conflicting in the identification of the specific clinical picture of diabetes, since it is also characterized by neuropathic changes.

Data were collected with the aid of a semi-structured questionnaire validated from the Summary of Diabetes self-care Activities Questionnaire. It contains questions related to sociodemographic variables and risk factors for the occurrence of diabetic foot, such as time of diagnosis, type of treatment, lifestyle (practice of physical activity, food, consultations, smoking, alcoholism and foot care), presence of arterial hypertension and physical examination of the patients' feet.

The application of this instrument occurred in waiting rooms and in the clinics provided by the institution's coordinator while patients waited for the appointments scheduled with the unit's healthcare professionals. The data were obtained by nursing students who are part of the research project entitled "Determinação do risco para o desenvolvimento do pé diabético em pacientes com Diabetes Mellitus tipo 2" (Determination of the risk for the development of diabetic foot in

patients with type 2 Diabetes Mellitus). Before starting the collection, students underwent training in order to standardize this collection and avoid bias in interpretation.

To perform the risk stratification of the diabetic foot, the recommendation of the *Manual do pé diabético*[3] (Manual of Diabetic Foot Care) was used, which classifies the patient into four degrees: 0 ("absent neuropathy"), 1 ("neuropathy present with or without deformities – claw toes, hammer toes, forefoot prominences, Charcot)", 2 (" peripheral arterial disease with or without present neuropathy") and 3 ("history of ulcer and/or amputation"). Thus, the higher the degree, the greater the risk of developing an ulcer and/or require an amputation over time. This classification is available to be used and to guide the conduct of care and monitoring of the professional after the initial assessment.[3]

For statistical analysis, the program Statistical Package for Social Sciences (SPSS) version 24.0 for Mac OS® was used. The data were stored in Microsoft Excel 2010 software, and the results are presented in tables. In the univariate descriptive analysis, absolute frequency, percentage, central tendency and dispersion were considered. Pearson's chi-squared test and Fisher's exact test were applied to analyze the association between categorical variables, which was used only in cases where the expected frequency of the variables was less than five. To measure the magnitude of the effect of the variables, the prevalence ratio and its confidence interval were calculated with a significance level of 5%.

The research was approved by the Ethics Committee of the Federal University of Maranhão under no 3.592.992. Participants who agreed to participate in the study agreed with the signing of the Informed Consent Form (ICF).

**RESULTS**

The data obtained showed that of the 284 patients interviewed, 65.8% were female, with a mean age of 63.7 years (median: 65.0; SD: ± 11.09) - the age ranged between 25 and 87 years. It was also observed that the majority were married (51.1%), retired (49.1%), had incomplete elementary school (42.4%) and lived with children and partner simultaneously (53%). Regarding the time of diagnosis of DM, 45.2% said they had lived with the disease for more than ten years and had an average monthly income of R$ 1,441.27.

Table 1 shows the data regarding lifestyle and some clinical factors related to the risks for the development of diabetic foot. Concerning life habits, it was found that 44.6% of participants followed a recommended diet for diabetics, 24.6% practiced some type of physical activity, 7.1% were smokers, and 9.3%, alcoholics. Regarding consultations to treat the disease, 75.9% reported having it frequently, however only 16.8% saw a doctors at least three times a year.

As for the type of DM treatment, it was observed that 89.7% of patients use oral

antidiabetics drugs, but 14.2% stated that they did not follow the recommended drug therapy. When asked about laboratory tests (fasting blood glucose and glycated hemoglobin) to check their blood glucose level, 31.1% reported not having undergone it in one year. In addition, 72.3% are hypertensive and 25.4% reported that they have already been hospitalized for complications from diabetes.

**Table 1.** Distribution of variables according to lifestyle and clinical factors for the development of diabetic foot in patients with type 2 Diabetes Mellitus. Maranhão (MA), 2020

| Variables | N | % |
|---|---|---|
| **Adequate diet** | 124 | 44.6 |
| **Physical activity** | 69 | 24.6 |
| **Smoking** | 20 | 7.1 |
| **Alcoholic** | 26 | 9.3 |
| **Has consultation frequently** | 214 | 75.9 |
| **How many consultations a year*** | | |
| None | 8 | 2.9 |
| One | 50 | 17.9 |
| Two | 60 | 21.5 |
| Three | 47 | 16.8 |
| More than four | 114 | 41.1 |
| **Type of treatment♦** | | |
| Oral antidiabetic drugs | 253 | 89.7 |
| Insulin | 41 | 14.5 |
| Food education | 91 | 32.2 |
| Physical actvities | 59 | 21.0 |
| **Follows drug therapy*** | | |
| Yes | 236 | 85.8 |
| No | 39 | 14.2 |
| **Undergoes blood tests to check blood glucose level/per year*** | | |
| None | 84 | 31.1 |
| Once | 56 | 20.7 |
| Twice | 42 | 15.6 |
| Others | 68 | 25.2 |
| **Hospitalization due to diabetes** | 71 | 25.4 |
| **Arterial hypertension** | 205 | 72.7 |
| Total | 284 | 100% |

**\*** The number that does not correspond to the total of 284 patients refers to those classified as missing due to lack of information.
♦The total value is greater than 100% because the same patient could have more than one treatment modality
Source: prepared by the authors.

Data on patients' foot care are shown in Table 2. The results found showed that most of them did not perform self-examination (59.9%) and had the habit of cutting their nails (95.8%) - in 55.9% of cases, the type of cut was rounded.

Regarding self-care practices, there was a relevant number of participants who

do not examine inside the shoes before putting them on (40.8%), do not dry between the fingers after washing them (48.9%), do not they moisturize their feet (67.7%) and do not wear socks when they wear closed shoes (73.5%). In smaller proportions, those who claimed to have the habit of walking barefoot (12.4%) and foot bathing (3.9%) were identified. When asked about the physical examination of the feet by healthcare professionals during consultations, most of the interviewees said that this did not happen (92.4%) and stated that they had not been instructed about care to avoid injuries (64.9 %).

**Table 2.** Distribution of patient compliance related to foot care practices**.** Maranhão (MA), 2020

| Variables | N | % |
|---|---|---|
| **Self-examines the feet** | 113 | 40.1 |
| **Has a habit of cutting nails** | 272 | 95.8 |
| **Nail cutting type\*** | | |
| Rounded | 157 | 55.9 |
| Straight | 124 | 44.1 |
| **Examines inside the shoe before putting it on** | 168 | 59.2 |
| **Dries between fingers after washing them** | 144 | 51.1 |
| **Walks barefoot** | 35 | 12.4 |
| **Foot bathes** | 11 | 3.9 |
| **Wears socks when wearing closed shoes** | 75 | 26.5 |
| **Moisturizes the feet with creams or oils** | 91 | 32.3 |
| **In the consultations, were you advised on foot care to avoid injuries?\*** | | |
| Yes | 97 | 35.1 |
| No | 179 | 64.9 |
| **Does the healthcare professional assesses your feet during consultations?\*** | | |
| Yes | 21 | 7.6 |
| No | 254 | 92.4 |
| **Total** | **284** | **100%** |

\* The number that does not correspond to the total of 284 patients refers to those classified as missing due to lack of information.
Source: prepared by the authors.

The distribution of clinical variables observed during physical examination of the feet in patients with type 2 DM is described in Table 3. The most prevalent clinical changes were: dry skin (42.0%), cracked heels (37.1%), loss of sensation (16.3%) and previous history of ulcers (4.7%). The presence of deformities was identified in 13.7% of the participants, and the main types were hallux vagus (28.9%) and claw toes (13.2%). With regard to the evaluation of the foot pulses, the tibial and pedal pulses were altered in 45.3% and 39.6% of the interviewees, respectively.

**Table 3**. Distribution of feet clinical changes identified in diabetic patients observed during physical examination. Maranhão (MA), 2020

| Variables | N | % |
|---|---|---|
| **Altered tibial pulse** | 124 | 45,3 |
| **Presence of dry skin** | 116 | 42,0 |
| **Altered pedal pulse** | 106 | 39,6 |
| **Presence of cracking** | 103 | 37,1 |
| **Absent sensibility** | 45 | 16,3 |
| **Presence of toenail fungus** | 42 | 15,1 |
| **Feet deformities** | 38 | 13,7 |
| **Types of deformities** | | |
| Hallux vagus | 11 | 28,9 |
| Claw toes | 5 | 13,2 |
| Hammer toes | 2 | 5,3 |
| **Presence of interdigital mycosis** | 27 | 9,7 |
| **Presence of calluses** | 19 | 6,9 |
| **History of previous ulcer** | 13 | 4,7 |
| **History/presence of amputations in lower limbs** | 6 | 2,2 |
| **Presence of ulcer** | 2 | 0,7 |
| **Total** | **284** | **100%** |

Source: prepared by the authors.

Table 4 shows the degree of risk of developing ulcers and the association of this risk according to lifestyle and clinical factors in patients with DM. In general, most of the sample was classified as grade 0 (74.1%), that is, absence of neuropathy. However, among those with some degree of risk, grade 3 stood out, present in 11.9% of respondents.

When assessing the association between the degrees of risk with sociodemographic variables and lifestyle, a varied distribution was observed, with significant increases in relation to the general sample. There was a significant percentage increase in male participants with grade 3 when compared to the entire research group (11.9% vs 20%). Although there was no statistical association in the other variables, there was an increase in grade 3 in alcoholic patients (11.9% vs 23.1%); in smokers, this occurred in grades 1 and 3 (5% vs 15%; and 11.9% vs 20%, respectively).

**Table 4.** Distribution of diabetic patients according to the degree of risk of developing ulcers based on general factors, according to lifestyle and clinical factors. Maranhão (MA), 2020

| Variables | Degree of risk | | | | Total N/% | p-value |
|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | | |
| **General distribution of the degree of risk** | 74.1% | 5.0% | 9.0% | 11.9% | 284 (100%) | ___ |
| **Age ≥ 60 years old** | 73.0% | 4.6% | 10.7% | 11.7% | 26 (100%) | 0.461 |
| **Male** | 67.4% | 4.2% | 8.4% | 20.0% | 95 (100%) | 0.027 |
| **Inadequate diet** | 72.2% | 6.6% | 10.6% | 10.6% | 151 (100%) | 0.268 |
| **Alcoholism** | 65.4% | 3.8% | 7.7% | 23.1% | 26 (100%) | 0.335 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Smoking** | 60.0% | 15.0% | 5.0% | 20.0% | 20 (100%) | 0.095 |
| **Sedentarism** | 72.2% | 5.7% | 10.0% | 12.0% | 209 (100%) | 0.407 |
| **Does not self-examine the feet** | 72.1% | 6.7% | 9.7% | 11.5% | 165 (100%) | 0.402 |
| **Arterial hypertension** | 75.5% | 4.0% | 8.5% | 12.0% | 200* (100%) | 0.609 |
| **Time of diagnosis ≥ 10 years** | 73.6% | 4.8% | 10.4% | 11.2% | 125 (100%) | 0.908 |

\* Number does not correspond to the total number of hypertensive patients found in the study; five of them were not classified as to the degree of risk due to the lack of information at the time of the survey.
Source: prepared by the authors.

Table 5 shows the statistically significant results of the analysis of the association between the patients' lifestyle and the presence of clinical changes in the feet. These data show that among those with inadequate nutrition, the chances of having an altered tibial pulse were approximately twice as high (OR = 2.039, CI = 1.244-3.342; p = 0.004); however, those who had arterial hypertension were 49.5% less likely to experience it (OR = 0.505; CI = 0.290-0.880; p = 0.015).

The sedentarism variable was significantly associated with two clinical changes, so that sedentary respondents were twice as likely to have an altered pedal pulse (OR = 2.193; CI = 1.183-4.063; p = 0.011) and three times more to have loss of plantar sensitivity (OR = 3.713; CI = 1.276-10.806; p = 0.011). With regard to feet self-examination, the chances of the pedal pulse being altered in patients who did not perform it were twice as high as in those who had this care (OR = 2.015; CI = 1.210-3.357; p = 0.007). It is also noteworthy that, although there was a statistical association between alcoholism and cracked feet, the confidence interval comprised the value 1.

**Table 5.** Distribution of variables according to association and statistical significance of life habits and feet clinical changes. Maranhão (MA), 2020

| Risk factor | Clinical changes | | OR* (CI 95%)** | p-value |
|---|---|---|---|---|
| **Inadequate diet** | **Altered tibial pulse** | | | |
| | Yes | No | | |
| Yes | 76 | 42 | 2.039 | |
| No | 71 | 80 | (1.244-3.342) | 0.004♦ |
| **Arterial hypertension** | **Altered tibial pulse** | | | |
| | Yes | No | | |
| Yes | 99 | 98 | 0.505 | |
| No | 50 | 25 | (0.290-0.880) | 0.015♦ |
| **Alcoholism** | **Presence of cracks** | | | |
| | Yes | No | | |
| Yes | 5 | 21 | 0.369 | |
| No | 98 | 152 | (0.135-1.012) | 0.045♦ |
| **Sedentarism** | **Loss sensitivity** | | | |
| | Yes | No | | |
| Yes | 62 | 4 | 3.713 | |
| No | 167 | 40 | (1.276-10.806) | 0.011♦ |
| **Sedentarism** | **Altered pedal pulse** | | | |
| | Yes | No | | |

| | Yes | No | 2.193 (1.183-4.063) | 0.011♦ |
|---|---|---|---|---|
| Yes | 49 | 17 | | |
| No | 117 | 89 | | |
| **Does not self-examine the feet** | **Altered pedal pulse** | | | |
| | Yes | No | | |
| Yes | 77 | 33 | 2.015 (1.210-3.357) | 0.007♦ |
| No | 88 | 76 | | |

\* OR = odds ratio; \*\* CI= confidence interval (95%).
♦ Chi-squared test.
Source: prepared by the authors.

## DISCUSSION

Risk stratification for the occurrence of diabetic foot is important for the management of patients with type 2 Diabetes Mellitus, since the risk factors have a direct influence on the occurrence of these changes[10]. Based on the knowledge of these aspects, the nurse can act to track patients and prevent this complication by proposing educational activities, making these people capable and protagonists of self-care through changes in their lifestyle.

The results obtained in this research showed that females were the most prevalent among the number of patients with DM2, corroborating what was found in a study that evaluated the risk of developing diabetic foot in primary care, in which women represented 79,2% of the evaluated sample[14]. The greatest number of them in this study can be explained by the fact that they seek health services more frequently, as they are generally more concerned with their own health, in addition to being more accessible to participate in research in these environments[15].

In the present study, the mean age of patients was over 60 years, and the literature points to studies in which this sociodemographic variable has been associated with an increased risk for the occurrence of diabetic foot, a fact that is due to the loss of self-care skills and glycemic control.[16,17] Concerning this, authors of a survey[18] evaluating complications related to the time of diagnosis of DM identified a mean age of 58 years and found that 55.8% of patients had a time of diagnosis of the disease greater than ten years - in this study, this was observed in a little less than half of the interviewees. These authors realized that the age and duration of diabetes were independent predictors of the clinical course of the condition, in addition to highlighting that the presence of complications associated with diabetes can be mediated by these factors, since the number of years lived can be affected not only due to clinical exposure, but also due to the treatment they received throughout life[18].

The main clinical changes observed in the feet of the patients participating in this research were altered tibial and pedal pulses, dry skin and cracking, and are risk factors for the appearance of injuries. They indicate little knowledge about the disease, which can be explained by low level of

education, restricted blood flow to the peripheral limbs and lack of self-care with the feet[10].

These findings corroborate a study carried out in two outpatient health services in the city of Aracaju (SE), assessing the degree of risk for the occurrence of diabetic foot[19]. The main changes identified were the presence of scaly feet (66.4%), cracks and fissures (67.1%). Similarly, another study that also investigated the degree of risk for foot ulcers in diabetic patients indicated the presence of dry skin (84%), calluses (74%), altered sensitivity (34%) and feet deformity (22%)[20]. Therefore, the need to early identify these changes and intensify information about self-care is evident, in order to avoid future complications[19].

Another factor that has been linked to the development of complications related to diabetes is the level of education. In this investigation, most of the interviewees stated that they had only incomplete primary education or that they were illiterate, similarly to other studies[10,21]. Such a condition interferes both in the understanding of care for the disease and in adherence to treatment[22], which is why it must be considered when planning educational activities and evaluating users after the guidance offered[23].

In addition to sociodemographic aspects, life habits also influence the development of foot ulcers and other complications of diabetes, such as alcoholism, smoking, physical inactivity and inadequate nutrition. In the present study, an association was found between inadequate nutrition and an increase in the chances of alterations in the tibial pulse, although no similar result was identified in the literature. In contrast, research that investigated the behaviors and comorbidities related to microvascular complications of DM [24] found that patients who ate an adequate number of meals per day, as recommended, were 43% less likely to develop microvascular complications.

According to the American Diabetes Association[25], nutritional therapy is essential for maintaining metabolic control, adequate nutritional status, quality of life and the formation of healthy eating habits, as well as for the prevention or treatment of acute and chronic complications arising from the disease. A study evaluating the usual dietary control in patients with diabetic foot concluded that inadequate nutrition and lack of nutritional guidance lead to complications of the condition due to the high consumption of sweets, carbohydrates and lipids[26].

When assessing the practice of physical exercise, it was observed that more than half of the patients were sedentary and were more likely to have loss of plantar sensitivity and an altered pedal pulse. The literature has referred the practice of physical activity as a protective factor against foot injuries and the occurrence of diabetic feet[27]. Additionally, in a survey on the profile of patients registered in Hiperdia (a Brazilian program that monitors hypertensive and diabetic people) and lifestyle[28], it was found that women had

greater adherence to physical exercise (52.5%) compared to men (8.3%); in addition, 91.7% of male people who did not have this habit were more susceptible to developing complications from DM.

Regarding risk stratification for the development of diabetic foot, there was a higher occurrence in grade 3 in male individuals, which corroborates a study carried out in Foz do Iguaçu (PR) on the degree of risk of diabetic foot in primary health care. In this investigation, the men evaluated had a higher risk of having such a complication, a situation that may be associated with a lower search for health services and a deficit in self-care[29].

Two other important risk factors related to vascular complications were alcoholism and smoking. Although, in the present sample, they were identified at low frequency, when assessing their presence with the degree of risk for the occurrence of diabetic foot, there was an increase in the frequency of grade 3 for alcoholic patients, as well as higher rates in the degrees 1 and 3 for smokers, when compared with the general distribution obtained in the survey. Smoking favors the accumulation of atheromatous plaque, causing peripheral vascular resistance, which increases the risk of ulceration and delayed wound healing[30]. Quitting this habit is an isolated and effective measure that should be encouraged to prevent complications related to the disease and improve patients' quality of life[31-32].

With regard to alcoholism, excessive alcohol consumption in the long run has also contributed to this situation. This fact was evidenced in an investigation that evaluated the incidence of cardiovascular diseases and associated risk factors in individuals with type 2 diabetes[33], and identified that 7.6% of patients drank occasionally and 3.2% drank regularly, and patients who had high alcohol consumption were eight times more likely to develop cardiovascular disease. These data show to what extent life habits influence the occurrence of DM complications, especially diabetic foot.

Regarding the classification of the degree of risk for the appearance of foot ulcers, most patients evaluated in this research were classified as grade 0, which differed from a study that investigated the factors associated with foot ulceration in people with Diabetes Mellitus[34] and which revealed that 43.7% were classified as having some degree of risk, of which 13.3% went to grade 1,21.5% (grade 2) and 8.9% (grade 3). Therefore, professionals must commit themselves to provide comprehensive assistance to the population, identifying risk factors through the risk stratification scale, so that this becomes a strategy for preventing complications that must be incorporated into the routine of care with a view to management of patients with the disease[20].

As limitations of this work, the difficulty in carrying out the physical examination in an appropriate way stands out, due to the fact that the patients were approached in waiting rooms and sometimes the evaluation was interrupted

due to the consultation. Another limitation was the scarcity of studies related to the influence of risk factors for the occurrence of diabetic complications; most of them only refer to the prevalence of the factor.

**CONCLUSION**

The main risk factors identified for the development of diabetic foot in patients with type 2 DM, in relation to lifestyle and clinical conditions, were: inadequate nutrition, physical inactivity, not self-examining the feet, smoking, drinking, time of diagnosis of disease and old age. These favored the occurrence of the following clinical changes: altered tibial and pedal pulses, dry skin, presence of cracking and loss of sensitivity.

In general, when assessing the degree of risk for the occurrence of diabetic foot, it was evident that most patients were classified as grade 0; however, among those who presented some impairment, grade 3 stood out. When analyzing this distribution with the presence of risk factors, different distributions were observed, with greater emphasis on smoking and alcohol consumption, which contributed to variations within the rating scale for the degree of risk.

It is important to note that, although other risk factors were investigated in the research, these were not statistically significant. However, they should not be discarded by healthcare professionals when monitoring and evaluating patients, as they may be present and are considered by the

literature as a risk for the development of diabetic foot.

Therefore, this study helps healthcare professionals to identify the risk factors associated with possible clinical changes that lead to the development of diabetic foot, and also directs health actions in the search for preventative and effective interventions in order to improve the prognosis and the quality of life of patients, with emphasis on changes in lifestyle, favoring the development of disease complications. Concomitantly, the importance of carrying out a physical examination of the feet should be awakened among professionals, as this practice is not yet a reality in the routine of consultations and can be an effective measure in the prevention of diabetic foot.

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