

## Dermatological Modifications in the Feet of People with Diabetes Mellitus that are Being Monitored in Primary Care

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### Research Article

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### ABSTRACT

**Objective:** To identify dermatological changes in the feet of people with diabetes mellitus that are being monitored in Primary Care.

**Materials and methods:** Epidemiological study accomplished in the countryside of Ceara, Brazil, with 135 people with diabetes. For the data gathering, interviews, evaluation of medical handbooks and physical examination of the feet for the identification of dermatological changes were performed. Fisher's test was used, with a confidence level of 95% and a significance level of 5%.

**Results:** There was a predominance of cracks, decreased/absent hair growth, xeroderma, onychomycosis, peeling, and calluses. Regarding the clinical evaluation and the plantar sensitivity of the feet, there was evidence of a decrease in the dorsalis pedis and posterior tibial pulses, in addition to changes in the plantar sensitivity and the vibration sensitivity of both feet.

**Conclusion:** One needs to develop educational activities that support the practice of physical activities, empowerment, self-care and a periodic evaluation of the feet in Primary Care.

### INTRODUCTION

Dermatological modifications are characterized by changes in the functionality and integrity of muscles, bones, joints, nerves or tendons, that get worse in the presence of pain or chronic diseases [1]. Some dermatological modifications in the feet may be common in people with diabetes mellitus (DM), such as mycosis in fingernails and finger joints, calluses, cracks, dry skin, presence of bubbles or erythema, which contributes for the appearance of the diabetic foot [2].

The overall prevalence of diabetic foot is an average of 6.4%. In Brazil, the prevalence is 4% to 10% [3]. People with diabetic foot exhibit high rates of amputation, with a risk 25 times higher when compared to healthy people [4].

The diabetic foot is responsible for 40% to 70% of non-traumatic amputations in lower limbs, where 85% are preceded by an ulcer that could be avoided with the periodic tracking of dermatological modifications, thus generating elevated costs to the Public health System (SUS). The estimated average annual cost for the ambulatory treatment of a person with diabetic foot is of R\$ 600.44 ( ± R\$ 183) [4].

Therefore, the vulnerability of people with DM related to dermatological modifications in the feet increases the risk of diabetic foot and amputations, which highlights the need for comprehension and knowledge of this complex process by the multi-professional team [5].

The Primary Care has a vital role in the tracking of dermatological modifications because it is the main entrance to the public health system and also the space to answer the necessities of people, families and the community, with the communication of promotion, prevention and recovery of health to ensure care's integrity.

A thorough assessment of dermatological modifications of the feet during the nursing consultation is a fundamental stage in the tracking and prevention of diabetic foot and amputations [6]. It is also Worth it to highlight the importance of pharmacological therapy and new therapeutic molecules used in the treatment and control of DM [7-9].

As an important member of the Primary Care team, the nurse has a vital role in the care of people with DM and must be aware to dermatological modifications that may unleash complications and must also develop strategies of education in health, collective and individual interventions, continuous monitoring of glycemic control and periodic clinical exams of the feet.

Therefore, the study becomes relevant for emphasizing the importance in tracking and identification of dermatological modifications as a strategy to prevent complications in the feet of people with DM, thus enabling the early identification of risk factors, to open ways for the reflection about the improvement of care among these clientele and to contribute with the therapeutic success, to avoid future complications.

The study has the objective of identifying dermatological modification in the feet of people with diabetes mellitus that are being monitored in Primary Care.

### MATERIAL AND METHODS

Epidemiological, descriptive and transversal study, with a quantitative approach and focus in dermatological modifications in the feet of people with DM for the prevention of diabetic foot, developed in a Primary Care Unit (PCU) from a city in the Region of Maciço de Baturit, Ceará, Brazil, from March to December 2018.

The convenience sample was made of 135 participants that fulfilled the inclusion conditions: people with DM and one or more risk behaviour's for ulcers in the feet, with the capability of hearing and verbally respond to formulated questions. People with DM and bilateral amputation of inferior members were excluded from the study.

The following situations were considered as Risk Conditions/behaviour's: people with DM that had inadequate glycemic and metabolic control; last feet evaluation made over one year ago or people who had never made one; 10 years or more of DM's diagnostic; smokers; use of inadequate shoes, history of ulcer in the feet or amputation of one of the inferior members.

The participants with risk conditions/behaviour were identified in their home by seven Community health agents (CHA). The CHA were previously trained by the research team to identify risk conditions/behaviour. When at least one risk behaviour is evidenced, the person with DM would receive the invitation to attend in the ICU at a previously scheduled day.

For the data gathering, the following actions were made: interviews, handbook's evaluation and physical examination of the feet, to identify dermatological modifications. The interview's script includes epidemiological-clinical data, such as sex, year of birth, education level, job occupation and time with DM. The following variables were considered in the dermatological evaluation of lower limbs: feet care (feet hygiene; fingernails cutting and type of shoes), dermatological evaluation (presence of cracks, excess of hair, xeroderma, onychomycosis, peeling, calluses, mycosis between finger joints, ingrown nail, hyperkeratosis, bubbles, ulcers) and palpation of the pulse in the feet and tibia in the evaluation of foot's protective sensibility.

For the analysis, the data were organized in spreadsheets of the program Microsoft Office Excel 2016 and later transferred to the statistical program Epi Info™, version 7.2.1.0. Fisher's test was used, with a confidence level of 95% and a significance level of 5%.

The research was approved by the Committee of Ethics in Research (CEP) from Universidade da Integração Internacional da Lusofonia Afro-Brasileira, under-report ne 2.932.293/2018, followed the recommendation of the Resolution ne 466/12, from the National Health Council, and all participants signed the Term of Consent.

**RESULTS**

The research’s 135 participants showed an average age of 61.31 years old ( $\pm 11.95$ ), with the prevalence of females (75.56%) and elderly (57.78%). Regarding the job occupation, 37.78% were retired or pensioners. The average education level was of 6.7 ( $\pm 5.7$ ) years of study (**Table 1**).

**Table 1.** Sociodemographic profile of the study’s participants. Redenção, Ceará, 2019.

Age group	n	%
Elderly	78	57.78
Adult	57	42.22
<b>Sex</b>		
Female	102	75.56
Male	33	24.44
<b>Job occupation</b>		
Retired/Pensioner	51	37.78
Self-employed	30	22.22
Housekeeper	26	19.26
Employed person	24	17.78
Unemployed	4	2.96
<b>Education level</b>		
Illiterate	25	18.52
Literate	25	18.52
Primary School	55	40.74
Secondary School	27	20
University education	6	4.44
Source: Study’s data, 2018.		

Regarding the type of DM, 41.45% has type O2 DM, however, most of them (54.81%) could not affirm their type of DM. There was a prevalence of people with DM for more than ten years (58.52%) and nonsmokers (55.56%). The practice of physical exercise was not a common habit among the participants (**Table 2**).

**Table 2.** Clinical profile of the study’s participants. Redenção, Ceará, 2019.

Type of diabetes	n	%
Could not inform	74	54.81
Diabetes type O2	58	42.96
Diabetes type O1	3	2.22
<b>Time with diabetes</b>		
< 10 years	79	58.52
≥ 10 years	56	41.48
<b>Tobacco use</b>		
No	75	55.56

Ex-smoker	50	37.04
Yes	10	7.41
<b>Practice of physical exercise</b>		
No	82	60.74
Yes	53	39.26
Source: Study's data, 2018.		

**Table 3** highlights data that identify risk factors for feet ulcerations, where there is the prevalence of participants that did not carry out adequate hygiene of their feet (83.55%) and 41.48% used inadequate shoes for people with DM. The fingernail cutting was adequate in most of the participants. However, one highlights the presence of dermatological modifications that compromise the feet integrity, with the prevalence of cracks, decreased/absent hair growth, xerosis, onychomycosis, peeling and calluses.

**Table 3.** Dermatological evaluation of the study's participants. Redenção, Ceará, 2019.

<b>Feet hygiene</b>	<b>n</b>	<b>%</b>
Inadequate	115	85.19
Adequate	20	14.81
<b>Type of shoe</b>		
Adequate	79	58.52
Inadequate	56	41.48
<b>Type of fingernail cutting</b>		
Adequate	70	51.85
Inadequate	56	41.48
<b>Dermatological evaluation</b>		
Cracks	92	68.15
Decreases/absent hair growth	92	68.15
Xerosis	80	59.26
Onychomycosis	50	37.04
Peeling	46	34.07
Calluses	39	28.89
Mycosis between finger joints	24	17.78
Ingrown nail	21	15.56
Hyperkeratosis	12	8.89
Bubbles	3	2.22
Ulcers	3	2.22
Source: Study's data, 2018.		

In clinical evaluation and feet sensibility, there was a prevalence of reduction of the pulse in the feet and posterior tibia, in addition to changes in the feet's protective sensibility and vibratory sensibility of both feet (**Table 4**).

**Table 4.** Distribution of people with Diabetes Mellitus in the study, accordingly with parameter of clinical evaluation of the Right foot (RF) x Left foot (LF) and Feet sensibility. Redenção, Ceará, 2019.

Variables Evaluation	RF	RF	RF	LF	LF	LF
	(n= 135)	(%)	(IC 95%)	(n=152)	(%)	(IC 95%)
<b>Pulsation of the feet</b>						
Present	110	81.48	[73.8- 87.6]	106	78.52	[70.6-85.1]
Absent	5	3.7	[1.2-8.4]	3	2.22	[0.4-6.3]
Decreased	20	14.81	[9.2-21.9]	26	19.26	[12.8-26.2]
<b>Pulsation of the posterior tibia</b>						
Present	114	84.4	[77.2-85.1]	110	81.4	[73.8-87.4]
Absent	1	0.74	[0.02-4.06]	2	1.48	[0.18-5.2]
Decreased	20	14.81	[9.2-21.9]	23	17.04	[11.1-24.4]
<b>Feet's protective sensibility</b>						
Normal	110	74.07	[65.8-81.2]	103	76.3	[68.2-83.1]
Changed	35	25.9	[18.7-34.1]	32	23.7	[16.8-31.7]
<b>Tactile sensibility</b>						
Normal	127	94.07	[88.6-97.4]	129	95.3	[90.5-98.3]
Absent	3	2.22	[0.46-6.3]	3	2.22	[0.4-6.3]
Decreased	5	3.7	[1.2-8.4]	3	2.22	[0.4-6.3]
<b>Achilles' reflexes</b>						
Normal	127	94.07	[88.6-97.4]	123	91.1	[84.9-95.3]
Decreased	7	5.19	[2.1-10.3]	12	8.89	[4.6-15.01]
Absent	1	0.74	[0.02-4.06]	-	-	-
<b>Vibratory sensibility</b>						
Normal	78	57.78	[48.9-66.2]	78	57.78	[48.9-66.2]
Decreased	57	42.22	[33.7-51.02]	57	42.22	[33.7-51.02]
<b>Sensibility for pain</b>						
Normal	122	90.37	[84.1-94.7]	128	94.1	[89.6-97.8]
Decreased	13	9.63	[5.2-15.9]	7	5.19	[2.1-10.3]
<b>Thermal sensibility</b>						
Normal	122	90.3	[84.1-94.7]	115	85.19	[78.05-90.7]
Decreased	13	9.63	[5.2-15.9]	20	14.81	[9.2-21.9]
Source: Study's data, 2018.						

In the comparison between time of DM and dermatological evaluation of the participants, there was a statistical significance in hyperkeratosis, cracks, onychomycosis and Ingrown nail (**Table 5**).

**Table 5.** Comparison between time of DM and dermatological evaluation of the study's participants, Redenção, Ceará, 2019.

Variables	Time with diabetes		Statistic
	≥ 10 years	< 10 Years	[p-value] <sup>1</sup>
<b>Peeling</b>			
Present	21 [37.50]	25 [31.65]	0.299
Absent	35 [62.50]	54 [68.355]	
<b>Hyperkeratosis</b>			
Present	09 [16.07]	03 [3.80]	0.015
Absent	47 [83.93]	76 [96.20]	
<b>Mycosis between finger joints</b>			
Present	14 [25.00]	10 [12.66]	0.053
Absent	42 [75.00]	69 [87.34]	
<b>Cracks</b>			
Present	43 [76.79]	49 [62.03]	0.05
Absent	13 [23.21]	30 [37.97]	
<b>Onychomycosis</b>			
Present	26 [46.43]	24 [30.38]	0.042
Absent	30 [53.57]	55 [69.62]	
<b>Ingrown nail</b>			
Present	06 [31.6]	13 [68.4]	0.049
Absent	74 [55.6]	59 [44.4]	
<b>Calluses</b>			
Present	18 [32.14]	21 [26.58]	0.304
Absent	38 [67.86]	58 [73.42]	
<b>Bubbles</b>			
Present	02 [3.57]	01 [1.27]	0.372
Absent	54 [96.43]	78 [98.73]	
<b>Growth hair</b>			
Modified	40 [71.43]	52 [65.82]	0.309
Normal	16 [28.57]	27 [34.18]	
<b>Skin's moisture</b>			
Xeroderma	34 [60.71]	46 [58.23]	0.456
Normal	22 [39.29]	33 [41.77]	
<sup>1</sup> Fisher's test			

Source: Study's data, 2018.

## **DISCUSSION**

The clinical epidemiological characteristics of the studied sample are similar to other national and international studies, especially concerning the age, education level, job occupation and diagnostic time [10,11].

In the current study, the absence of information about the type of DM was observed in more than 50% of the evaluated participants, even in individuals with more than 10 years of diagnostic. However, there is a prevalence of Type 2 DM (75.4%) in the research's region [12] and also with a national highlight in the number of notified cases of type 1 and 2 of DM [13].

DM with more than 10 years is a relevant risk factor for feet complications [14]. This highlights the need for higher attention to this clientele because they are predisposed to a higher risk of developing dermatological modifications in the feet and to harm their quality of life.

Exercise was not a common habit among study participants. One survey found that 74% of people with dermatological foot modifications did not engage in any type of regular exercise [15]. However, physical exercise programs are recommended as a non-pharmacological treatment of diabetes due to its hypoglycemic effect [16].

Therefore, one perceives the importance of guiding people with DM to practice regular physical exercises, since the glycemic control is one of the factors that may help in the prevention of dermatological modifications in the feet.

The prevalence of participants that did not make an adequate hygiene of their feet associated with the use of inadequate shoes for people with DM, reveals itself as a risk factor for dermatological modifications in the feet, corroborating with the study of Gomes and Junior (2018) [10] where people with DM who had poor hygiene of their feet and used inadequate shoes had a higher risk of acquiring dermatological modifications in their feet.

The observation of hygiene and the guidance about the use of therapeutic shoes for people with DM is one of the most important factors that must be passed by the nurses to prevent dermatological modifications in lower members, since, inadequate shoes expose the feet to external trauma and may act as an unleashing factor in up to 85% of the cases of feet ulcers [17].

Consequently, the nurse must be always aware of the shoes used by people with DM in their daily routine, prioritizing safety and comfort, in addition to also highlight the importance of not walking barefoot to avoid trauma due to the reduction of sensibility [18].

The feet evaluation and self-care must be exhaustively advised to every person with DM, which must receive guidance and encouragement to adopt the habit of verifying their feet every day and to ask for the help of a health professional in case they find modifications such as cracks, calluses, fissures, maceration, bubbles, mycosis between finger joints, edema, hyperemia and onychomycosis.

The dermatological modifications that are most prevalent in this study were the cracks, decreased/absent hair growth, xeroderma, onychomycosis, peelings, and calluses.

In people with DM, the presence of these modifications reveals a higher risk of injuries that may evolve to amputations. The skin's fragility associated with the loss of sensibility unleashes the appearance of injuries because the absence of pain prevents the individual to notice repetitive superficial traumas, such as cracks, calluses and peeling [19].

People with DM may also have the impairment of some sensitive, motor and autonomic fibers, which reduce the sweat in the feet, leaving them dry, thus predisposing the feet to cracks, calluses, and fissures. This maximizes the risk of dermatological injuries [20]. Therefore, one perceives that keeping their feet clean and hydrated may contribute to the prevention of feet injuries.

Regarding the neurological evaluation of the feet, these are at odds with other studies, where the modifications associated with sensibilities (sole of the feet, thermal, vibratory and tactile) did not surpass 10% [21,22].

When comparing the participants' time with DM and the dermatological evaluation, there was a statistical significance in hyperkeratosis, cracks, onychomycosis and ingrown nails. People with type 2 DM and diagnostic time of over 10 years are more predisposed to developing dermatological modifications in their feet [23].

There was a prevalence of cracks, calluses, and mycosis in the feet of people with DM in the Brazilian field [2]. The onychomycosis was one of the common dermatological modifications in people with more than 10 years with DM in Brazil and Pakistan [24].

In most people with DM the formation of cracks, calluses and hyperkeratosis occurred due to the decrease of sweating, because it leaves the skin thin and dry<sup>[25]</sup>. This data highlights the importance of providing information to this clientele about the daily hydration of their feet to avoid this type of cutaneous modification.

The onychomycosis is mycosis that affects fingernails and is responsible for 15 to 40% of unguis diseases. They are considered as the hardest superficial mycosis to diagnose and treat, due to the density of the fingernails' keratin and for being a poor region in blood vessels<sup>[26]</sup>. This reinforces the need of providing information to people with DM about the care with this modification that is very hard to treat and that may severely compromise the nails' integrity.

The ulcers in lower members of people with DM may be avoided and stratification of risk factors, such as dermatological modifications is the first step for the reduction of the prevalence of diabetic foot and the amputation of lower members since it allows a more effective allocation of available resources for the prevention and treatment of this grievance<sup>[24]</sup>.

Faced with this and considering the dermatological modifications, in addition to orientations, the nurse needs to use practical activities during individual or collective care, to ease the patient's learning, thus showing the correct form of washing and drying the feet, how to cut their fingernails and how to hydrate the skin<sup>[2]</sup>.

The nurse is an important professional in the team of Primary Care. He may, in a systematically way, promote the prevention of diabetic foot, via periodic feet evaluation, to identify and treat possible dermatological modifications, thus empowering people with DM with autonomy and self-care, which contributes for the reduction of complications and the improvement of their quality of life<sup>[27]</sup>.

### CONCLUSION

This study's participants presented poor feet hygiene associated with the use of inadequate shoes for people with DM. In the identified dermatological modifications, there was a prevalence of cracks, decreased/absent hair growth, xeroderma, onychomycosis, peeling, and calluses, drawing the attention to the risk of the ulcers they may unleash.

One infers the relevance of health professionals in association with a unique and qualified care to people with DM and the promotion of educative activities that encourages the practice of physical activities, empowerment, and self-care of the feet, along with a specialized attention for the prevention of complications via periodic evaluation of the feet in primary care.

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