

# EAERLY DIAGNOSIS OF DIABETIC FOOT IN PRIMARY HEALTH CARE

## DIAGNÓSTICO PRECOCE DO PÉ DIABÉTICO NA ATENÇÃO BÁSICA

**Helen Meira Cavalcanti** - helen.meira@adventista.edu.br

Graduating in Physiotherapy at College Adventist of Bahia, FADBA, Cachoeira, Brazil. Doctor in Health Sciences, UFBA, Salvador, Bahia. Teacher at Adventist College of Bahia, FADBA, Cachoeira, Bahia.

**Milena Cipriano Santos** - milenacipriano5@gmail.com

Graduating in Physiotherapy at College Adventist of Bahia, FADBA, Cachoeira, Brazil.

**Alzeni Olivia da Silva** - alzeniadv@gmail.com

Graduating in Physiotherapy at College Adventist of Bahia, FADBA, Cachoeira, Brazil.

**Keyla Alves e Silva** - keylaalves522@gmail.com

Graduating in Physiotherapy at College Adventist of Bahia, FADBA, Cachoeira, Brazil.

**Camila Ferreira dos Santos** - milafsantos15772@gmail.com

Graduating in Physiotherapy at College Adventist of Bahia, FADBA, Cachoeira, Brazil.

**Sérgio Ricardo Nepomuceno Pereira** - sergioricardonpo@gmail.com

Graduating in Physiotherapy at College Adventist of Bahia, FADBA, Cachoeira, Brazil.

**Eloísa Priscila Batista Farias** - eloisafarias67@gmail.com

Graduating in Physiotherapy at College Adventist of Bahia, FADBA, Cachoeira, Brazil.

**Abstract:** Among the complications that can be triggered by diabetes mellitus, peripheral neuropathy is the most common affection, causing a delay in the speed of conduction of sensitive stimuli, facilitating the occurrence of repetitive traumas making the individual susceptible to plantar ulcers.

**Objective:** To characterize the protective sensitivity of diabetic feet seen in primary care in Recôncavo Baiano. **Methods:** This is a cross-sectional study with 127 diabetic patients registered in Family Health Strategies. **Results:** The monofilaments that responded most frequently were lilac, orange and red. The points with the highest degree of sensitivity are represented, by the lilac monofilament at point 1, 44 (34.6%) on the right foot, and on the left foot 49 (34.6%) at points 4 and 8. Followed by the monofilament orange, which on both the right and left feet showed 27 (21.3%) at point 9. The red monofilament with 24 (18.9%) on the right foot and 21 (16.5%) on the left foot, both in the point 9. **Conclusion:** The characterization of the protective sensitivity of diabetic feet seen in the ESF's in the city of Cachoeira was difficult to discriminate in form and protective sensitivity for the foot. The results suggest the examination and care of the feet by encouraging educational strategies for supported self-care.

**Keywords:** Diabetic Foot; Assessment; Primary Health Care.

## INTRODUCTION

Global estimative indicates that 382 million people live with Diabetes Mellitus (DM) (8,3%), and this number can grow at 592 million in 2035<sup>(1)</sup>. The population aging, the growing obesity prevalence and sedentarism, as like urbanization process, are considerate firstly responsible factors to highly incidence and DM prevalence all over the world. The scenery entailed high social costs and financial to patient and health system<sup>(1-2)</sup>.

Among the complications who might be triggered by DM, peripheric neuropathy (NP) it's more common involvement, causing retard in speed conduction of sensitive stimulus, facilizing repetitive trauma occurrence in the foots becoming to ulcers<sup>(1)</sup>. The peripheric neuropathy can compromise sensitive fibers, that motor and autonomic. The Sensitive component produce gradual loss of sensibility of pain, plantar pression perception, temperature and proprioception. The sensibility loss constitutes in significant factor in these cases, conducing to lesion/ulceration of the inferior member.

The international working group about Diabetic Foot (IWGDF) conceptualizes diabetic foot as "infection, ulceration and/or destruction of soft tissues associated to neurologic alterations and couple grades of peripheral arterial disease (PAD) in inferior members<sup>(3-4)</sup>.

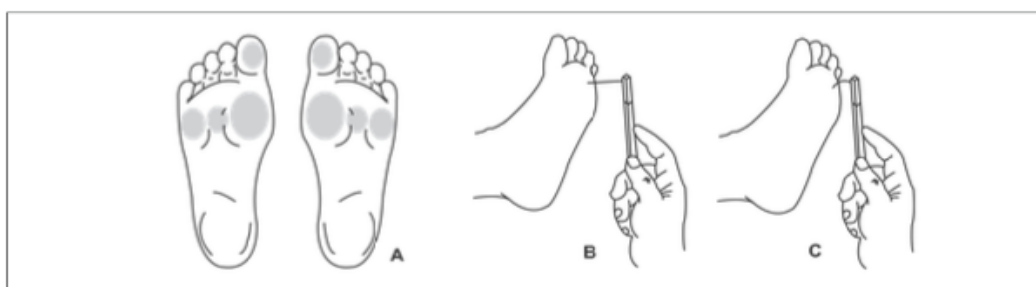
The International Working Group on the Diabetic Foot (IGGDF) conceptualizes diabetic foot as "infection, ulceration and/or destruction of soft tissues associated with neurological changes and various degrees of peripheral arterial disease (PAD) in the lower limbs"<sup>(5)</sup>.

About 50% of people with type 2 diabetes mellitus have PN and approximately 20% of these people's hospitalizations are related to foot problems. The risk of amputation, when compared to non-diabetics, is increased by 15 to 40%<sup>(2)</sup>. The most important risk factors for the appearance of foot ulcers are diabetic polyneuropathy, misinformation about foot care, the presence of abnormal pressure points that favor callosities and deformities, peripheral vascular disease, trauma caused by the use of inappropriate shoes, as well as individuals with a previous history of ulcer or amputation of recurrence<sup>(6-7)</sup>. Screening to identify the foot at risk of ulceration requires two extremely simple measures, clinical history and examination of the feet performed in the community, centers or health centers, outpatient clinics or hospitals<sup>(5)</sup>. Unfortunately, it is not yet routine in several workplaces around the world. Data from a multicenter study in Brazil show that only 58% (1,300) of patients with DM2 treated at specialized and non-specialized centers had a record of foot examination performed in the previous year<sup>(8)</sup>. A study cited by Kattia Ochoa-Vigo reported a reduced percentage of new and larger amputations in the same limb or in the contralateral, results that can be attributed to the

educational process instituted for the participants, addressing foot care, as well as providing orthosis to patients <sup>(9)</sup>. Regarding the educational strategies of self-care, authors emphasize the direction to examination and foot care <sup>(9-12)</sup>, in addition to emphasizing good glycemic control and regular exercise. The purpose is to sensitize, motivate and change the attitudes of the person who should incorporate the information received, about foot and footwear care, into their daily lives, consequently reducing the risk of injury, ulcers and infection. The objective of this study was to characterize the protective sensitivity of diabetic feet treated in primary care in the Recôncavo Baiano.

## METHODS

This is a cross-sectional study based on semi-structured interviews through an evaluation form in which the sociodemographic and clinical conditions related to the sensory condition were described. To evaluate the protective sensitivity of the lower limbs, Semmes-Weinstein monofilaments (Sorri-Bauru Estesíometer) <sup>(1,9)</sup>, a low-cost and easy-to-operate evaluation method, suggested by the SBD-Brazilian Society of Diabetes, were used as a tool for neurological evaluation of plantar pressure (figure 1). These nylon monofilaments have different thicknesses and are classified according to the pressure they exert and by colors that indicate the degree of involvement of surface sensitivity <sup>(1)</sup>. Data collection was carried out at the participants' homes, from May 2017 to July 2018.



**Figure 1** - Areas of the test (A) and application of monofilament (B,C). Source: Pedrosa HC, Nery ES, Sena. The challenge of the project saving the diabetic foot. *Diabetes Therapy*, 1998;4<sup>(19)</sup>:1-10.

## Population

Population The population estimate for the municipality of Cachoeira by the last sense, since the last ten years, in 2019 comprised 33,470 individuals. Of the 14 Family Health Strategy (FHS) in the city, they were selected through a convenience sample, considering those located in the central

region of the city and viable access. In four FHS's, 127 individuals of both sexes were evaluated. Inclusion criteria in this study were patients with diabetes mellitus, registered in the FHS, with or without a diagnosis of hypertension, aged over 18 years, who agreed to participate in the research and signed the free and informed consent form.

This study was approved by the Research Ethics Committee of the Faculdade Adventista da Bahia (FADBA) with CAAE 468513-2-0000-0042.

## Statistical Analysis

A descriptive analysis was performed followed by categorical variables by relative frequency and continuous variables by measures of central tendency through mean and median. The analysis was performed using SPSS (Statistical Package for the Social Sciences) software, for Windows (version 21.0).

## RESULTS

127 diabetic individuals participated in the study, 92 (72.4%) were female, and the average age was  $64.30 \pm 12.5$  years. In relation to income, 50 (39.4%) reported receiving up to one minimum wage per month. As for the level of education, only 39 (30.7%) reported having reached elementary school. The highest occupation of individuals was retirees, 58 (45.7%).

As for the clinical diagnosis, 67 (52.8%) had only diabetes and 57 (44.9%) had diabetes and hypertension. With regard to personal history related to other diseases, 76 (59.8%) reported metabolic and 30 (23.6%) cardiovascular problems.

The monofilaments that responded most frequently were lilac, orange and red. The points with the highest degree of sensitivity are represented, respectively, by lilac monofilament at point 1, 44(34.6%) on the right foot, and on the left foot had 27 (21.3%) at point 9. Red monofilament with 24 (18.9%) on the right foot and 21 (16.5%) on the left foot, both at point 9.

Tables 1 and 2 illustrate the information corresponding to the use of Semmes-Weinstein monofilaments and their respective points.

Variable	N=127		
	N / %		
Right Foot	Purple	Red	Orange
Point 1	44 (34,6%)	17 (13,4%)	10 (7,9%)
Point 2	41 (32,3%)	10 (7,9%)	3 (2,4%)
Point 3	42 (33,1%)	7 (5,5%)	10 (7,9%)
Point 4	42 (33,1%)	12 (9,4%)	10 (7,9%)
Point 5	39 (30,7%)	13 (10,2%)	7 (5,5%)
Point 6	37 (29,1%)	13 (10,2%)	14 (11%)
Point 7	42 (33,1%)	10 (7,9%)	5 (3,9%)
Point 8	43 (33,9%)	15 (11,8%)	11 (8,7%)
Point 9	19 (15%)	24 (18,9%)	27 (21,3%)
Point 10	24 (18,9%)	9 (7,1%)	9 (7,1%)

**Table 1** - Frequency in the right foot sensitivity  
 Source: Results of the present study.

Variable	N=127		
	N / %		
Left Foot	Purple	Red	Orange
Point 1	42 (33,1%)	16 (12,6%)	6 (4,7%)
Point 2	40 (31,5%)	8 (6,3%)	7 (5,5%)
Point 3	38 (28,9%)	10 (7,9%)	7 (5,5%)
Point 4	49 (38,6%)	12 (9,4%)	4 (3,1%)
Point 5	41 (32,3%)	9 (7,1%)	9 (7,1%)
Point 6	41 (32,3%)	4 (11%)	9 (7,1%)
Point 7	40 (31,5%)	6 (4,7%)	5 (3,9%)
Point 8	49 (38,6%)	14 (11%)	8 (6,3%)
Point 9	27 (21,3%)	21 (16,5%)	27 (21,3%)
Point 10	23 (18,1%)	14 (11%)	9 (7,1%)

**Table 2:** Frequency in the left foot sensitivity.  
 Source: Results of the present study.

## DISCUSSION

Among the complications of diabetes are chronic lesions in blood vessels, vasculopathies that affect sensorimotor function, impairing nerve conduction and causing progressive loss of long-term sensitivity, as well as motor sensitivity<sup>(13-14)</sup>. The impairment of protective sensitivity is one of the

most frequent changes and its evolution occurs slowly and partially, with the feet being the most affected resulting in neuropathy <sup>(10,13-14)</sup>.

The combination of neuropathy and/or vasculopathies in patients with diabetes mellitus characterizes the diabetic foot by the variety of multifactorial abnormalities. Diabetic foot is the most frequent cause of complications, with a high rate of amputation, prolonged hospitalization and high hospital cost in our country <sup>(10,12)</sup>.

In the United States of America, the diabetic foot comprises 25% of hospital admissions, which entails high costs, raising \$28,000 for each admission for ulceration, increasing in cases of amputation. Unfortunately, in Brazil the data are scarce or non-exists, the knowledge of health professionals about diabetic foot is critical <sup>(1)</sup>. Until we move in this direction, the reality of resolution through public health policies is low. However, it is necessary for health professionals to contribute to the predisposition to the diabetic foot <sup>(15)</sup> and in time to instruct, guide individuals with DM.

In this study, the sensory condition of individuals registered in FHS's in the city of Cachoeira-BA was characterized. Of the 127 survey participants, 69.3% did not complete elementary school. The low level of education can interfere with understanding and adherence to the proposed treatment to control diabetes and its complications, bringing fewer opportunities for learning about health care. This increases the risks of these individuals developing the diabetic foot <sup>(16)</sup>.

The average age of the population was  $64.3 \pm 12.5$  years, which demonstrates an elderly population. The literature indicates that age is a risk factor for patients with type 2 diabetes to develop neuropathy, especially when related to the time since diagnosis of the disease <sup>(17)</sup>. Regarding the clinical diagnosis, most of the research participants had diabetes associated with hypertension. A survey conducted with diabetics from Minas Gerais found that all respondents had the same associated clinical condition, and, according to national data, these two comorbidities together contribute to the increase in morbidity and mortality of the Brazilian population <sup>(18)</sup>.

In this study, the monofilaments used in the evaluation of sensitivity with greater predominance were lilac (2.0g), red (4.0g) and orange (10.0g). In lilac, the point on the lateral face of the middle foot predominated, both on the right and left foot. Red and orange, on the other hand, were more frequent at the point below the calcaneus. Normally, the plantar region is protected by an adipose cushion, which dissipates weight forces in all directions. Therefore, displacements or atrophy in these cushions will cause increased pressure under them, especially under the metatarsal heads with rigid deformity, increasing the pressure in this region <sup>(19)</sup>.

This change is explained by the fact that this region of the foot has a greater amount of keratin and fat, precisely because it is one of the most overloaded regions during locomotion tasks and receives sensory innervation of the sural nerve. It is also known that this nerve is one of the first to

be affected in the progression of diabetic neuropathy, and may justify its greater impairment in relation to other areas <sup>(20)</sup>.

Prolonged exposure to hyperglycemia associated with cardiovascular factors results in impairment of nerve fibers. This favors insensitivity, biomechanical changes and, therefore, modifies the pressure site in plantar regions. The increase in abnormal pressure causes hyperkeratosis and callosities, which are pre-ulcerative <sup>(1,12,21)</sup>.

Orange monofilament is established as a criterion for diabetic neuropathy <sup>(1)</sup>, which indicates loss of protective sensation to the foot, vulnerability to injuries and loss of discrimination for hot and cold. This characterization draws attention to the beginning of the onset of the disease. Although in this study orange monofilament was not predominant, attention should be paid to the prevalence of red on both feet, indicating loss of sensitivity in the forefoot region, which seems to be a warning sign for patients with diabetes.

A study conducted by the Brazilian Society of Orthopedics and Traumatology of São Paulo, with 300 individuals, has shown that the place with the greatest vulnerability to ulcers, infections arising from these ulcers and amputations is the forefoot. Of the patients who developed ulcers, 70% were in this region; infections resulting from ulcers were 65.4% also in the forefoot region and partial or complete amputation performed, 53.3% was in the forefoot <sup>(22)</sup>.

Likewise, we should note that the prevalence of loss of sensitivity in the forefoot region of the individuals in the research becomes a warning sign for the risk of plantar ulceration. Mainly because it has a profile of low education, advanced age and associated metabolic disease. This population should have access to public policy actions promoted by health professionals working in the FHS. If these actions are not resolute, these individuals will be likely to suffer from plantar ulcers and amputations.

A large part of the sample of the population of the present study focused on this initial phase, being predisposed to the consequences, such as loss of the protective sensation to the foot, and may still feel deep pressure and pain. Therefore, a change in sensitivity should be identified early on, the aspects established and reinforced in order to avoid complications resulting from this loss.

In view of the vulnerability in the population studied, some of the indispensable items for the prevention of diabetic foot ulcers is education for individuals with DM and their caregivers, specialized teams at different levels, as well as in primary care (primary level).

The organization of health services from the perspective of promotion and prevention permeates the empowerment of the subject and his life history. Strengthening their affective bonds is a primary tool for the resumption of autonomy over their health <sup>(23-24)</sup>. It is necessary to share with the patient the responsibilities for success in treatment and, with this, avoid or minimize future complications



responsible for reducing their quality of life <sup>(25)</sup>.

## CONCLUSION

In this study to characterize the protect sensibility of diabetic foot protection attended at ESF in city of Cachoeira, was hard to discriminate to form and protective sensibility to foot. These conditions signalize presence of diabetic neuropathy, pointing that necessity to precocious assessment to diabetic foot, as like prevent actions.

## REFERENCES

1. Oliveira JE, Vencio S. Guidelines of Brazilian Diabetes Society . São Paulo: 2018; Editora Clannad.
2. Moura EC, Pacheco-Santos LM, Peters LR, Serruya SJ, Guimarães R. Research on chronic noncommunicable diseases in Brazil: meeting the challenges of epidemiologic transition. *Rev Panam Salud Publica*. 2012; 31(3):240–5. <https://www.scielosp.org/pdf/rpsp/2012.v31n3/240-245/en>; (Acesso em 14 de março 2019)
3. Pedrosa HC, Nery ES, Sena. The Challenge Project Saving diabetic foot. *Find in Diab* ,1998;4(19):1-10. <https://doi.org/10.1590/S0103-21002005000100014>;
4. Reiber GE, Lipsky BA, Gibbons GW. The burden of diabetic foot ulcers. *Am J Surg* 1998; 176(Suppl.2A):5-10. doi: 10.1016/j.jcot.2021.01.017.
5. Bakker K, Apelqvist J, Lipsky BA, Van Netten JJ. The 2015 IWGDF guidance documents on prevention and management of foot problems in diabetes: development of an evidence-based global consensus. *Diabetes Metab Res Rev* 2016;32(Suppl. 1):2. Doi: <http://dx.doi.org/10.1002/dmrr.2694>.
6. Bus SA, van Netten JJ, Lavery LA, Monteiro-Soares M, Rasmus- sen A, Jubiz Y et al. IWGDF guidance on the prevention of foot ulcers in at-risk patients with diabetes. *Diabetes Metab Res Rev*. 2016;32(Suppl 1):16-24. doi: 10.1002/dmrr.2696.
7. Assumpção EC, Pitta GB , Macedo ACL, Mendonça GB, Albuquerque LCA , Lyra LCB et al. Comparação dos fatores de risco para amputações maiores e menores em pacientes diabéticos de um Programa de Saúde da Família. *J Vasc Bras*. 2009;8(2):133-138. <https://doi.org/10.1590/S1677-54492009000200006>;
8. Gomes MB, Gianella D, Faria M, Tambascia M, Fonseca RM, Réa R et al. Prevalence of type 2 diabetic patients within the targets of care guidelines in daily clinical practice: a multi-center study in Brazil. *Rev Diabet Stud*. 2006;3(2):82-7. doi: 10.1900/RDS.2006.3.82
9. Ochoa-Vigo K, Pace AE. Diabetic Foot: Prevention Strategies. *Acta Paul Enferm*. 2005;18(1):100-9. <https://doi.org/10.1590/S0103-21002005000100014>;



10. Brasileiro JL, Oliveira WTP, Monteiro LB, Chen J, Júnior EPL, Molkenhain S et al. Diabetic Foot: clinic aspects. *J Vasc Br* 2005;4(1):11-21.  
<https://app.periodikos.com.br/article/5df24eeb0e88256c24b5f733/pdf/jvb-4-1-> (Acesso em 12 de agosto de 2019).
11. Fajardo CA. A importância do cuidado com o pé diabético: ações de prevenção e abordagem clínica. *Rev Bras Med Fam e Com.* 2016;2(5):43-58. [https://doi.org/10.5712/rbmfc2\(5\)25](https://doi.org/10.5712/rbmfc2(5)25)
12. Gois JPDS, Chaves ASC. Pé diabético: avaliação dos fatores de risco relacionados a amputações maiores e menores. *Rev Eletr Acerv Sa.* 2020;12(1):1-9.  
<https://doi.org/10.25248/reas.e1484.2020>.
13. Bortoletto MSS, Haddad MCL, Karino ME. Pé diabético, uma avaliação sistematizada. *Arq. Ciênc. Saúde Unipar.* 2009;13(1):37.  
<https://revistas.unipar.br/index.php/saude/article/view/2795/2081> (Acesso em 18 de setembro de 2019).
14. Braga DC, Bortolini SM, Rozetti IG, Zarpellon K, Nascimento JC, Neris JE. Avaliação de neuropatia e complicações vasculares em pacientes com diabetes mellitus em um município rural de Santa Catarina. *Rev. AMRIGS.* 2015;59(2): 78-83.  
<https://pesquisa.bvsalud.org/portal/resource/pt/biblio-833930> (Acesso em 13 de agosto de 2019).
15. Patrícia SF, Eduardo F, Carolina MS. Relação entre sensibilidade tátil plantar, idade e IMC com o equilíbrio em sujeitos diabéticos e não diabéticos. *Rev. Cient. UMC.* 2019;4(1):1-16;  
<http://seer.unc.br/index.php/revistaumc/article/view/253/244>; (Acesso em 18 de agosto de 2019).
16. Pecoraro RE, Reiber GE, Burgess EM. Pathways to diabetic limb amputation: basis for prevention. *Diab Care.* 1990;13(5):513-21; doi: 10.2337/diacare.13.5.513.
17. Rodrigues FFL, Santos MA, Teixeira CRS, Gonela JT, Zanetti ML. Relação entre conhecimento, atitude, escolaridade e tempo de doença em indivíduos com diabetes mellitus. *Acta Paul Enferm.* 2012;25(2):284-90; <https://doi.org/10.1590/S0103-21002012000200020>.
18. Miranzi SSC, Ferreira FS, Iwamoto HH, Pereira GA, Miranzi MAS. Qualidade de vida de indivíduos com diabetes mellitus e hipertensão acompanhados por uma equipe de saúde da família. *Texto Contexto Enferm.* 2008;17(4): 672-9; <https://doi.org/10.1590/S0104-07072008000400007> .
19. Sumpio BE. Foot ulcers. *New Engl J Med* 2000; 343(11):787-93;  
DOI: 10.1056/NEJM200009143431107.
20. Sacco ICN , Sartor CD, Gomes AA, João SMA, Cronflir R. Avaliação das perdas sensorio-motoras do pé e tornozelo decorrentes da neuropatia diabética. *Rev. bras. Fisioter.* 2007;11(1):27-33; <https://doi.org/10.1590/S1413-35552007000100006>.
21. Ferreira LGF, Torres MV. Análise da correlação entre alterações sensitivas e mobilidade funcional em idosos diabéticos. *Rev Fisioter S Fun. Fortaleza.* 2013; 2(1): 42-49;  
[https://repositorio.ufc.br/bitstream/riufc/13549/1/2013\\_art\\_lgfferreira.pdf](https://repositorio.ufc.br/bitstream/riufc/13549/1/2013_art_lgfferreira.pdf); (Acesso em 17 de setembro de 2019)

22. Ferreira RC, Silva APS, Costa MT, Frizzo .GG, Santin RAL, Fucs PMMB. Aspectos epidemiológicos das lesões no pé e tornozelo do paciente diabético. *Acta Ortop. Bras.* 2010;18(3):135-141; <https://doi.org/10.1590/S1413-78522010000300004>.
23. Mendes EV. O cuidado das condições crônicas na atenção primária à saúde: o imperativo da consolidação da estratégia da saúde da família. Brasília. Organização Pan-Americana da Saúde- Representação Brasil. 2012; [https://bvsms.saude.gov.br/bvs/publicacoes/cuidado\\_condicoes\\_atencao\\_primaria\\_saude.pdf](https://bvsms.saude.gov.br/bvs/publicacoes/cuidado_condicoes_atencao_primaria_saude.pdf), (Acesso em 16 de setembro de 2019).
24. Pola HM, Lago OS, Barrientos AM, Santos TF, Santos ND, Caetano JS. Realidade sobre o conhecimento das complicações e do tratamento pelos diabéticos do município de Cachoeira na perspectiva do autocuidado. *Rev Bras. Saúde Funcional.* 2018;5(2):6-10; <https://seer-adventista.com.br/ojs3/index.php/RBSF/article/view/1023>, (Acesso em 16 de setembro de 2019).