EVIDENCE FOR THE EVALUATION OF THE FEET OF PEOPLE WITH DIABETES MELLITUS

ABSTRACT

Objective: to identify the evaluation criteria of the feet of the person with Diabetes Mellitus. Method: integrative review with search in MEDLINE, LILACS, Cochrane, SCOPUS and SciELO virtual libraries, with temporal delimitation between 2011 and 2017 and final sample of 16 articles categorized in anamnèsis, skin and attachment evaluation, neurologica evaluation, vascular evaluation, anatomical evaluation of the feet and self-care. Results: most articles were from 2013, with level of evidence II. The anamnèsis category comprised sociodemographic and clinical issues and the category assessment of the skin and appendages contemplated the affections of skin, nails, hair and interdigital spaces. In the neurological evaluation category, the Semmes-Weinstein monofilament test 10g was predominant for the evaluation of tactile sensitivity. In the vascular evaluation, palpation of the pedis and tibialis pulses was noted. In the anatomical evaluation category of the feet, only two articles portrayed the type of deformity researched and in four studies self-care guidelines were performed. Conclusion: in summary, the study allowed to extract important indicators for the evaluation of the feet and consonance was observed between the analyzed studies with what is recommended. Descritores: Diabetes Mellitus; Diabetic Foot; Risk Factors; Prevention; Physical Examination; Signs and Symptoms.

RESUMEN

Objetivo: identificar los criterios de evaluación de los pés de la persona con Diabetes Mellitus. Método: revisión integrativa con búsqueda en las bases de datos MEDLINE, LILACS, Cochrane, SCOPUS e biblioteca virtual SciELO, con delimitación temporal entre 2011 y 2017 y amostra final de 16 artículos categorizados en anamnèsis, evaluación de la piel y anexos, evaluación neurologica, evaluación vascular, evaluación anatómica de los pés y autocuidado. Resultados: la mayoría de los artículos fue de 2013, con nivel de evidencia II. La categoría anamnèsis comprendió cuestiones sociodemográficas y clínicas y la categoría evaluación de la piel y anexos contempló las afecciones de piel, uñas, pelos y espacios interdigitales. En la categoría evaluación neurologica, predominó el teste con monofilamento Semmes-Weinstein 10g para la evaluación de la sensibilidad táctil. En la evaluación vascular, destacó la palpación de los pulsos pediosos y tibiales. En la categoría evaluación anatómica de los pés, apenas dos artículos retrataron el tipo de deformidad pesquisada y en cuatro estudios se realizaron orientaciones de autocuidado. Conclusión: en síntesis, el estudio permitió extraer indicadores importantes para la evaluación de los pés y observó consonancia entre las pesquisas analizadas con lo que se recomienda. Descritores: Diabetes Mellitus; Pé Diabético; Factores de Riesgo; Prevenção; Exame Físico; Sinais e Sintomas.
Evidence for the evaluation of the feet of the person with Diabetes Mellitus.

OBJECTIVE

- To Identify the evaluation criteria of the feet of people with Diabetes Mellitus.

METHOD

Integrative review conducted by the following steps: establishment of the hypothesis; search in literature; categorization of studies and formation of the database; evaluation of the studies included in the review; interpretation of results; and synthesis of knowledge.9

Data collection was performed from January to March, 2017 in the databases: Medical Literature Analysis and Online Retrieval System (MEDLINE); Latin American and Caribbean Literature in Health Sciences (LILACS); Cochrane; SCOPUS and the Scientific Electronic Library Online (SciELO).

The question that guided the study was: What are the criteria used to evaluate the feet of the person with Diabetes Mellitus?

Based on the guiding question, the following descriptors of DeCS (Health Sciences Descriptors) and MeSH (Medical Subject Headings) were used: diabetes mellitus (diabetes mellitus); diabetic foot; risk factors; prevention; physical examination; signs and symptoms. These descriptors were combined two by two using the Boolean AND operator on all bases.

Original articles in Portuguese, English and Spanish were included in the study, with a five-year time cut, covering the researches published between 2011 and March 2017. Exclusion criteria were articles with only abstracts available and those who did not respond to the guiding question of the study.

After crossing the descriptors in the abovementioned databases, there were 3280 publications referring to the researched topic. Following the reading of the titles and summaries of the respective studies, 3199 publications were excluded, with 81 studies remaining in line with the eligibility criteria. Subsequently, the refinement of the search was carried out, with a thorough reading of the eligible publications in full, when 65 studies were excluded and the final sample with a total of 16 articles was determined. The selection discriminated by databases is shown in figure 1.
After reading the selected studies, a table was prepared based on the PRISMA guidelines (Main Items for Reporting Systematic Reviews and Meta-analyses) to collect information with: title, authors, year of publication, periodical, language, objectives, target population, sample, instrument used, data collection, inclusion and exclusion criteria, statistical analysis, results, conclusions and updated references.

In addition, the selected studies were classified according to the level of evidence as follows: I - systematic reviews or meta-analysis of relevant clinical trials; II - evidence of at least one well-delineated randomized controlled trial; III - well-delineated clinical trials without randomization; IV - well-delineated cohort and case-control studies; V - systematic review of descriptive and qualitative studies; VI - evidence derived from a single descriptive or qualitative study; VII - opinion of authorities or committees of experts including interpretations of information not based on research. 

The searches resulted in 16 publications. Of these, eight were written in Portuguese; seven in English and one in Spanish. Regarding the year of publication, it was verified that the majority was in the year 2013, with the total of four published studies, followed by the years 2015 and 2016, with a total of three articles each. Regarding the level of evidence, it was verified that the majority is composed by descriptive studies (n = 10) that do not present strong evidence. Only three studies have level of evidence II.
Evidence for the evaluation of the feet...

Figure 2 shows the studies included in this review and presented according to: article, authors, year of publication, type of study, level of evidence, sample and objective.

<table>
<thead>
<tr>
<th>Article</th>
<th>Authors/Year</th>
<th>Type of study/ Level of evidence</th>
<th>Sample/Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Cisneiros LL, Gonçalves LAO / 2011.</td>
<td>Qualitative/ VI</td>
<td>30 patients / Knowing and to present meanings attributed by diabetic patients and their families to primary care aimed at preventing complications in the feet.</td>
</tr>
<tr>
<td>12</td>
<td>Hu H1, Han CM, Hu XL, Ye WL, Huang WJ, Smit AJ / 2012</td>
<td>Observational cross sectional/ VI</td>
<td>19 patients Evaluate the association between autofluorescence of the skin and ulcers in the feet of people with diabetes and identify other factors that affect their role in determining the risk of ulcer.</td>
</tr>
<tr>
<td>13</td>
<td>Santos HC, Ronsoni MF, Colombo BS, Oliveira CSS, Hohl A, Coral MHC, Sande-Lee SV / 2015</td>
<td>Observational study cross sectional / VI</td>
<td>116 patients / Evaluate the degree of neuropathy in diabetics through the Neuropathic Symptom Score and Neuropathic Compromise Score to homogenize the diagnosis, quantify the prevalence and promote preventive measures.</td>
</tr>
<tr>
<td>14</td>
<td>Silva JV, Souza-Munoz RL, Figueiredo AS, Fernandes BM, Melo JFG / 2013</td>
<td>Observational control case/ IV</td>
<td>90 patients / Evaluate risk factors for loss of protective planar sensitivity in diabetic patients and to correlate this loss with neuropathic symptoms.</td>
</tr>
<tr>
<td>15</td>
<td>Altaf QA, Sadiqi H, Piya MK, Tahrania AA / 2016</td>
<td>Prospective observational cohort / IV</td>
<td>228 patients / Evaluate the impact of lack of foot sensitivity through the estimated value of the glomerular filtration rate in patients with type 2 diabetes.</td>
</tr>
<tr>
<td>16</td>
<td>Barros MFA, Mendes JK, Nascimento JA, Carvalho AGC / 2012</td>
<td>Intervention study/ II</td>
<td>24 patients / Evaluate the impact of a physiotherapeutic intervention in the prevention of diabetic foot.</td>
</tr>
<tr>
<td>20</td>
<td>Pereira FGF, Diogènes MAR, Freire DF, Meneses MS, Xavier ATF, Ataíde MBC /2013</td>
<td>Descriptive / VI</td>
<td>12 Nurses / Identify the conducts used during the nursing consultation to the person with diabetes mellitus for the prevention of diabetic foot.</td>
</tr>
<tr>
<td>21</td>
<td>Cubas MA, Santos OM, Retzlaff EMA, Telma HLC, Andrade IPS, Moser ADL, et al /2013</td>
<td>Field explorer / VI</td>
<td>40 patients / Check the knowledge of users of the diabetes program about preventive care to diabetic foot, identify the guidelines that the patient receives regarding this prevention and observe in the participants of the diabetes program adherence to self-care procedures.</td>
</tr>
<tr>
<td>22</td>
<td>Amaral Junior AH, Amaral LAH, Bastos MG, Nascimento LC, Alves MJM, Andrade MAP /2014</td>
<td>Observational, prospective cases / VI</td>
<td>77 patients / Evaluate the impact of Paid Diabetic Foot Ambulatory in reducing diabetic patient morbidity, with emphasis on lower limb injuries.</td>
</tr>
<tr>
<td>24</td>
<td>Oliveira PS, Bezerra EP, Andrade LL, Gomes PLF, Soares MJG,</td>
<td>Quantitative description / VI</td>
<td>38 nurses / Identify guidelines provided by nurses to people with DM on foot care; investigate the frequency of the foot exam and the aspects evaluated; to verify what health education activities are performed by nurses.</td>
</tr>
</tbody>
</table>
Samples of the studies analyzed ranged from 12 to 307 participants, who consisted of nurses or people diagnosed with Diabetes Mellitus. As a research tool, 12 studies used questionnaires to screen the data. The great majority did not show the dominant sex among the participants. Among the main impairments related to diabetic foot were vascular, neurological and deformity alterations.

Regarding the methodological design, there was a higher prevalence of cross-sectional studies. The statistical analysis used in the majority of the studies was chi-square, Spearman, Kruskal-Wallis and Mann-Whitney correlation analysis, McNemar's test, Student's t-test and test from Shapiro-Wilk.

The studies used different tests and materials for diabetic foot evaluation. Figure 3 shows the evaluation criteria and the form of evaluation used during the examination of the feet according to each category:

<table>
<thead>
<tr>
<th>Category</th>
<th>Evaluation Criteria / Quantity articles</th>
<th>Evaluation form</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anamnesis</strong> (n=11)</td>
<td>- Age, Sex; (10), History of Amputation, Deformity (10), History of Amputation, - Body Mass Index (1) - By-pass on lower limbs (1), - Intermittent claudication (5) - Burning and / or stabbing pain, Numbness, Paresthesia, Weakness in feet, Ataxia (2). - Glycated Hemoglobin and Glomerular filtration rate (1).</td>
<td>Interview for collection of clinical and epidemiological history.</td>
</tr>
<tr>
<td><strong>Skin and attachment evaluation</strong> (n=08)</td>
<td>- Skin: Presence of mycoses, ulcerations, dehydration, cracks, cracks. Interdigital spaces with humidity (8). - Coloration (Cyanosis-3, Redness-2, Postural Flush-1) - Temperature (Hot foot, Cold foot - 6), (Hair distribution - 3). - Calosities -3, Edema, Bruising, Dorsal Vasodilatation-1. - Unails: nail cutting, nail dystrophies (brittle, thickened nails, ingrown - 2).</td>
<td>Inspection and palpitation</td>
</tr>
<tr>
<td><strong>Neurological Evaluation</strong> (n=12)</td>
<td>Protective and Tactile Sensitivity (9)</td>
<td>Semmes-Weinstein monofilament stereo meter 10g, cotton balls test tubes with cold and hot water pins</td>
</tr>
<tr>
<td></td>
<td>Thermal sensitivity (4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pain sensitivity (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vibration Sensitivity (5)</td>
<td>biotensiometer, tuning fork 128 Hz</td>
</tr>
<tr>
<td></td>
<td>Patellar reflex (1)</td>
<td>reflex hammer</td>
</tr>
<tr>
<td></td>
<td>Tendon reflex (1)</td>
<td>reflex hammer</td>
</tr>
<tr>
<td></td>
<td>Scores of neuropathic symptoms: pain or discomfort, sensory and locational symptoms, time and improvement of symptoms (4)</td>
<td>Standard Scales Classification of the symptomatology: mild - ESN between three and four, moderate between five and six or severe between seven and nine points.</td>
</tr>
<tr>
<td><strong>Vascular</strong></td>
<td>Evaluation of the pulses: dorsal pedicle and posterior</td>
<td>Palpitation</td>
</tr>
</tbody>
</table>
As shown in figure 3, in the anamnesis category, the concern was to seek the main risk factors related to diabetic foot with regard to sociodemographic and clinical data of the person.

On the other hand, the results of the skin evaluation category and the appendices examined the conditions that most affect the skin, nails, and interdigital spaces of the person with Diabetes Mellitus, which are primary indicators in a clinical evaluation of the foot.

In relation to the neurological evaluation category, different tests were registered to investigate changes in sensitivity and reflexes. They are: protective and tactile sensitivity with the Semmes-Weinstein 10g monofilament stereoisometer and cotton balls; thermal sensitivity with hot and cold water test tubes; painful sensitivity with the use of pins; vibration sensitivity with biontiensometer and 128 Hz tuning fork; reflex patellar and tendine Aquileu with reflex hammer; measurement of neuropathic symptoms such as pain and tingling by means of standardized scales for the measurement of neuropathic symptoms.

In the vascular evaluation category, the posterior pediatric and tibial pulses were identified by palpation, arterial examination by the ankle arm index (ABI) with Doppler and sphygmomanometer and evaluation of the pressure of the first and second fingers by System Systoe Photophlethysmograph.

In relation to the category anatomical evaluation of the feet, five articles investigated the problem, but only two of them portrayed the type of deformity researched, such as finger overlap and Foot of Charcot. Regarding self-care, three studies carried out the guidelines through questionnaires, lectures and leaflets that emphasized the care needed to avoid secondary complications and the importance of practicing physical activities.

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**DISCUSSION**

In this review, in response to the question that guided the study, it was observed that different indicators were pointed out by the scholars in the analyzed publications and that, in categorizing them, it was possible to obtain a better vision of which are the criteria commonly used for the evaluation of the foot of the person with Diabetes Mellitus.

In the meantime, it was possible to verify that, in the anamnesis category, most studies (n = 10) were concerned with investigating the main risk factors that contribute to diabetic foot impairment, such as smoking, hypertension visual impairment, history of ulcer, amputation and / or deformities in the feet.

According to the Brazilian Society of Diabetes, it is of great importance during the anamnesis to investigate the clinical history and risk factors associated with the development of diabetic foot as: the history of micro and macrovascular complications; poor vision; the history of ulcers or amputation in the feet; arterial hypertension; obesity; smoking and poor glycemic control.\(^5\)

The identification of risk factors for the development of diabetic foot is extremely necessary for the adequate prevention of ulcers and amputations. Health professionals who know the risk factors are potential supporters of self-care and decrease, in a relevant way, the appearance of complications.\(^27\)

Most of the research focused on investigating the presence of mycoses, ulcerations, dehydration, cracks, cracks and interdigital spaces with humidity (n = 8). In order to investigate the presence of signs suggestive of the risk of injury. These are changes frequently found in the feet of people with DM and their presence, associated with loss of peripheral sensitivity, is often triggering the diabetic foot.\(^7\) However, other
indicators, such as callosities and nail dystrophies, were few portrayed in the studies, which indicates that more extensive and detailed investigations are necessary.

Regarding the neurological evaluation, the studies investigated in this review used different tests to evaluate the sensitivity and reflexes. Currently, it is recommended, for the identification of diabetic neuropathy, the evaluation of pain sensitivity through the test of the bite with the use of pins or needles; of thermal sensitivity with the use of a hot and cold water test tube; of the vibratory using a tuning fork of 128 Hz and the tactile sensitivity with a cotton or monofilament of Semmes-Weinstein ten grams. The reflex tests, however, include the evaluation of the patellar and tendinous reflex Aquileus by means of the percussion of the tendons with a reflex hammer.2,27

Among these, the method of choice is Semmes-Weinstein's monofilament test at ten grams for the ability to identify sensitivity changes associated with good specificity, simplicity, and low cost. This fact may have contributed to the greater number of studies (n = 9) in this review choosing to do so. However, the performance of this test does not eliminate the need to add other tests, because, to confirm the change, it is suggested to associate at least one more method.2,28

It is also observed that a great part of the objectives of the evaluated articles had as a purpose to search for neuropathic signs, which allows to infer that the concern in identifying the presence of diabetic neuropathy is due to this being one of the main causes of the diabetic foot.29 In this sense, it is important to emphasize the importance of incorporating neurological assessment, with appropriate tests, in all evaluations of the feet of the person with DM.

Another determinant condition for diabetic foot is the presence of Peripheral Arterial Disease (PAD), and vascular evaluation is paramount in examining the feet. As seen, the studies in this survey prioritized the assessment of the tibia and pedis pulses (n = 3). PAD screening, in addition to palpation of the pulses, should be carried out in the search for claudication, pain at rest at night or during walking, and reduced gait speed. Also, it is recommended to evaluate the Arm Ankle Pressure Index (AAI), in which values lower than 0.9 are a sign of changes in the vascular level, and the observation of the color of the skin for signs of cyanosis or pallor, temperature of the feet and the decrease of the pilification.2,7,8

It was possible to observe that, in evaluating the anatomy of the feet, the studies did not elaborate on the deformities due to diabetic neuropathy, so that only one study cited finger overlap and one, Charcot's Arthropathy. Deformities result from atrophy and weakness of small dorsal muscles and can be classified as hammer toes, claw toes, metatarsal prominences, hallux valgus, and Charcot arthropathy.29-30

The bony prominences resulting from these deformities, due to hyperpressure and excessive friction, can lead to hyperkeratosis, gait limitations, risk of ulcerations and secondary infections. Changes such as claw toes, hammer toes and metatarsal prominences can lead to a burning metatarsalgia. Hallux valgus, which consists of lateral hallux deviation, accompanied by a deviation in the medial portion of the head of the first metatarsal bone, has, as an implication, localized pain and in the plantar region of the first metatarsus, which is aggravated by ambulation, contributing to the claudicating march. Charcot arthropathy, called the "foot of Charcot", is an osteoarticular deformity that generates intense inflammatory activity and bone destruction resulting from the sensorial loss associated with repetitive mechanical trauma in the lower limbs leading to the clinical picture of intense pain and postural instability, factors that increase the risk of falls.31-3

All of these implications should alert health workers to the opportunity to assess plantar pressure and advise the individual on the use of appropriate therapeutic and shoe insoles for pressure relief.7,30

Regarding the guidelines and self-care measures for the prevention of diabetic foot, in the studies analyzed (n = 3), the daily foot inspection, the use of moisturizers, the drying of the feet and interdigital spaces, the use of proper shoes, avoid walking barefoot, nail care, such as using sanding and correct cutting, in addition to encouraging the practice of physical activity, avoid smoking and increase the frequency of examination of the feet. In addition to these measures, it is important for health professionals to address injury prevention issues such as monitoring of water temperature during foot hygiene to avoid burns due to decreased thermal sensitivity; the use of socks to promote the detection of exudate; shoes and socks of appropriate size and without seams to avoid excessive friction; check daily the internal portion of the footwear to detect the presence of objects that could injure the feet,
if necessary, with the use of mirrors; do not remove corns and calluses, as these should be evaluated and treated by the health team.  

CONCLUSION

In summary, the study allowed to extract important indicators for the evaluation of the feet and the conscience among the analyzed studies was observed with what is recommended in the main guidelines and guides referring to the problematic. And, although there are limitations, such as the presence of studies with a low level of evidence, the variety of instruments for foot evaluation and the absence of studies that include systematic and standardized evaluations, it is worth mentioning that this survey brings new perspectives by providing a consensus among the criteria that may support wider assessments in the feet and promote a more holistic assistance to the person with DM. It is also suggested to apply this knowledge in the elaboration of instruments in order to better guide the professional during the evaluation of the feet of the person with DM in clinical practice, as well as in scientific investigations.

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REFERENCES


Evidence for the evaluation of the feet...