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Article

Health literacy regarding diabetic foot and associated factors in individuals with type 1 and type 2 diabetes assisted by primary health care

Letramento em saúde quanto ao pé diabético e fatores associados em pessoas com diabetes tipo 1 e 2 assistidos pela atenção primária à saúde

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ABSTRACT: Objective: To identify the factors associated with lower levels of health literacy regarding diabetic foot among individuals with diabetes mellitus attended in primary healthcare. **Methods:** An epidemiological study conducted among individuals with type 1 and type 2 diabetes mellitus registered at health units in the city of Montes Claros-MG, Brazil. Socioeconomic and demographic conditions, health literacy regarding diabetic foot, arterial blood pressure levels, and cardiovascular risk were investigated. **Results:** A total of 282 individuals participated, with an average age of 59.53 years. Lower levels of health literacy regarding diabetic foot were observed in 52.8% (n=149) of the participants. Variables associated with lower levels of health literacy included age (OR=2.33; 95%CI=1.02-5.31; p=0.045), education level (OR=0.39; 95%CI=1.01-2.51; p=0.035), and family income (OR=4.55; 95%CI=2.36-8.79; p<0.001). **Conclusion:** Lower levels of health literacy regarding diabetic foot were associated with older age, lower education level, and reduced family income.

KEY WORDS: Health literacy. Diabetes mellitus. Diabetic Neuropathies. Diabetic Foot. Diabetes Complications. Primary Health Care.

RESUMO: Objetivo: identificar os fatores associados a menores níveis de letramento em saúde quanto ao pé diabético entre pessoas com diabetes mellitus atendidas na atenção primária à saúde. **Métodos:** estudo epidemiológico conduzido entre pessoas com diabetes mellitus tipo 1 e 2 cadastradas em unidades de saúde na cidade de Montes Claros-MG, Brasil. Foram investigadas condições socioeconômicas e demográficas, letramento em saúde quanto ao pé diabético, níveis pressóricos arteriais e risco cardiovascular. **Resultados:** participaram 282 pessoas com média de idade de 59,53 anos. Menores níveis de letramento em saúde quanto ao pé diabético estiveram presentes em 52,8% (n=149) dos participantes. Associaram-se a menores níveis de letramento em saúde as variáveis idade (OR=2,33; IC95%=1,02-5,31; p=0,045), escolaridade (OR=0,39; IC95%=1,01-2,51; p=0,035) e renda familiar (OR=4,55; IC95%=2,36-8,79; p<0,001). **Conclusão:** menores níveis de letramento em saúde quanto ao pé diabético estiveram associados aos mais velhos, com menor escolaridade e renda familiar reduzida.

PALAVRAS-CHAVE: Letramento em Saúde. Diabetes Mellitus. Neuropatias Diabéticas. Pé Diabético. Complicações do diabetes. Atenção Primária à Saúde.

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INTRODUCTION

Health literacy refers to the cognitive and social capacity of the individual to access, understand, judge and apply information in their daily lives to maintain their state of health. This is a change in behavior that can create barriers to the complications of non-communicable diseases, such as diabetes mellitus[1]. This disease is understood as a set of metabolic dysfunctions resulting from problems in the action and/or secretion of insulin and by the rise of glucose in the blood. Its diagnosis, when late, usually comes with complications[2].

One of the main complications of diabetes is the diabetic foot, known for the emergence of infections, wounds and/or destruction of the deepest tissues of the lower limbs, especially the feet. It may be related to neurological, metabolic and peripheral vascularization problems[3-6]. Factors related to poor socioeconomic conditions may influence the increase in the prevalence of diabetic foot, ranging from 19% to 34% in the population; in underdeveloped countries, the prevalence may be higher[7]. Diabetic foot ulcers often become worse due to infections, resulting in a 20% incidence of lower limb amputation throughout life and a mortality rate of 50% to 70% in five years[7,8].

People with diabetes should actively participate in the maintenance of treatment, appropriating skills for self-care actions, since they have co-responsibilities in the health care process[9]. Thus, a libertarian approach to health would be to raise the levels of health literacy of people and the community, seeking the necessary and sufficient empowerment to manage information, analyze and apply, consciously, the knowledge and resources available[10]. The better understanding of health literacy can act as a protection against complications due to self-care applied by the patient in their daily life[11,12].

In this sense, investigating the health literacy of the diabetic foot, as well as the profile of people with the disease, can contribute to the creation of preventive strategies in order to avoid the development of this clinical complication. Thus, this study aimed to identify the factors associated with lower levels of health literacy regarding diabetic foot among patients with type 1 and 2 diabetes mellitus assisted by primary health care.

MATERIALS AND METHODS

An epidemiological study of the observational type was conducted between May and October 2020 with users of Family Health Strategy Units in Montes Claros, Minas Gerais, Brazil.

Three Basic Family Health Units (BFHU) were selected from a simple random draw among the 73 pole-units in the city at the time of data collection. Those responsible for the selected units provided lists with the names of all registered diabetic individuals. The investigation involved individuals aged 18 years or older, registered in the strategy and with laboratory diagnosis of diabetes mellitus type 1 and 2. There was exclusion of individuals with three or more comorbidities in order to avoid the overlap of triggering factors in health literacy levels[9]; those whose mother language was not Portuguese; and those that presented visual or hearing problems during the data collection stage reported by the participants or identified by the research team[1]. Cognitive impairment was verified by means of the Mini Mental State Examination[13] among individuals aged 60 years or more, since this age group presents a high risk of developing mental confusion and not getting a correct diagnosis[13-15]. Therefore, participants who presented values compatible with cognitive impairment were excluded from the study in order to minimize the response bias[1,13].

The following variables were investigated:

a) Sociodemographic and economic conditions: sex (male; female); age group (years) categorized by quartiles for homogeneous distribution of the variable (22 to 54; 55 to 61; 62 to 68; 69 or more); schooling in full years of study (0; 1 to 4; 5 to 8; 9 to 11; 12 or more); marital status (single; married; stable union; widowed; divorced; separated); self-declared skin color (white; yellow; black; brown; indigenous); *per capita* income in BRL (up to 1,045.00 BRL [minimum wage in 2020][16]; above 1,045.00 BRL); BRL spent on medicines in the last month (no; yes; if so, how much).

b) Mini Mental State Examination for cognitive assessment (13 cut-off point for illiterate people; 18 for low and medium schooling [1 to 8 years of incomplete study]; and 26 for high schooling [8 or more years of study])[13].

c) Health literacy measured by the diabetic foot health literacy (DFHL) instrument (higher or lower levels). Values less than or equal to 14 define lower levels of health literacy. This is validated among people with diabetes assisted by primary health care (Cronbach alpha=0.73; Kappa=<0.60; intraclass correction coefficient=0.79)[1].

d) Anthropometric data: waist and hip circumference (0 to 150 cm); cardiovascular risk measured by the waist-to-hip ratio (male: ≤ 0.95; women: ≤0.85)[17]; blood pressure levels through systolic blood pressure (SBP) and diastolic blood pressure (DBP)[17], considering the following values: optimal blood pressure <120 and <80; normal pressure 120-129 and/or 80-84; pre-hypertension 130-139 and/or 85-89; hypertension stage 1: 140-159 and/or 90-99; hypertension stage 2: 160-179 and/or 100-109; hypertension stage 3: ≥180 and/or ≥110)[17].

The study participants were approached in their own residence accompanied by a community health agent who made the initial invitation. The Informed Consent Form was presented to each. Everyone had the opportunity to read the document, and those who agreed to participate signed the form in two copies, with a copy being given to each patient. The instruments were applied in the interview format and anthropometric evaluation performed in a reserved and appropriate environment. The Mini Mental State Examination was applied among those aged 60 years or older. The final score is generated by the sum of the score of each item, ranging from 0 to 30 points. There is a significant influence of schooling on the final score of the instrument, suggesting different cut-off points for elderly with or without schooling[18]. As a cut-off point, 13 for illiterate people, 18 for low and medium education

and 26 for high schooling[13].

A questionnaire on sociodemographic and economic conditions was applied. Then, the level of health literacy was evaluated through the DFHL instrument. It is an instrument consisting of 18 trios of words referring to the access and knowledge of factors associated with diabetic foot. For each trio of words, a main term must be associated with one of the other two to determine the level of health literacy. A point is added to each correct association, in this way, the final result may vary from 0 to 18 points. Values equal to or less than 14 suggest problems in health literacy[1]. The instrument was applied using printed plates.

The central terms were found in the upper margin, highlighted in bold, and the two association options were found just below with similar font and size, and without highlighting features. The interviewer performed the reading of the central term and, in the sequence, asked the participant about which word would be correctly associated with the term read, which was also read for those without schooling (illiterate). Prior to the evaluations, participants were instructed to say "I don't know" in conditions where they did not know the correct association, avoiding guesswork.

A 2.0 cm wide Fiber Glass® retractable inextensible tape was used to measure the waist and hip circumference. The participants wore light clothing and the abdominal region was bare. They were instructed to stand in the orthostatic position, with arms stretched along the body. The measurement was performed in the smallest curvature located between the last rib and the iliac crest, with care not to compress tissues, being the reading made at the end of an exspiration[19]. In the measurement of the perimeter of the hip, the patient kept the arm slightly abducted and in an orthostatic position. The region was measured by taking the largest diameter, in which the measuring tape was at the level of the major pericarps of the femur[20].

BD® stethoscopes and BD® Aneroid sphygmomanometers were also used to measure blood pressure, all duly calibrated and certified by the National Institute of Metrology, Standardization and Industrial Quality. Blood pressure measurements were taken with the person sitting, after five minutes of rest. Participants were asked to empty their bladder, not ingest food for at least 30 minutes before the measurement and not consume cigarettes and caffeine. Three measurements were taken, eliminating the initial measurement. The arithmetic mean of the second and third blood pressure measurements was considered.

A probabilistic sample for infinite population was estimated in the analyses, considering the parameters in the sampling planning: a proportion of 50% of people with diabetes with lower levels of health literacy; a confidence level of 95%; a sample error of 6 percentage points; increase in losses of 5%. Thus, a sample of 281 participants was estimated.

Excel for Windows and Statistical Package for the Social Sciences® version 25.0 were used during the statistical analyses. The descriptive analysis was applied to categorical variables, estimating absolute and relative frequencies. For the continuous variables, the mean, standard deviation (SD) and 95% confidence interval (95%CI), as well as minimum and maximum values were estimated. The appropriate test was chosen for the distribution of normality of the sample: Pearson or Spearman correlation; the choice of this correlation was defined by the statistical test of normality (Kolmogorov-Smirnov tests), applying a significance level of 5%. The association between independent and dependent variables (diabetic foot health literacy: higher levels; lower levels) was identified through the chi-square test, obtaining the Odds Ratio, its statistical significance and 95%CI. The variables associated with the dependent variable ($p \leq 0.20$) in the univariate analysis were included in the multiple analyses. Logistic regressions were performed to estimate multiple models. The final model was adjusted keeping the variables associated with $p<0.05$.

The work was approved by the Research Ethics Committee (# 3.991.379). All participants signed the informed consent form.

RESULTS

The participants were 282 individuals with type 1 and 2 diabetes mellitus. There were no exclusions, losses or refusals of the participants; the elderly evaluated by the Mini Mental State Examination presented preserved cognitive status (mean=26.16; SD=2.81), in this way, all were included in the study.

The majority were women (67%; n=189) with mean age of 59.53 years, ranging from 22 to 92 years (SD=10.34; 95%CI=57.55-61-60). The average family income was 782.98 BRL (SD=513.81; 95%CI=681.62-882.54; minimum value 0.00 BRL; maximum value 2,500.00 BRL). The average level of education was 7.55 (SD=4.34; 95%CI=7.06-8.04; minimum value 0; maximum value 28) and the average amount spent on drugs was 61.87 BRL (SD=127.04; 95%CI=38.72-88.48; minimum value R$ 0.00; maximum value R$ 800.00) (Table 1).

Systolic blood pressure ranged from 90 to 160 mmHg (mean=123.50; SD=14.31; 95%CI=120.70-160.40) and diastolic blood pressure varied from 50 to 100 mmHg (mean=75.70; SD=11.03; 95%CI=73.40-77.80). The average waist-to-hip ratio among women was 0.92 (SD=0.27; 95%CI=0.87-0.98); this value was also found among men (SD=0.12; 95%CI=0.87-0.96). It was found that 90.4% (n=66) of the women presented compatible values with increased cardiovascular risk; among men, this condition was found in 69.4% (n=25).

Lower levels of DFHL were observed among 52.8% of the participants (n=149; mean=14.12; SD=2.19; 95%CI=13.71-14.56; minimum value 8; maximum value 18).

In the univariate analysis, the variables age (p=0.005), schooling (p=0.005), family income (p<0.001) and cardiovascular risk (p=0.048) were associated with lower levels of DFHL (Table 1).

Multivariate analysis showed a higher chance of lower levels of DFHL among the older (OR=2.33; 95%CI=1.02-5.31; p=0.045), with lower schooling (OR=0.39; 95%CI=1.01-2.51; p=0.035) and reduced family income (OR=4.55; 95%CI=2.36-8.79; p<0.001) (Table 2).

Table 1 - Univariate analysis of independent variables according to health literacy regarding diabetic foot, Montes Claros, Minas Gerais, Brazil, 2020. (n=282)

Variable			Diabetic foot health literacy				
	n	%	Higher levels	Lower levels	OR	95%CI	p-value[a]
Sex							
Female	189	67.0	87	102	1		
Male	93	33.0	46	47	0.87	0.53-1.43	0.587
Age (years)							
22 - 54	76	27.0	40	36	1		
55 - 61	63	22.3	32	31	1.08	0.55-2.10	0.829
62 - 68	75	26.6	41	34	0.92	0.49-1.75	0.802
69 - 92	68	24.1	20	48	2.67	1.34-5.31	0.005
Schooling (years)							
0	17	6.0	4	13	1		
1 - 4	72	25.5	19	53	0.86	0.25-2.96	0.809
5 - 8	86	30.5	40	46	0.35	0.11-1.17	0.089
9 - 11	51	18.1	34	17	0.15	0.04-0.54	0.004
12 or more	56	19.9	36	20	0.17	0.05-0.59	0.005
Family income							
Above 1,045.00 BRL	73	25.9	54	19	1		
Up to 1,045.00 BRL	209	74.1	79	130	4.68	2.59-8.46	<0.001
Self-reported skin color							
White	88	31.2	44	44	1		
Yellow	17	6.0	8	9	1.12	0.39-3.18	0.824
Black	44	15.6	18	26	1.44	0.65-3.00	0.325
Brown	130	46.1	61	69	1.13	0.66-1.94	0.656
Indigenous	3	1.1	2	1	0.50	0.04-5.72	0.577
Marital status							
Single	35	12.4	13	22	1		
Married	162	57.4	83	79	0.56	0.26-1.19	0.133
Stable union	11	3.9	4	7	1.03	0.25-4.22	0.963
Widowed	50	17.7	22	28	0.75	0.31-1.82	0.528
Divorced/separated	24	8.5	11	13	0.69	0.24-2.01	0.505
Spent on medications							
No	150	53.2	71	79	1		
Yes	132	46.8	62	70	1.01	0.63-1.62	0.951
Systolic blood pressure[b]							
Optimal	52	21.9	25	27	1		
Normal	77	32.5	39	38	1.54	0.75-3.15	0.238
Pre-hypertension	41	17.3	16	25	1.66	0.85-3.22	0.136
Hypertension stage 1	51	21.5	19	32	0.70	0.21-2.33	0.565
Hypertension stage 2	12	5.1	7	5	0.98	0.13-7.20	0.988
Hypertension stage 3	4	1.7	2	2	0.93	0.12-7.08	0.941
Diastolic blood pressure[b]							
Optimal	84	35.4	39	45	1		
Normal	83	35.0	42	41	1.51	0.79-2.85	0.206
Hypertension stage 1	52	21.9	20	32	1.32	0.40-4.32	0.648
Hypertension stage 2	12	5.1	5	7	1.88	0.34-10.56	0.472
Hypertension stage 3	6	2.5	2	4	1.73	0.30-9.98	0.538
Cardiovascular risk[b]							
Absent	49	46.7	29	27	1		
Present	56	53.3	16	33	2.21	1.00-4.90	0.048

[a] chi-square test: significant p<0,05. [b] number of respondents lower than the number of participants, due to refusal to participate in data collection. Minimum wage in 2020: 1,045.00 BRL.

Table 2 - Final model of factors associated with lower levels of health literacy regarding diabetic foot, Montes Claros, Minas Gerais, Brazil, 2020. (n=282)

Variable	OR	95%CI	p-value
Age (years)			
22 - 54	1		
55 - 61	0.96	0.46-2.01	0.911
62 - 68	0.80	0.38-1.66	0.545
69 - 92	2.33	1.02-5.31	0.045
Schooling (years)			
0	1		
1 - 4	1.59	0.42-5.91	0.493
5 - 8	0.74	0.19-2.75	0.649
9 - 11	0.34	0.09-1.36	0.128
12 or more	0.39	1.01-2.51	0.035
Family income			
Above 1,045.00 BRL	1		
Up to 1,045.00 BRL	4.55	2.36-8.79	< 0.001

Hosmer-Lemeshow - X2=8.171; p-value=0.417.

DISCUSSION

This study demonstrated that age, education and family income may affect health literacy among people with diabetes mellitus assisted by primary health care. This result reinforces the importance of self-care, supported and encouraged by the primary health care team through health education programs aimed at diabetes care. Professionals should encourage the user to become active and be interested in personal care in general, either through individual or collective strategy[21]. The health care strategies applied by professionals gain strength when individuals are properly informed and aware of their treatment[22]. In this sense, health literacy is relevant for patient awareness of foot care, generating understanding and changes in habits to avoid complications[23].

Lower levels of DFHL were associated with low levels of schooling, a result similar to previous publications[9,23-26]. A study conducted in northern Portugal evaluated 351 people and confirmed that lower levels of health literacy were associated with no or low schooling. Another research conducted in northern Brazil (Belém-PA) found that the low level of functional health literacy may be a factor conditioning self-care and be influenced by low schooling, since it provides skills to make decisions directed to self-management of health[25]. These results show that school education can raise health-related understanding, which favors the insertion of healthy life habits. Low education level and high age are peculiar attributes of primary health care patients who generally have greater difficulty in changing their behaviors[1].

Another factor that was also associated with lower DFHL levels was advanced age. The result observed in Montes Claros-MG confirmed that advanced age was associated with low levels of knowledge about diabetes[26]. Older people may have limitations in critical thinking and difficulties in understanding the need for self-care as a prevention strategy.

People with low family income had a higher chance of developing inadequate DFHL, a finding similar to the scientific literature[1]. Due to the scarcity of resources, this public has difficulty in allocating personal or family income to pay for diabetes treatment, which can affect access to health-related information. This scenario may worsen in places where the population is not fully assisted[2].

Cardiovascular risk did not make up the adjusted model of multivariate analysis, however, it presented statistical correlation in univariate analysis. It should be considered that people with a diagnosis of diabetes mellitus have higher risks for cardiovascular disease. A study conducted in São Paulo found an association between high level of health literacy and better results in the treatment of people with heart failure. It was also observed that there was greater drug adherence and lower rates of readmission and hospitalization among this public[27].

No association was observed between blood pressure levels and lower DFHL levels. This result may be explained by the fact that the study did not evaluate the medical history, use of drugs to control blood pressure levels or the existence of a diagnosis of arterial hypertension among participants. The limitation of this study is the absence of direct observation of self-care activities with feet among participants, which was evaluated only through a questionnaire. Moreover, other factors such as type of diabetes and time of diagnosis should be considered in complementary research in order to generate more complete evidence.

Lower levels of DFHL were associated with advanced age, low level of education and reduced family income. The need for the creation and implementation of more effective health strategies directed to specific groups is highlighted. Such strategies should be elaborated through methods that are easy to understand and prioritize the change of behavior, as well as the monitoring of this change.

Authors' contribution: Árlen Almeida Duarte de Sousa: responsible for the design, selection and analysis of materials and data, article writing, critical review of the work, approval of the final manuscript and publication of the article; Ana Monique Gomes Brito: participated in the selection and analysis of materials and data, writing of the article, critical review of the work, approval of the final manuscript and publication of the article; Stéfany Allaide Fasolak Alves: participated in the selection and analysis of materials and data, writing of the article, critical review of the work, approval of the final manuscript and publication of the article; João Victor de Jesus Vicente: participated in the selection and analysis of materials and data, writing of the article, critical review of the work, approval of the final manuscript and publication of the article; Andrea Maria Eleutério de Barros Lima Martins: responsible for the design, selection and analysis of materials and data, writing of the article, critical review of the work, approval of the final manuscript and publication of the article. All authors declare that they had sufficient participation in the work to assume responsibility for the total content.

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