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Original Article

KNOWLEDGE ABOUT THE DISEASE AND ADHERENCE TO TREATMENT IN PATIENTS WITH DIABETES

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ABSTRACT

Introduction: Glycemic decompensation in diabetes is one of the major factors for the development of chronic disease complications. Factors involved in the adequate control of diabetes include adherence to pharmacological treatment and knowledge about the disease.

Methods: Cross-sectional study on the factors associated with adherence to drug treatment and knowledge about diabetes in diabetic patients treated at Hospital Universitário de Santa Maria between 2018 and 2019, based on the validated Morisky-Green test and on the Diabetes Knowledge Questionnaire.

Results: A total of 201 patients diagnosed with diabetes were included, the majority (85.6%) of which had type 2 diabetes and were white (75.6%), with a mean age of 59.4 years. An association between insufficient knowledge about diabetes and patients with type 2 diabetes was observed. An association was found between patients with type 2 diabetes using insulin and non-adherence to drug treatment compared with patients with type 2 diabetes who did use insulin. The research also showed that non-adherence to drug treatment was associated with higher occurrence of hypoglycemia compared with patients who adhered to drug treatment.

Conclusion: The data obtained in our study allows us to conclude that non-adherence to pharmacological treatment makes diabetes therapy more complicated and worsens the prognosis.

Keywords: *Diabetes mellitus*; treatment adherence and compliance; glycemic control; diabetes complications

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INTRODUCTION

Diabetes is considered one of the major global epidemics of the 21st century and a public health issue[1,2]. According to the Brazilian Diabetes Society (Sociedade Brasileira de Diabetes, SBD), more than 13 million people live with the disease in Brazil, which corresponds to 6.9% of the population[3]. Worldwide, an estimated 463 million people live with diabetes, and the estimated number for 2030 is 578 million, according to the International Diabetes Federation[4]. Type 2 diabetes is an asymptomatic disease, but with major long-term complications[5]. Chronic complications from type 2 diabetes can be divided into microvascular ones – retinopathy, nephropathy, and neuropathy – and macrovascular ones – stroke, coronary artery disease, and peripheral vascular disease[5]. The goal of diabetes treatment is to keep blood glucose levels as near normal as possible while avoiding acute and chronic complications[6].

The silent nature of type 2 diabetes, with its unpredictable symptoms, is a major barrier to motivating behavioral changes by patients and has a great impact on treatment adherence as well[4]. Multidisciplinary, patient-centered, and well-

coordinated approaches improve self-management, which should be the cornerstone of diabetes care[4,5]. Systematic reviews and meta-analyses support the benefits of self-management and team-based care[7,8]. However, patients with diabetes may have complex drug regimens or adverse drug experiences, which may present more barriers to adherence[9].

Self-care of patients with diabetes helps prevent complications and improve quality of life, in addition to increasing patient's longevity[3]. This includes adequate nutrition, physical activity, blood glucose monitoring, and the correct use of medications. Among those self-care aspects mentioned, a study reported that the use of medications taken orally have greater adherence than insulin injection[10]. The aspect with the least adherence reported in the research was practice of physical activities[10].

Dias et al. reported that, among patients with type 2 diabetes who answered a questionnaire about risk factors and disease outcomes, 33.13% have poor knowledge and 18.34% have regular knowledge about their illness[11]. Regarding adherence to the treatment of diabetes, it is influenced by several factors, from specific patient-related factors to the health professionals and the health system[12,13]. Despite the importance of glycemic control, non-adherence to hypoglycemic drugs or non-adherence to treatment is common in this population, which increases the risk of chronic complications of diabetes and mortality.

The proposal of this study is to evaluate the sociodemographic profile of patients with diabetes, to identify factors that may contribute to worsen treatment adherence, and to understand patients' knowledge about their disease as a possible influence on the correct use of medications.

METHODS

Design

This is a quantitative, descriptive, cross-sectional study conducted at Hospital Universitário de Santa Maria (HUSM), state of Rio Grande do Sul, Brazil, from October 2018 to November 2019.

Patients

We included patients with diabetes over 18 years old, of both sexes, who had their medical follow-up in Hospital Universitário de Santa Maria. Patients scheduled for visits at clinical specialties were consecutively invited to participate.

As inclusion criteria, we identified the diagnosis of diabetes in electronic medical records prior to the invitation. Patients were given a questionnaire and decided if they accepted to take part in the study. Patients who had difficulty understanding the instruments due to cultural factors or who did not sign the Informed Consent Term were excluded.

This study was approved by the Ethics Committee at the Universidade Federal de Santa Maria.

Data Collection

A directed interview was conducted, administered individually and in person. Information on disease duration, treatment performed, presence of chronic complications, socio-economic status, and education were collected. Descriptions of chronic complications or comorbidities were collected from electronic medical records or reported by the patient. We also collected information on the frequency of capillary blood glucose testing and the frequency of visits with dentistry, psychology, nutrition, and nursing professionals in the last year.

Laboratory tests collected up to 3 months before the visit were recorded. We assessed the dosage of glycated hemoglobin (HbA1c), creatinine, and albumin.

The Morisky-Green test (MGT)[14] is a validated questionnaire that can be used to observe patients' attitudes during treatment[15,16]. The Diabetes Knowledge Questionnaire (DKN-A)[17] is a self-administered questionnaire that assesses patient's knowledge about their disease. MGT and DKN-A both have already been translated and validated in Portuguese[16,18]. Those questionnaires were applied in Portuguese to patients with diabetes. In addition, data from physical and laboratory exams were collected through medical records.

The DKN-A[17] is composed of 15 items of multiple-answer questions on the different aspects related to the general knowledge of diabetes. This questionnaire consists of five broad categories: basic physiology (including the role of insulin); hypoglycemia; food groups and their substitutions; management of diabetes in the event of another disease; and general principles of disease care. A high score (up to 8 points) indicates greater knowledge and an improvement in psychological attitudes about diabetes.

Specifically, regarding the degree of adherence to pharmacological treatment, the most used questionnaire in Brazil, i.e., the MGT[14], was adopted. It includes four questions that refer to forgetting to take medication or stopping altogether for multiple reasons and is a simple and direct questionnaire with "yes" or "no" questions only. Patients were only considered in the "adherent" group when they obtained the maximum test score. Any wrong answer placed the patient in the "non-adherent" (NA) group.

Statistical Analysis

Regarding the statistical analysis, a database was built using Excel for Windows software and a double entry was made for its validation. Divergent data were corrected. For analysis, the data were transposed to the SPSS 18 software, the frequency of variables was calculated, and Fisher's exact test

was applied, which measures association between two qualitative variables.

Concerning the description of variables, continuous variables with normal distribution were described as mean and standard deviation (SD); those with non-normal distribution as median and interquartile range (P25-75); and categorical ones as number of cases (percentage). In terms of univariate analysis, Student's t test was used to compare two means, and one-way analysis of variance (ANOVA) to compare three or more means. Categorical variables were analyzed using the chi-square test. Variables with non-normal distribution underwent logarithmic transformation. Correlations were analyzed using Pearson and Spearman tests. The analyses for repeated measures were performed by ANOVA for repeated measures with Bonferroni correction. As for multivariate analysis, logistic regression and multiple linear regression were performed for categorical and continuous outcomes, respectively. Independent variables were included in the models as they presented a significant association in the univariate analysis or biological relevance.

RESULTS

The research included 201 patients diagnosed with diabetes, of which 29 (14.4%) had type 1 diabetes and 172 (85.6%) had type 2 diabetes. There was a certain proportionality between genders (45.3% men and 54.7% women), and the majority self-reported as white (75.6%). The mean age of patients was 59.45 ± 13.1 years. Clinical and laboratory characteristics of the patients according to the MGT score and DKN-A are described in Table 1 and Table 2, respectively.

Table 1: Clinical and sociodemographic characteristics in adherent and non-adherent patients.

	Adherent (61)	Non-adherent (140)	p-value
Age (years)	62.25 ± 10.35	58.06 ± 13.85	
Male sex (%)	49.2	43.6	0.538
Race (%)			0.372
Caucasian	80.00	73.57	
African-descendant	13.33	12.86	
Other	6.67	13.57	
Religion (%)			0.738
Catholic	70.00	63.57	
Evangelic	20.00	22.14	
Spiritualist	5.00	2.86	
Other	5.00	10.71	
Family income* (%)			0.158
< 1	38.33	31.42	
1-2	33.33	47.86	
> 2	28.34	20.71	
Years of education (%)			0.963
Up to 1	6.67	6.43	
1 to 3	15.00	12.86	
4 to 8	50.00	49.28	
9 or more	28.33	31.43	
Smoker (%)			0.457
Never smoked	55.00	54.99	
Current	66.67	10.00	
Former	38.33	27.01	
Alcohol (%)			0.095
Never	60.00	50.71	
Social consumer	15.00	31.43	
Alcohol abuser	1.67	2.15	
Former Alcoholic	23.33	15.71	
Presence of diabetic neuropathy£ (%)	21.67	18.57	0.697
Presence of cerebrovascular disease§ (%)	10.00	8.57	0.789
Presence of ischemic cardiopathy€ (%)	30.00	13.57	0.009
Time of diabetes in years	13.71 ± 8.78	14.82 ± 9.85	0.452
Insulin users (%)	46.67	72.86	0.001
Glycated hemoglobin	8.19 ± 1.78	8.52 ± 1.89	0.285
Family history of diabetes (%)	62.71	61.43	1.00

Continua

Tabela 1: Continuação

	Adherent (61)	Non-adherent (140)	p-value
Number of used drugs	6.57 ± 2.35	6.60 ± 3.01	0.931
Number of used tablet	8.90 ± 4.50	8.94 ± 4.99	0.955
Body mass index (kg/m²)	30.66 ± 6.86	31.48 ± 8.70	0.572
Systolic blood pressure in mmHg	135.41 ± 21.90	133.85 ± 18.93	0.623
Diastolic blood pressure in mmHg	84.69 ± 12.17	82.89 ± 9.99	0.641

* Minimum wage equal to $ 220.70 (reference year = August 2015); [Ł] Chart review; [£] Chart review: neuropathy to patients with description of positive monofilament test, sensorial changes, or suggestive lesions; [§] History of transient ischemic attack or stroke; [€] History of unstable angina, acute myocardial infarction or diagnosis of ischemic heart disease.

Table 2: Clinical and sociodemographic characteristics in patients with sufficient knowledge (SK) and insufficient knowledge (IK).

	SK (100)	IK (101)	p-value
Age (years)	54.92 ± 13.96	63.93 ± 10.49	
Male sex (%)	57.1	42.9	0.089
Race (%)			0.511
Caucasian	74.0	77.2	
African-descendant	12.0	13.9	
Other	8.9	14.0	
Religion (%)			0.239
Catholic	62.0	69.3	
Evangelic	22.0	20.8	
Spiritualist	6.0	1.0	
Other	10.0	8.9	
Family income* (%)			0.273
< 1	29.0	37.6	
1-2	44.0	43.6	
> 2	27.0	18.8	
Year of education (%)			0.001
Up to 1	1.0	13.6	
1 to 3	9.0	17.8	
4 to 8	45.0	54.5	
9 or more	45.0	8.0	
Smoker (%)			0.771
Never smoked	54.0	56.4	
Current	12.0	8.9	
Former	34.0	34.7	
Alcohol (%)			0.223
Never	58.0	49.5	
Social consumer	26.0	26.7	
Alcohol abuser	3.0	1.0	
Former Alcoholic	13.0	22.8	
Presence of diabetic neuropathy[£] (%)	20.0	18.8	0.860
Presence of cerebrovascular disease[§] (%)	11.0	6.9	0.335
Presence of ischemic cardiopathy[€] (%)	17.8	19.0	0.857
Time of diabetes (years)	15.06 ± 9.1	13.8 ± 9.88	0.362
Insulin users (%)	73.0	57.4	0.026
Glycated hemoglobin	8.56 ± 1.80	8.26 ± 1.91	0.294
Family history of diabetes mellitus (%)	58.6	64.4	0.468
Number of used drugs	6.31 ± 2.70	6.87 ± 2.91	0.164
Number of used tablet	7.92 ± 4.06	9.92 ± 5.34	0.003
Body mass index (kg/m²) (mean ± standard deviation)	31.55 ± 7.56	30.89 ± 8.7	0.623
Systolic blood pressure in mmHg	133.90 ± 21.84	134.84 ± 17.68	0.752
Diastolic blood pressure in mmHg	83.56 ± 10.62	83.39 ± 10.93	0.912

* Minimum wage equal to $ 220.70 (reference year = August 2015); [Ł] Chart review; [£] Chart review: neuropathy to patients with description of positive monofilament test, sensorial changes, or suggestive lesions; [§] History of transient ischemic attack or stroke; [€] History of unstable angina, acute myocardial infarction or diagnosis of ischemic heart disease.

Among patients with type 1 diabetes, the majority had 9 years of instruction or more (55.2%), 64% had a monthly income of up to 2 minimum wages, 93.1% had glycemic control with capillary tests, and 82.8% had hypoglycemia after their previous visit. Most already had chronic complications of diabetes (58.6%). Almost 80% of patients with type 1 diabetes were NA to drug treatment; however, 69% of them had sufficient knowledge about diabetes according to DKN-A.

Among patients with type 2 diabetes, 60% were insulin users and 68.6% underwent self-monitoring of blood glucose. Approximately half of the patients reported hypoglycemia after their last visit. Most patients with type 2 diabetes had no chronic complications of diabetes (61%), 74.8% had 8 years of education or less, and 79.1% had a monthly income of up to 2 minimum wages.

According to the applied questionnaires, patients with type 2 diabetes had less knowledge about diabetes (53.2%) than patients with type 1 diabetes (31%) ($p < 0.05$) (Figure 1). Most patients with type 2 diabetes (68.4%) were NA to the treatment (MGT).

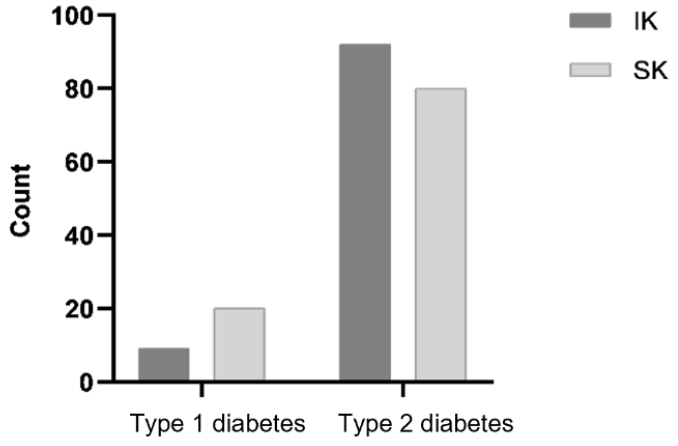

Figure 1: Relationship between type of diabetes and knowledge about the disease according to the DKN-A.
DKN: Diabetes Knowledge Questionnaire; IK: Insufficient knowledge; SK: Sufficient knowledge.

We observed that patients with type 2 diabetes who were insulin users were less adherent to pharmacological treatment (77.5%) ($p < 0.05$) (Figure 2) and presented higher mean HB1Ac levels (8.5 ± 1.69) than patients who did not use insulin (7.7 ± 1.68) ($p < E0.05$).

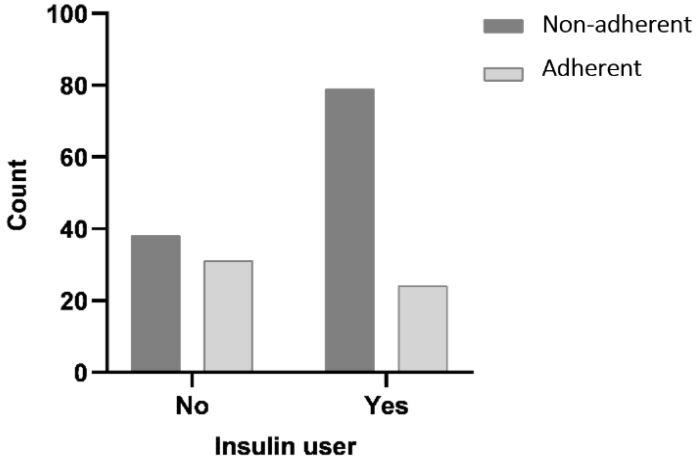

Figure 2: Relationship between insulin use and adherence to medical treatment in patients with type 2 diabetes.

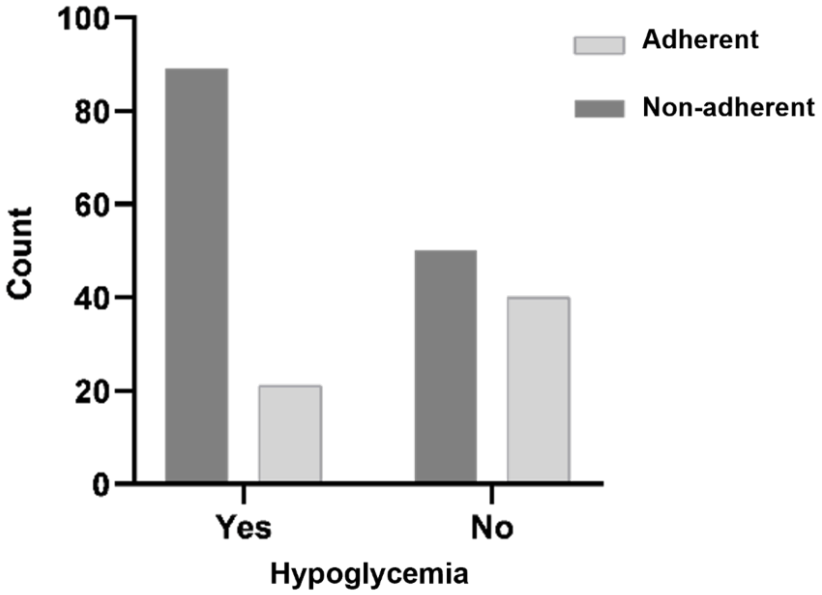

Figure 3: Relationship between adherence to pharmacological treatment according to the Morisky-Green test and occurrence of hypoglycemia.

NA individuals reported higher occurrence of hypoglycemia (64%) in comparison to patients who adhered to drug treatment (33%) ($p < 0.0001$) (Figure 3). There was a higher prevalence of NA patients living in rural areas (86.4%) compared with those living in the urban area (65.4%) ($p < 0.05$).

A binary logistic regression was performed to verify, among patients with type 2 diabetes, whether non-adherence to drug treatment and insulin use predicted the occurrence of hypoglycemic episodes. The model containing NA patients with type 2 diabetes by MGT who used insulin was significant for predicting hypoglycemic episodes. [$X^2(1) = 29.873$; $p < 0.0001$, Nagelkerke R^2 0.215]. This model associating NA patients with type 2 diabetes and use of insulin was a significant predictor of the occurrence of hypoglycemia (odds ratio = 5.830; 95%CI = 3.003-11.318).

DISCUSSION

We assessed the profile of patients with diabetes in a tertiary hospital in southern Brazil. It is important to allocate the Brazilian reality with regards to specialist consultation in the Brazilian public health system. The time between being referred to a specialist and the actual consultation may be very long, as shown in a survey performed by Datafolha that pointed to a waiting time of at least 6 months in 29% of the cases, and among them, 16% may need to wait for over a year[19]. There are reports in the literature of cases in which the waiting time for consultation with a specialist exceeded 2 years[20]. In this scenario, we found that glycemic control is not adequate in most patients. In an attempt to understand the reasons for the difficulty in management, we conducted an investigation of adherence rates and knowledge about the disease, in addition to other variables that could influence this outcome.

Our study brings to light some important clinical implications: high rates of non-adherence to pharmacological treatment of diabetes and the associations with worse clinical outcomes, such as the occurrence of hypoglycemia and worse HB1Ac levels. This is very worrisome, because it impairs the therapeutic goals of diabetes control and decreases patients' quality of life.

Insulin users had the worst adherence to drug treatment, with high rates of recorded hypoglycemia, maybe due to difficulties in adjusting the correct dose of insulin, or even patient's resistance to apply the insulin for fear of hypoglycemia, which is the main adverse effect of the drug.

The higher number of insulin users in the NA group corroborates with the results of another Brazilian study[21] and it is an important finding. Although insulin may be used in different therapeutic stages of type 2 diabetes, in our sample, insulin use in type 2 diabetes was related, with statistical significance, to non-adherence and to higher HbA1C levels, which may reflect a worst disease control in those patients.

Regarding the differentiation between the degree of knowledge in relation to diabetes, patients who had sufficient knowledge were younger and had higher formal education, but there was a higher proportion

of insulin users. It is concluded that patients who use insulin are more careful due to the risk of hypoglycemia. The questionnaire used to assess knowledge has a domain directly related to the use of insulin and management of hypoglycemia. We did not detect any relationship between degree of knowledge and adherence in the instruments used.

Limitations of this study are inherent to its methodology of an observational and cross-sectional study. There is no possibility to conclude causality in certain variables, comprising only correlation. The use of questionnaires is a practical and low-cost tool to measure knowledge and adherence. The MGT questionnaire is simple and direct, the DKN-A is a little longer and needs more interpretation, but both of them have their importance in understanding the individual patient's profile and patient's understanding of the disease and the treatment and how adherent to the treatment the person is. It would have been interesting to apply the questionnaires more times with the same person to compare the results. An important limitation refers to collecting the rest of the data. Most laboratory findings and comorbidities were collected by searching the electronic file, depending on the writing of accurate information and on the right comprehension of the collectors. We could notice this fact in regard to description of the chronic complications on medical records.

A Brazilian meta-analysis of randomized clinical trials shows that self-monitoring capillary glycaemia improves Hb1Ac in 0.31% in 12 weeks and in 0.34% in 24 weeks. This improvement seems to be more efficient in patients with worse glycemic control[22]. This data might be related to the improvement of self-knowledge about glycaemia levels varying with food ingestion, physical exercises, and medication, which brings knowledge about individual effects of each behavior, helping in adherence to diabetes treatment.

There are many factors related to treatment adherence, and they can be associated to the patient, to the health care provider, to the health system, to medication, and to other factors[23]. Those include lack of patient's involvement and education, poor communication, and lack of medication schedule[24]. In order to improve adherence, it is important to share the decision-making process with the patient, establishing a partnership between doctor and patient, explaining risk factors control and treatment, deliberating on choices, and helping in the decision[25]. The poor adherence found in this study is likely related to the lack of those strategies. A Brazilian study[26] related behavioral strategies with promotion of adherence on oral antidiabetic drugs, considering it an effective strategy to improve management of glycemic levels. Therefore, to ensure better therapeutic benefits, it is important to guarantee adherence to the prescribed therapy. Adherence can be improved by keeping in mind the factors that might interfere with this process, overcoming these issues with individualized plans[24].

The data obtained by our study allow us to conclude that there are high rates of diabetic patients who do not adhere to pharmacological therapy, which makes the treatment of the disease very complicated and worsens the prognosis. According to our study, the use of insulin seems to decrease the adherence to drug treatment, among the possible reasons for this may be the fear of adverse effects of the drug, such as hypoglycemia. However, non-adherence to drug treatment in insulin users was shown to be a predictive model for the occurrence of hypoglycemia in these patients.

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