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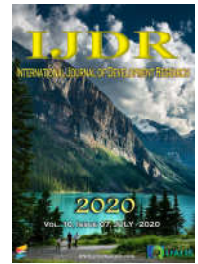
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RESEARCH ARTICLE

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EVALUATION OF INSULIN THERAPY EDUCATION IN DIABETIC PATIENTS ACCOMPANIED IN A SPECIALTY CENTER

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ABSTRACT

Introduction: Insulin therapy for glycemic control, in addition to its indication for DM1, is increasingly being detected as a treatment option for DM2. This work aims to identify flaws in the process of automatic insulin application aiming to assist in learning and reducing consequences for erroneous practice, improving the quality of life of patients. **Materials and methods:** 75 patients were recruited from the Endocrinology Outpatient Clinic of Centro Universitário do Estado do Pará who had been on insulin therapy for at least 6 months and used the Adapted Injection Techniques Questionnaire and a supplementary questionnaire designed for research. **Results:** Among the most used places for injection by patients: abdomen (94.7%), thighs (69.3%), arms (48%) and buttocks (13.3%). 86.7% rotated the application site and 13.3% did not. 47.7% performed insulin aspiration in the wrong way. 76.9% used a 90° angle for application to the skin. Only 16 of the patients mix NPH and regular insulin. **Conclusion:** Patients adherence to insulin self-care is associated with lack of motivation, no acceptance of the disease, pain on application, physical and cognitive limitations, which leads to several complications.

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INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder characterized by persistent hyperglycemia, resulting from the deficient production of the pancreatic hormone insulin or in its action, or even in both mechanisms. It is estimated that about 425 million people have DM worldwide, reaching epidemic proportions. Persistent hyperglycemia is associated with chronic micro and macro vascular complications, increased morbidity, reduced quality of life and increased mortality rate (Edition, 2017; Cho, 2018). DM is an important and growing health problem for all countries, regardless of their level of development. If current trends persist, the number of people with diabetes projected by the International Diabetes Federation (International Diabetes Federation, IDF) is over 628.6 million in 2045 (Cho, 2018). The classification of DM is based on its etiology and the causal factors of the main types of DM - genetic, biological and environmental - are not yet fully known.

Therefore, according to the World Health Organization (WHO) and the American Diabetes Association (ADA) DM is classified into types 1 and 2, gestational diabetes and other forms of Diabetes mellitus (Edition, 2017; Saeedi, 2019). Traditionally, diabetes complications are categorized as micro and macrovascular disorders and occur at variable intervals during the course of the disease, resulting in diabetic retinopathy, glomerular nephropathy, autonomic and peripheral neuropathies, coronary disease, cerebrovascular disease and peripheral arterial disease. Diabetes has been responsible for contributing to problems, directly or indirectly, in the musculoskeletal system, in the digestive system, in cognitive function and in mental health, in addition to being associated with several types of cancer. Little attention has been paid to the global trends in diabetes complications and to how the characteristics of diabetes-associated morbidity have changed (Saeedi, 2019; Fonseca, 2019). As diabetes is a difficult disease to control and with several acute and chronic complications, rigid and permanent treatment is of

fundamental importance, in order to guarantee a strict metabolic control, associated with simple preventive and curative measures, such as adequate diet, activity physical therapy and insulin therapy (Moreira, 2016; De Sousa, 2019). The DCCT (Diabetes Control and Complications Trial) study, which is a prospective study, concluded that treatment in patients with DM1 intensively with multiple daily doses of insulin of different actions is effective in reducing the frequency of chronic complications of DM (Miller, 2019). The use of insulin in the treatment of DM2 is used in diabetics with severe hyperglycemia associated with ketonemia or ketonuria, even newly diagnosed, or for diabetics who do not respond to treatment with changes in lifestyle and / or oral hypoglycemic, anti-hypoglycemic or insulin action sensitizers (Araújo, 2000). The treatment of DM1 or DM2 aims to maintain blood glucose levels throughout the day within normal limits, avoiding glycemic variability as much as possible. When insulin is needed to treat diabetes, it is used with multiple doses of neutral protamine Hagedorn (NPH) insulin, with intermediate action, with regular insulin doses, with fast action (Araújo, 2017).

Exogenous insulin therapy for good glycemic control, in addition to its classic indication for DM1, is increasingly recognized as a treatment option for DM2. Metabolic control can be achieved by administering multiple daily doses of insulin to the subcutaneous tissue, being considered an important measure for the prevention of acute and chronic complications of this disease (Araújo, 2017). In Brazil, disposable syringes are the instrument for applying doses daily doses of insulin most used, due to its lower cost, ease of acquisition, greater familiarity of health professionals in handling the material and for being distributed free of charge by government agencies (Araújo, 2017). As for the application of insulin, there are several places available, this must be applied to the subcutaneous tissue of the abdomen, the anterior aspect of the thigh, the anterior and posterior aspect of the arm and the upper gluteus. It is important to rotate the application sites, thus avoiding complications such as lipohypertrophy or insulin lipoatrophy (Teles, 2016). One of the situations of concern when it comes to insulin application at home is the measurement errors of the aspirated dose during its preparation. The application of a dose different from that prescribed can lead to unforeseen complications such as hypoglycemia or hyperglycemia, leading to the installation of acute and chronic complications (Stacciarini, 2011). Home insulin therapy poses a challenge for health professionals in terms of maintaining its quality and effectiveness, as it requires the training of people responsible for preparing insulin doses, thus ensuring their autonomy, as people aware of this responsibility make fewer mistakes during their preparation when others assume that responsibility for them (Oak). Therefore, this work aims to identify the flaws in the insulin self-application process aiming to assist in the learning of patients and to minimize the consequences arising from this erroneous practice, thus improving the quality of life and autonomy of patients with DM on insulin therapy..

MATERIALS AND METHODS

A study of a quanti-qualitative nature was carried out, using the Questionnaire of Injection Techniques (ITQ) 15 adapted and the complementary questionnaire elaborated for the research, which was developed at the Endocrinology Clinic of the Center of Medical Specialties of the Centro Universitário

do Estado do Pará (CEMEC-CESUPA), in the city of Belém, Brazil. All ethical statements present in Resolution 466/12 of the National Health Council were respected, as well as the international rules contained in the Nuremberg Code. In addition, the study was approved by the Research Ethics Council of that institution. 75 patients with Diabetes mellitus I and II were recruited, undergoing outpatient treatment at CEMEC-CESUPA, who had been on insulin therapy for at least 6 months. In addition, all patients were 18 years of age or older, regardless of gender and who agreed to participate in the study, by signing the Informed Consent Form, prepared by the researchers. For data collection, the questionnaire instrument adapted by interviewing and filling in the data by the patient was used. In addition, to evaluate the technique of insulin therapy application, during the observation of the data collection procedure, a practical evaluation was carried out using another Complementary Questionnaire, in which the researcher provided the patient with a sample with several types of syringes, so that that of its usual use was identified and subsequently asked to demonstrate the dose to be aspirated, as well as the technique used for insulin administration. After the practical evaluation, the technique was considered to be correct or wrong in application. After that, the information was consolidated and the data obtained were computed and organized in a database for analysis, in the form of graphs and tables, using the programs Microsoft Excel and Microsoft Word versions 2013. The analysis of these data was performed through of the Bioestat version 5.0 statistical analysis program. Text editing was performed using the Microsoft Word version 2013 program.

RESULTS

Initially, the epidemiological factors related to Diabetes mellitus were evaluated, observing the sex most affected, the age group, the type of diabetes and the years of evolution, according to table 1: In addition, the interviewees were asked about the cleanliness of the skin and the applicator vials of the insulin unit, with the following results being obtained: In addition, the most used site for injection by patients was questioned, being found: abdomen (n = 71; 94.7%), followed by thighs (n = 52; 69.3%), arms (n = 36; 48 %) and buttocks (n = 10; 13.3%). As for the rotation between the places of application, it was noted that the majority performed (n = 65; 86.7%), while the others (n = 10; 13.3%) did not perform the rotation. Another important point questioned was regarding the reuse of cutting instruments and some reasons associated with this reuse:

When asked the patients if there was pain in the application and how they evaluated their technique of giving injections, the researchers observed the following data: Another important item evaluated was the health education process for insulin therapy, which was evaluated as follows: Insulin aspiration is one of the most important points in the appropriate treatment for patients with diabetes. During the application of the complementary questionnaire, it was seen that among the interviewees there was no significant incidence of patients who aspirated insulin according to the prescription, since the amount between who aspirate correctly 34 (52.3%) compared to those who do not correctly do 31 (47.7%). However, among patients who aspirated incorrectly, 10 (32.3%) aspirated insulin A LESS and there was a significant incidence of patients who aspirated insulin A MAIS, with 21 patients (67.7%), as shown in table 6.

Table 1- Clinical-epidemiological profile of patients at the insulin therapy endocrinology clinic

Rated Factor	N	%	p*
Gender			
Female	56	74,7	p < 0.0001
Male	19	25,3	
Age group (years)			
< 30	5	6,7	p = 0.0057
30 a 39	8	10,7	
40 a 49	15	20,0	
50 a 59	18	24,0	
60 a 69	21	28,0	
≥ 70	8	10,7	
Type of DM			
DM 1	20	26,7%	p < 0.0001
LADA	2	2,6%	
DM 2	53	70,7%	
Years of Diabetes			
0 a 05	11	14,7	p < 0.0001
06 a 10	26	34,7	
11 a 15	11	14,7	
16 a 20	15	20,0	
21 a 25	7	9,3	
Mais de 25	5	6,7	
Insulin Time (years)			
≤ 05	49	65,3	p < 0.0001
06 a 10	15	20,0	
> 10	11	14,7	
IMC			
Eutrophic	22	29,3	p = 0.0339
Overweight	27	36,0	
Obesity Grade I	16	21,3	
Obesity Grade II	10	13,3	

*Chi-square Adherence. Source: Research data.

Table 2 - Cleaning the skin prior to application and cleaning the bottle or pen eraser before using insulin in patients at the endocrinology outpatient clinic for insulin therapy.

Rated Factor	N	%	p*
Assepsis of the skin			
Yes	64	85,3	p < 0.0001
No	11	14,7	
Cleaning the pen bottle or eraser			
Yes	40	53,3	p = 0.6442
No	35	46,7	

*Test Chi-square Adherence. Source: Research data.

Table 3. Use of a syringe for use by patients at the CEMEC endocrinology outpatient clinic for insulin therapy

Rated Factor	N	%	P
Do you use the syringe more than once?			
Yes	48	73,8	p** = 0,0002
No	17	26,2	
How many times do you reuse the same needle?		N=48	
02 times	24	50,0	p* < 0.0001
03 - 05 times	20	41,7	
06 or more times	4	8,3	
Why you reuse the pen needle?			
Falta de outra	9	18,8	p** = 0,0072
Por conveniência	13	27,1	
Economizar dinheiro	26	54,2	

* G Adherence test. ** Chi-Square Adherence Test. Source: Research data

During the observation of the technique, 59 (90.8%) of the patients chose an appropriate site for the application and only 6 (9.2%) chose an inappropriate site. Regarding the correct angle, 50 (76.9%) performed the application using the 90° angle with the skin and 15 (23.1%) chose the wrong angle. In addition, 16 (24.6%) of the patients mix NPH and regular insulin, among which 12 (75.0%) mix properly and 4 (25.0%) do it inappropriately, presented shown in table 6.

Table 4. Occurrence of painful injections in patients at the CEMEC endocrinology clinic on insulin therapy

Rated Factor	N	%	p*
Are your injections always painful?			
Yes	39	52,0	p < 0.0001
No	36	48,0	
How would you best describe your injections?		N=39	
Always painful	3	7,7	p < 0.0001
Often painful	10	25,6	
Sometimes painful	18	46,2	
Almost never painful	8	20,5	
What do you attribute painful injections to?			
Do not know	14	35,93	p < 0.0001
Incorrect injection technique	11	28,1	
Injection site	5	12,8	
Quantity or volume injected	5	12,8	
I've used the needle before	4	10,3	

* Chi-Square Adherence Test. Source: Research data

Table 5 - Variables surveyed in relation to the process of application and control of the disease in patients of the CEMEC endocrinology outpatient clinic on insulin therapy

Fator Avaliado	N	%	p*
Jump or miss injection			
Yes	36	48,0	p = 0.8174
No	39	52,0	
Who taught you how to give the injection?			
Specialist doctor	43	57,3	p < 0.0001
Generalist nurse	27	36,0	
Pharmaceutical	3	4,0	
Diabetes Educator	0	0,0	
General practitioner	2	2,7	
Do they examine your injection sites?			
Only if I complain	12	16,0	p < 0.0001
03 months	43	57,3	
06 months	1	1,3	
01 year	4	5,3	
I do not remember	15	20,0	
Frequency of capillary glycemia			
Rarely or never	25	33,3	p
1 to 2 times a day	26	34,7	
3 to 4 times a day	11	14,7	
More than 4 times a day	10	13,3	
Several times a week	3	4,0	
Experience with Hyperglycemia			
Yes	44	58,7	p < 0.0001
No	31	41,3	
Experience with Hypoglycemia			
Yes	48	64,0	p < 0.0001
No	27	36,0	

* Qui-quadrado Aderência. Fonte: Dados da pesquisa

Table 6 - Insulin aspiration according to medical prescription performed by patients at the CEMEC endocrinology outpatient clinic on insulin therapy

Rated Factor	N=65	%	p*
Suitable Location			
Yes	59	90,8	p < 0.0001
No	6	9,2	
90° angle with the skin		N=39	
Yes	50	76,9	p < 0.0001
No	15	23,1	
Insulin aspiration according to medical prescription			
Yes	34	52,3	p = 0.8041
No	31	47,7	
If not, you did dose in what amount?		N = 31	
A mais	21	67,7	p** = 0.0408
A menos	10	32,3	
Mixture of regular insulin and NPH			
Yes	16	24,6	p < 0.0001
No	49	75,4	
If yes, mix properly		N = 16	
Yes	12	75,0	p** = 0.0408
No	4	25,0	

* G Adherence test. ** Chi-Square Adherence Test. Source: Research data

DISCUSSION

The prevalence of women, according to table 1, was 56 (74.4%), differing from the International Diabetes Federation, whose studies show that in 2019, the prevalence in women (9.0%) is slightly lower than in men (9.6%), with 17.2 million more men than women living with diabetes, but with an expected increase in both sexes by 2030 and 2045. During the observation of age, the age group between 60 and 69 years old (28.0%) was the highlight in the research. This finding is consistent with the progressive increase in the prevalence of diabetes in this age group, as shown in studies by the International Diabetes Federation in 2019, which estimates about 111 million inhabitants with diabetes, which would correspond to 1 in 5 people with diabetes in this age group age, with an expectation of an increase of 195 million by 2030 and 276 million by 2045. Other studies also point out the same as that of Stacciarini, Pace and Haas (2009), Stacciarini, Caetano and Pace (2011), with a prevalence of 55% for 60 years or more. As age increases, physiological insulin secretion and insulin sensitivity decrease, configuring the pathophysiological mechanism of DM (Dib Sergio Atala, 2008).

The action of insulin can be hampered by obesity, a risk condition for the development of diabetes (Brazilian Diabetes Society, 2007). Observing the data in table 1, we can notice that most patients are overweight 27 (36.0%), followed by eutrophic 22 (29, 3%) and obesity I and II totaling 26 (33.9%) reinforcing with the literature, in which the majority of people who have DM2 are obese or overweight and are insulin-independent, but may need insulin treatment for obtaining adequate metabolic control¹². Although a body mass index (BMI) > 25 kg / m² is associated with an increased risk of DM2, individuals of Asian ethnicity have this risk already increased in a BMI > 23 kg / m² (Brazilian Diabetes Society, 2007). Treatment using insulin does not only depend on the type and prescribed dose of this medication, it also depends on how it is administered. To achieve the goals of the treatment, as well as to carry out the insulin application safely, we have the recommendations of the SBD and the ADA on the technique of insulin preparation and application, encompassing all the stages of the process, consequently contributing to the prevention or reduction of complications from poor glycemic control (Stacciarini, 2011; Brazilian Diabetes Society, 2007; American Diabetes Association, 2004; Brazilian Diabetes Society, 2019). The first step in this process is to clean the material and the location where the insulin will be administered. As for users who clean the rubber on the insulin vial and perform skin antisepsis, respectively, in Table 2, it can be seen that 85.3% and 53.3% of those surveyed perform this step, when compared with the studies by Karino ME (2015) (Karino, 2015). It is worth noting that 59.8 and 78.7% of users perform antisepsis of the skin and clean the rubber of the insulin vial, respectively, a habit that is a necessary condition to avoid contamination of the materials used, preventing infections at application (Souza, 2000). The manufacturing and sterility specifications of disposable syringes are guaranteed by manufacturers only on first use, for this reason, the single use recommendation is described in the original packaging, a recommendation that was required by the Sanitary Surveillance of Medicines (DIMED) in its ordinance n° 3 de 07 (Teixeira, 2001). Even if the disposable syringe, made of polypropylene, is sterile, has an expiration date for use, is distributed in hermetically sealed packages and its reprocessing or re-sterilization is prohibited due to the loss of

its characteristics, in addition to offering health risks to users (Castro, 2004). In Table 3, it was observed in this study that it is often reused at home. This fact is confirmed when we observe that the reuse of disposable syringes is performed by 48 (73.8%) users, as well as in other national studies that discussed this theme, but with the percentage frequency varying from 76.9% to 94.6% (Rossi, 2001; Peyrot, 2012). It is worth mentioning that when questioned, 26 (54.2%) of patients reuse syringes in order to save money, the vast majority complain that the supply of free syringes at health posts is limited. According to table 4, when it comes to injections, pain is a feared and expected factor by patients (Simões, 2016), however in insulin injections, if performed with the proper technique, pain is not expected. Pain is only present when there is an error in the application technique or when the insulin is cold, which causes pain and irritation after application, and can be avoided by removing insulin vials from the refrigerator 10 to 20 minutes before use (Maia, 2016). In the scope of the professionals who guided this technique, as we can see in table 5, it appears that 43 (57.3%) users referred the specialist doctor, 27 (36.0%) the nurse, 2 (2.7%) the general practitioner, 3 also mentioned the pharmacist (4.0%). It is noteworthy that during the interview, users reported lacking formal guidance about the technique. We also observed a correlation between the factors that determine interferences in the insulin aspiration technique, for Stacciarini TSG is directly related to the lack of knowledge about the disease, which implies a carelessness, by the patients, about following the prescribed dose and in the required skills. for the preparation of insulin doses, such as storage, homogenization (NPH insulin), insulin mixture, among others¹². Poorly oriented, inappropriate and insecure practices in insulin self-application can interfere with metabolic control and, consequently, influence the progression of chronic complications of diabetes mellitus (Mendes, 2017).

Among the situations that cause most concern when it comes to insulin application at home are errors in measuring the aspirated dose during its preparation. The administration of a wrong dose can result in complications such as hypoglycemia or hyperglycemia, leading to the onset of acute and chronic complications. Unfortunately, the literature lacks statistical data that relate the frequency of complications to the measurement errors of the aspirated dose. In this study, according to table 6, we observed that patients have more hypoglycemia 48 patients (64.0%), of patients who presented hypoglycemia in the last six months, 22 patients (45.8%) had 1 to 2 episodes in which they needed assistance, and of the total only 12 patients (25%) needed medical or hospital assistance, pre-prandial blood glucose in adults (Brazilianm, 2007). According to the research data, 31 patients when using insulin aspiration, using disposable syringes, did it differently from the prescribed one (47.7%), both for a higher and a lower dosage, where 67, 7% of subjects aspired for more and 32.3% aspired for less. When comparing this variable with Stacciarini TSG, we noticed a correlation between the statistics found, in relation to the subjects who aspired a dose higher than the prescribed (55.7%), as to those who aspired a dose lower than the prescribed (44.3%) (Stacciarini, 2011). Even with the data showing an insulin application more than the prescribed, after analyzing the insulin self-application technique, following the recommendations of the ADA and SBD, and starting from the application of the complementary questionnaire used in this work, a minimum value of hit score of 76.9% for correct skin angulation, given this, summarized in table 6 (Stacciarini,

2009). Note the importance of this study for medical education and also for the knowledge of patients about the techniques of insulin application, how it works in the body and the complications of its inappropriate use. Regarding the benefits, mainly, of the population that uses this daily medication, the elucidation of doubts about the management of insulin therapy steps, from storage to insulin aspiration, to the final stage where the application occurs, was the point that most contributed for the research participants, since at each point of the questionnaire it was an additional opportunity for them to acquire more information about the correct way of application or even basic doubts about the technique or pathology of the disease.

In general, patients are always guided about the technique and care in applying insulin, however, those patients who performed it incorrectly continued to persist in some errors, such as failure in the process of preparing the application or aspiration of insulin. Collected data demonstrated that the complications resulting from these errors include: hypoglycemia, hyperglycemia and lipodystrophy. Patients' adherence to insulin self-care is associated with lack of knowledge, demotivation, non-acceptance of the disease, pain in the application of insulin, physical and cognitive limitations, these factors are directly related to overdoses. When comparing the doses aspirated by patients in relation to the prescribed, it was observed that the majority performed according to the prescription, however this majority surpassed in a few participants those who aspirated incorrect doses. In short, the present study aims to offer data obtained from scientific observation, and to spread knowledge about the nuances of the insulin self-application process, as well as its complications, difficulties and an intrinsic analysis of the profile of the studied population, and the importance of health professionals do a first instruction, as well as subsequent checks of self-applications.

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