

GLYCEMIC SELF-MONITORING: DIFFICULTIES IN THE REALIZATION CARE PROCEDURES FACED BY DIABETES MELLITUS PATIENTS

AUTOMONITORIZAÇÃO GLICÊMICA: DIFICULDADES NA REALIZAÇÃO DO PROCEDIMENTO POR PACIENTES COM DIABETES MELLITUS

AUTOCONTROL DE GLUCEMIA: DIFICULTADES EN LA REALIZACIÓN DEL PROCEDIMIENTO DE PACIENTES CON DIABETES MELLITUS

Rosimeire Fernandes de Oliveira¹
Jaqueline Almeida Guimarães Barbosa²
Gilberto de Lima Guimarães²
Silmar Maria da Silva²
Maria Ivanilde de Andrade¹
Maria Regina Calsolari¹

¹ Santa Casa de Misericórdia de Belo Horizonte, Instituto de Ensino e Pesquisa – IEP. Belo Horizonte, MG – Brazil.

² Universidade Federal de Minas Gerais – UFMG, Escola de Enfermagem, Departamento de Enfermagem Básica. Belo Horizonte, MG – Brazil.

Corresponding author: Jaqueline Almeida Guimarães Barbosa. E-mail: jaqueline@task.com.br
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ABSTRACT

Objective: to evaluate the realization of glycemic self-monitoring in diabetes patients. **Method:** quantitative, descriptive-exploratory and observational study. Adult diabetes patients were observed while performing the procedure in a secondary care service, and each aspect was noted on a form. Data were treated statistically and discussed based on the scientific literature. **Results:** among the 60 participants, 63% were women; 53.3% were retired; the age varied between 35 and 60 years (51.7%); 60% had elementary education; 51.7% had an income of up to one minimum wage; 38% had received the diagnosis of diabetes between the ages of 11 and 20 years, and of these, 93.3% were unaware of glycemic goals; 86.7% did not clean their hands before and after the procedure and did not dispose of the waste properly; 91.7% did not clean the device after use; 75% did not record the results. **Conclusion:** the participants presented difficulties and flaws in the practice of glycemic self-monitoring that may compromise the surveillance of their real health status. There is thus a need for training to promote effective realization of the procedure and prevention of complications, as well as improvements in disease control. It is therefore up to nurses who assist this clientele to undertake efforts to make possible that patients gain the necessary skills to exercise the technique of glycemic self-monitoring and awakening of their awareness regarding the health risks implied in incorrect actions.

Keywords: Diabetes Mellitus; Self-care; Education Nursing.

RESUMO

Objetivo: avaliar a realização do procedimento de automonitorização glicêmica em pacientes com diabetes. **Método:** estudo quantitativo, tipo descritivo-exploratório e observacional. Pacientes adultos com diabetes foram observados enquanto realizavam o procedimento no serviço de atenção secundária, e cada aspecto era assinalado em um formulário. Os dados sofreram tratamento estatístico e discutidos a partir da literatura científica. **Resultados:** entre os 60 participantes, 63% eram mulheres; 53,3% aposentados; idade entre 35 e 60 anos (51,7%); 60% com ensino fundamental; 51,7% com renda de até um salário mínimo; 38% tinham diagnóstico de diabetes entre 11 e 20 anos e, destes, 93,3% desconheciam as metas glicêmicas; 86,7% não higienizavam as mãos antes e após o procedimento e não faziam o descarte correto dos resíduos; 91,7% não realizavam a limpeza do aparelho após o uso; 75% não registravam os resultados. **Conclusão:** os participantes apresentaram dificuldades e falhas na prática de automonitorização glicêmica, que podem comprometer a vigilância do seu real estado de saúde, emergindo a necessidade de capacitação, com vistas à eficácia do procedimento e prevenção de complicações, além de melhorias no controle da doença. Assim, cabe ao enfermeiro que atua nessa clientela empreender esforços que possibilitem a aquisição pelo paciente das habilidades necessárias ao exercício da técnica da automonitorização glicêmica e o despertar de sua consciência para os riscos à saúde provocados por uma ação incorreta.

Palavras-chave: Diabetes Mellitus; Autocuidado; Educação em Enfermagem.

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RESUMEN

Objetivo: evaluar el desempeño del procedimiento de autocontrol glucémico de pacientes con diabetes. **Método:** estudio cuantitativo tipo exploratorio descriptivo observacional. Se investigó cómo algunos pacientes adultos con diabetes realizaban el procedimiento en los servicios de atención secundaria y cada aspecto se anotaba en un formulario. Los datos se analizaron estadísticamente y se discutieron desde el punto de vista de la literatura científica. **Resultados:** entre los 60 participantes, 63% eran mujeres, 53.3% jubilados, entre 35 y 60 años (51,7%), 60% con enseñanza primaria, 51.7% con ingresos de hasta un sueldo mínimo, 38% con diagnóstico de diabetes de 11 y 20 años y, de ellos, un 93,3% no conocía las metas glucémicas. Un 86,7% no se lavaba las manos ni antes ni después del procedimiento ni eliminaba correctamente los residuos; 91,7% no limpiaba el aparato después de usarlo; 75% no anotaba los resultados. **Conclusión:** los participantes mostraron dificultades y deficiencias en la práctica del autocontrol glucémico, lo cual pone en riesgo la vigilancia de su estado real de salud y demuestra la necesidad de capacitación con miras a la eficacia del procedimiento y a la prevención de complicaciones, además de mejorar el control de la enfermedad. Por lo tanto, la enfermera que trabaja con este tipo de clientes debería esforzarse para que ellos aprendan a desempeñar la técnica de autocontrol glucémico y que sean conscientes de los riesgos para la salud causados por una acción incorrecta. **Palabras clave:** Diabetes Mellitus; Autocuidado; Educación Enfermería.

INTRODUCTION

There are 415 million people diagnosed with diabetes mellitus (DM) worldwide, of which 13.4 million are in Brazil, making it the fourth country with highest prevalence of the disease. It is estimated that by the year 2040 more than 640 million people will have diabetes.¹

The high incidence of DM is attributed to changes in the sociodemographic and epidemiological profile of the population. Increased life expectancy, sedentary lifestyle, unhealthy eating habits, obesity and excessive consumption of alcoholic beverages are factors that contribute to the epidemiological panorama. The disease has no cure but can be controlled through adjustments in diet, physical exercise, medication use and glycemic control.¹ However, treatment is considered complex, since it requires a change in habits and behaviors, and self-care throughout life.

The glycemic control of DM patients is essential for the prevention of complications, among which the most important are microvascular complications that can seriously compromise the quality of life of these individuals: diabetic retinopathy (DR), diabetic nephropathy (DN) and diabetic neuropathy. DR is one of the most disabling complications of DM, being the most common cause of acquired blindness. DN affects about 10 to 40% of diabetic patients and is among the main causes of renal failure. Diabetic neuropathy can lead to diabetic foot and consequent risk of limb amputation. Hyperglycemia is an important risk factor for these complications. Glycemic self-monitoring is therefore an essential strategy for prevention of all of these complications.^{2,3}

Currently, the most commonly used methods for monitoring glycemic rates are glycoprotein hemoglobin (HbA1c) measurement, which is recommended to be checked quarterly, and glycemic self-monitoring through measurement of capillary glycemia. The latter requires the realization of frequent digital punctures and strict control of schedules and routines as measurements must be carried out in accordance with the meals.⁴

Collaborators at the American Diabetes Association (ADA) say that glycemic self-monitoring is an integral part of the set of

therapeutic interventions for disease control and is considered one of its most effective components. This procedure allows the patients to better understand themselves and provides important information for their physicians for the adjustment of glycemic goals and pharmacological treatment.⁵

Glycemic self-monitoring can be performed in any place where individuals are and, for that, they need to have a glucometer. A glucometer is a portable device produced by different laboratories and developed to gauge the approximate value of blood glucose concentration. The distribution of glucometers and its accessories is done free of charge by the Unified Health System. The technique basically involves the collection of peripheral blood samples with a lancet, in order to fill the field destined for the electronic strips for reading from a single drop of blood.

The justification of the study is based on the premise that despite of the benefits and importance of self-monitoring of capillary glycemia, it is observed that many patients fail to do such monitoring for various reasons, sometimes reporting lack of time or appropriate conditions, sometimes insufficient amount of necessary material (test strips and lancets) and lack of family support. Discomfort during puncture is one of the main limitations of glycemic monitoring, and the procedure is considered practical but more painful than the insulin application.⁶

The relevance of the study is based on the assertion that the information obtained can help nurses in educational actions aimed at glycemic control, so essential in the treatment of DM. Given these considerations, the objective of this study was to evaluate the performance of glycemic self-monitoring by DM patients.

METHOD

This is a quantitative, descriptive, exploratory and observational study. It was carried out at a *Centro de Especialidades Médicas* (CEM), of public nature located in the city of Belo Horizonte-MG. The population was composed of patients with DM type 2 followed-up in the service of endocrinology.

The inclusion criteria were: (1) to have a glucometer at the moment of the approach; (2) handling of the device without the aid of a third party; (3) adult persons of both sexes. The following cases were excluded: (1) illiterate patients; (2) patients with cognitive deficit and/or visual impairment; (3) people that were not able to manipulate the device.

Initially, patients who had been followed-up at the hospital were randomly invited to participate in the study. At this moment, they were informed about the objectives of the study and the form of data collection. Before accepting it, the Informed Consent Term was read in full extent and the invited patients were informed that they could refuse to participate in the work, at any time, without any consequence to their treatment. Only one patient declined to participate and seven were unable to participate because they did not meet one of the inclusion criteria.

Data collection took place in a private room in the CEM and was carried out during three months. Each participant was asked to present his/her personal blood glucometer and to perform glycemic self-monitoring. The instrument of data collection was composed of a script based on *Sociedade Brasileira de Diabetes*.⁷ The instrument was divided into: (a) sociodemographic data, considering the health situation, DM complications and lifestyle; (b) evaluation of self-monitoring, with the following items: (1) knowledge and skills of the patient about the use of the lancing device and the test strip; (2) handling of the glucometer and skills for coding and configuring the device; (3) digital hygiene and puncture; (4) frequency of the glycemia measurements and their record; (5) disposal of the material used; (6) glycemic goals established by the health professional to follow-up the patient. With the instrument in hand, the researcher collected the information and asked the patient to perform the glycemic self-monitoring. The technique employed by the participant was carefully observed by the researcher using the script. Thus, guided observation aimed to evaluate the patient.

In the data analysis, estimates of mean, standard deviation, minimum, maximum and quartiles were calculated for the continuous variables, and estimates of frequency and proportions were calculated while for the categorical variables. The data were tabulated and processed with the help of STATA (Data Analysis and Statistical Software), version 12.0.

The study was approved by the Ethics and Research Committee of the Santa Casa Teaching and Research Institute of Belo Horizonte-MG (CEP IEP-BH), under Opinion 100460/2014, CAAE: n° 38211814.1.0000.5138.

RESULTS

The final sample consisted of 60 patients with type 2 DM, of which 63.3% were female, aged between 35 and 70 years (51.7%), retirees (53.3%), with income up to one minimum wage (51.7%)

and complete primary education (60%). The mean age was 59.1 ± 8.1 years (30-70). The mean time of diagnosis of DM2 was 16.9 ± 11.2 years (01-40). The time of diagnosis of the disease was between 11 and 20 years (38.35%), as described in Table 1.

Table 1 - Sociodemographic characteristics of DM2 patients (n = 60). Belo Horizonte, MG, Brazil, 2015

Variables	n (%)	Mean (\pm SD)	Minimum-Maximum
Age		59.1 ± 8.1	30 – 70
Sex			
Female	38 (63.3)		
Male	22 (36.7)		
Age group (years)			
35-60	31 (51.7)		
61-69	29 (48.3)		
Diagnostic time		16.9 ± 11.2	01 - 40
01-10	20 (33.3)		
11-20	23 (38.3)		
21-40	17 (28.3)		
Education			
Illiterate	0 (0.0)		
Complete elementary school	36 (60.0)		
Incomplete elementary school	0 (0.0)		
Complete high school	15 (25.0)		
Incomplete high school	6 (10.0)		
Complete superior education	3 (5.0)		
Incomplete superior education	0 (0.0)		
Occupation			
Housewife	5 (8.3)		
Retired	32 (53.3)		
Employed	23 (38.3)		
Monthly income			
None	5 (8.3)		
Up to 1 minimum wage	31 (51.7)		
From 1 to 2 mw	15 (25.0)		
From 2 to 3 mw	7 (11.7)		
Up to 3 minimum wages	2 (3.3)		

Source: The author.

Regarding lifestyle, 10% reported smoking and 11.7% stated that they consume alcoholic beverages socially; 43.3% of the participants said to go jogging. However, 43.3% did not practice any type of physical exercise. When questioned about their health status and symptoms, complaints were frequent, including weakness (60%), malaise (53.3%) and muscle pain (46.7%). Only 15% did not report any symptom. The majority (56.7%) did not receive

health care in other specialties. Most patients (56.6%) used slow-acting insulin associated with fast-acting insulin, while two (3.3%) did not use insulin. The device used by the participants was of the brand Accu-Chek Active of the manufacturer Roche®.

Table 2 presents the results of the practice of glycemic self-monitoring. It is noted that the questions 1, 8, 9 and 10 were observed in 46 patients because 14 of them did not have the lancing device. This caused no problems to the study because the participants who did not have the lancing device used disposable lancets or needles to obtain the drop of blood. It is worth to mention that lancing devices are not offered by the public network of the region where the patients lived, and the reason why being they are not made available together with the glucometer is not known because they are provided as a set by manufacturers.

Among all the aspects evaluated, the correct insertion of the test strip in the glucometer was the one that obtained the highest percentage of accuracy (98.3%), and the item with lowest accuracy was glycemic goals (only 6.7% were aware). The results showed low rates of correct actions for the practice of hand hygiene and drying, as well as for the correct disposal of the material used and about the hygiene of the glucometer. Difficulties regarding the configuration and calibration of the glucometer, described in Table 2, were also identified.

Table 2 - Percentage of correct actions in the Glycemic Self-Monitoring procedure. Belo Horizonte, MG, Brazil, 2015

N° of the question	Form data	n (%)
1	Did the patient know how to put the lancet on the lancing device?	40 (87)
2	Did the patient configured the glucometer?	7 (11.7)
3	Did the patient wash his/her hands properly?	8 (13.3)
4	Did the patient dry his/her hands?	8 (13.3)
5	Did the patient code the glucometer?	14 (23.3)
6	Did the patient check the strips for expiration date?	21 (35.0)
7	Did the patient insert the test strip correctly?	59 (98.3)
8	Did the patient prepare and positioned the lancing device?	39 (84.8)
9	Did the patient graded the lancing device?	20 (43.5)
10	Did the patient place the lancing device on his/her finger correctly?	39 (84.8)
11	Did the patient put enough blood on the strip?	56 (93.3)
12	Did the patient perform sanitization after collection?	14 (23.3)
13	Did the patient record the result?	15 (25.0)
14	Did the patient store the strips properly?	32 (53.3)
15	Did the patient dispose of the material used properly?	8 (13.3)
16	Did the patient sanitize the glucometer after use?	5 (8.3)
17	Did the patient know his glycemic goals?	4 (6.7)

Source: The author.

The participants were asked about with which frequency they perform glycemic self-monitoring, as described in Table 3. Although most (53.3%) of them reported measuring their blood glucose three or more times a day, 36.7% do it only once or twice a day. The results show that 26 patients (43.3%) performed the test at least once a week at dawn. The study shows that reuse of the puncture needle is a common practice among diabetes patients: 27 (45%) participants reused the needle throughout the day, thus making three punctures with the same needle. Yet, 41.7% reused for periods longer than one day.

Table 3 - Percentage of frequency of realization of capillary glycemia and reuse of lancets. Belo Horizonte, MG, Brazil, 2015

N° of the question	Form data	N	%
How many blood glucose measurements per day?			
18	1	10	16.7
	2	12	20.0
	3	30	50.0
	> 3	8	13.3
How many blood glucose measurements at dawn per week?			
19	None	29	48.3
	1	26	43.3
	2	3	5.0
	3	2	3.4
How many times reuses the lancet?			
20	None	8	13.3
	1 day	27	45.0
	1 week	14	23.4
	1 month	11	18.3

Source: The author.

DISCUSSION

The research group is characterized by low income and schooling, dependent on the *Sistema Único de Saúde* to obtain the necessary resources for the treatment of diabetes. Such treatment includes access to materials to measure capillary glucose. The use of tobacco and alcohol by the participants appeared at low rates, which is a favorable factor for their health status. However, practice of physical activity was deficient. Complaints of weakness can be the result of low physical activity, but this assertion requires more detailed evaluation by the health team.

Regarding the technique of glycemic self-monitoring, it was identified that, in general, the group performs the procedure with a satisfactory frequency, differing from other studies⁸. Yet, a more qualified practice is necessary, as it was observed that the procedure usually did not include attention for proper hygiene and drying of the hands in recording the results

of the glycemic measurement, as well as calibration, configuration and cleaning of the glucometer.

Hand hygiene is a practice that eliminates dirt and microorganisms from the distal phalanges, a location commonly used in capillary puncture. This conduct is essential to prevent the onset of infections as the puncture opens a "door". There is a report in the literature of amputation of the fingers resulting from poor hand hygiene before measurement of capillary glycemia.⁷

In this sense, health education and the role of the nursing professional emerge as important to raise awareness regarding patient safety. Hand hygiene eliminates food residues, mainly fructose-based ones, so that they do not influence the results. It should be noted that, in case of impossibility of hand hygiene, 70% alcohol or alcohol gel can be used to increase the alternatives for personal care.⁷⁻⁹

In the case of hand drying, its non-performance may interfere with the quality of the blood drop and thus with the results. When 70% alcohol is used, drying with paper towels is not recommended; the hands should be allowed to dry spontaneously to avoid that the presence of alcohol does not lead to errors in the results.⁷

The reuse of sharp materials is contraindicated because needles and lancets lose the sharpness when reused and this causes more pain in the perforation, leading patients to avoid the procedure. However, reuse is a still observed behavior, especially considering the difficulty to acquire all the necessary materials for their treatment. When reusing needles, patients must be aware that the sterility of the material is lost and there is a higher risk of infection.^{7,8}

The frequency of self-monitoring was within the recommended minimum in most cases. The type of DM, the time of diagnosis and the associated comorbidities are important variables for the indication of frequency of home capillary glycemia monitoring. Among the main comorbidities cited are hypertension, hypothyroidism, glaucoma, hypercholesterolemia and arthrosis.^{5,7}

Among the patients, 16.7% reported self-monitoring only once a day, and this highlights the need to raise awareness about the importance and benefits of knowing the glycemia throughout the day. Regarding the verification of glycemia during the dawn, in order to diagnose situations of hypoglycemia, the results found can be considered satisfactory, given the difficulties and resistance that the patients have to carry out this procedure.

In the present study, we observed that the calibration and configuration of the glucometer are not duly valued, neither its hygiene, storage, and the verification of the expiration dates of the test strips, essential for the final results of the procedure to be reliable and safe. These are aspects that need to be emphasized by health professionals in all consultations.

Test strips should be stored and preserved in their original packaging at room temperature between 2°C and 30°C in a dry and low light place. The expiration date of the strips is established by the manufacturer and should be checked and monitored before

their use, as the use of expired strips may produce altered results. The cover should be returned as soon as the strip is removed.⁷

Hygiene of the glucometer was not performed. This is a factor that may potentially alter the correct reading of the results, if there is any blood or other dirt on the glucometer. Glucometers that are read by photometry require periodic cleaning of the lens. Internal sanitation consists of removing the protective cap from the lens, moistening a cotton swab with water and gently wiping the dirty area where the drop of blood is deposited, and the lens should be replaced only after being dry. Chemical solutions such as alcohol or detergents should not be used to perform cleaning. Glucometers that have biosensor do not need internal hygiene because they do not have direct contact with blood.⁷

Regarding the calibration of the device, it is necessary to mention that there are several types of glucometers and each one has its peculiarities according to the manufacturer, the model, method of measurement of glucose, conditions of use and storage. The calibration can be done with rigid tape, chip or even be dispensed. In the glucometer used by the participants, the calibration was done through a chip. The calibration procedure should be repeated every time a test strip box is exchanged, thus ensuring that the coded number matches the number on the reagent strip box. It is important to emphasize that the lack of observation to this orientation can interfere in the results.⁷ It is noted that not checking the calibration at the moment of data collection may have been due to the fact that this had already been checked at another time by the patient, when the box of strips was started.

Regarding the configuration of the glucometer, this is a resource that allows the patients to keep a record in the glucometer memory, storing the results of each blood glucose measurement, as well as the date and day of the measurement. This record constitutes an additional resource in the control of glycemic index. This setting is necessary only when the glucometer is received or when it is necessary to change its battery. However, difficulties have been observed in setting this configuration, something also observed among health professionals, as it is something that is not so simple to do, indicating that this needs to be reviewed by the manufacturers of the device.

Patients who had a lancing device had no difficulty in preparing and putting it together. However, they did not have the same familiarity with its grading; this detail should be the target of attention of professionals. The adjustment of the depth allows less discomfort at the puncture depending on the age and other characteristics of the patients, such as thinner or thicker skin, the latter requiring a deeper degree. Capillary glycemia puncture is indicated in places with less sensitivity, such as the lateral part of the fingers resulting in decreased pain and more adherence of the patients to the use of the glucometer. This care was adopted among the participants of this study, reflecting guidelines previously received in the service.^{5,7}

In this research, the most striking results were the lack of knowledge about glycemic goals on the part of the patients, as well as the lack of records of the measurements, aspects of paramount importance in the control of the disease. The essential elements to be recorded are the blood glucose value, measurement time, dosage of the medication used, interval since the last meal, practice of physical exercise, and if the patients have had any discomfort recently such as nervousness or sadness that may have led to emotional changes.^{7,9}

The effectiveness of these records, preferably in an appropriate place, that allows their visualization in a sequenced way and without loss of data, is an essential aspect in the search for control of the disease and prevention of its complications. It should be noted that the patients should be advised to take all of these records with them when they go to consultations. The elaboration and availability of a glycemic diary is a low-cost possibility that may help to avoid such problems. Glycemic goals should be informed by the physician and may allow adjustment of blood glucose, helping to achieve the expected results, that is, the stability of good glycemic rates.

Regarding the disposal of sharp materials, the patients did not carry adequate containers for the temporary disposal of the material used in puncture and also did not carry out the proper disposal in the health services, indicating that they were not aware of the importance of such biosafety conduct. Such attitude ends up exposing society as a whole to biological risks.^{5,7} One option would be the use of safe lancets that eliminate the risk of accidents. Comparisons with other studies were limited because no similar studies were found.

Despite of the detected flaws, doubts and difficulties were rarely exposed during nursing care with these patients, who, in general, prioritize other aspects during the consultation at the care service, such as those of a medical nature. It is important to stress the need to evaluate these abilities also with family members and caregivers who carry out the measurement of capillary glycemia.

The purpose of glycemic self-monitoring is to provide data for eventual necessary therapeutic adjustments, aiming at achieving a better glycemic control and helping to prevent acute and chronic complications due to both hyper and hypoglycemia. Such complications may be not only disabling, but also fatal. Self-monitoring defines the patient's glycemic map and provides an action plan for the efficient use of medication, monitoring and adjustment of the life habits of DM patients.^{7,9}

We reinforce, therefore, the importance of educational actions that lead individuals to have more knowledge and technical skills to carry out the procedure. These actions need to be able to sensitize the patients to the importance of the care to be taken at each stage of its realization, so that such care is done effectively and safely.

CONCLUSION

Patients presented difficulties to perform complete and correct self-monitoring of capillary glycemia. This result is worrying given the importance of this procedure for the control of DM. The main problems identified were the lack of knowledge about glycemic goals and the lack of records of the values found, followed by failures in the handling of the glucometer and in the control of the expiration dates of the test strips, carelessness with cleaning the glucometer, and with hand hygiene and drying, as well as with the correct disposal of the material used.

Health professionals need to be aware of the difficulties encountered by patients so that they can act to help them overcome each obstacle, making them aware of the importance of looking at the details, since correct hand hygiene to correct disposal of sharp material. This educational process must be continually provided and the checked step by step so that the procedure may be effectively performed and complications may be prevented throughout life. It remains to be examined whether the multiprofessional team is properly empowered to provide these guidelines.

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