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Original Article

Knowledge about type 2 diabetes mellitus in women at different stages of the female life cycles*

Conhecimento sobre diabetes mellitus tipo 2 de mulheres em diferentes ciclos femininos

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ABSTRACT
Objective: to analyze the knowledge of women at different stages of the female life cycles regarding type 2 diabetes mellitus. **Methods:** this cross-sectional study was conducted with 46 women with type 2 diabetes. Data were collected using a sociodemographic and clinical questionnaire, a disease knowledge test, and anthropometric assessment. Knowledge about the disease was analyzed by calculating the mean ± standard deviation of the total score for participants and for each life cycle. To compare knowledge across female life cycles, an independent samples *t*-test was conducted. **Results:** the mean knowledge score about the disease was 6.7 ± 2.3 points, with 56.5% of participants demonstrating limited knowledge. Key areas of lack included ketonuria, food substitution, and unawareness of the causes and management of hypoglycemia. Women in the climacteric/menopausal stage had a higher average knowledge score (7.5 ± 2.8) compared to those in the postmenopausal stage (6.15 ± 1.8), though the difference was not statistically significant (p=0.056). **Conclusion:** women with type 2 diabetes showed limited knowledge about the disease regardless of cycle stage, which may impact disease management. **Contributions to practice:** the data are crucial for interventions and health education for women with diabetes, as well as for improving disease management.
Descriptors: Diabetes Mellitus, Type 2; Self-Management; Menopause; Feeding Behavior.

RESUMO
Objetivo: analisar o conhecimento de mulheres em diferentes ciclos femininos em relação ao diabetes *mellitus* tipo 2. **Métodos:** estudo transversal realizado com 46 mulheres com diabetes tipo 2. Os dados foram coletados por meio de formulário sociodemográfico e clínico e do teste de conhecimento sobre a doença, além da avaliação antropométrica. Para analisar o conhecimento sobre a doença, realizou-se média ± desvio-padrão considerando o escore total das participantes e de cada ciclo feminino. Visando comparar o conhecimento dos ciclos femininos, foi realizado o teste *t* para amostras independentes. **Resultados:** o conhecimento sobre a doença teve média de 6,7±2,3 pontos, e 56,5% das entrevistadas apresentaram pouco conhecimento, com destaque para a cetonúria, substituição de alimentos e desconhecimento das causas e cuidados com a hipoglicemia. Mulheres no climatério/menopausa apresentaram conhecimento com escore médio maior (7,5±2,8) quando comparadas àquelas na pós-menopausa (6,15±1,8), sem diferença estatística significante (p=0,056). **Conclusão:** as mulheres com diabetes tipo 2 mostraram pouco conhecimento sobre a doença independentemente do ciclo feminino, o que pode gerar impactos no gerenciamento da doença. **Contribuições para a prática:** os dados são essenciais para intervenções e educação em saúde das mulheres com diabetes e no cuidado do controle da doença.
Descritores: Diabetes *Mellitus* Tipo 2; Autogestão; Menopausa; Comportamento Alimentar.

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Introduction

Diabetes mellitus (DM) is a chronic, highly prevalent disease characterized by a set of metabolic disorders related to defects in insulin production and/or action, leading to persistent hyperglycemia. Specifically, type 2 diabetes mellitus (T2DM) represents the most common form of the disease, accounting for 90% to 95% of cases. It is primarily marked by insulin resistance and is associated with risk factors such as advanced age, obesity, physical inactivity, and family history[1].

In Brazil, the prevalence of diabetes was 10.2% in 2023, considering capital cities and the Federal District, with a higher incidence among females (11.1%) [2]. It is known that throughout their lives, women undergo several physiological and hormonal periods, and that menopause along with T2DM can cause several complications to the female body. In this phase of the life cycle, women experience estrogen deficiency and the onset of a new pattern of body fat distribution, which raises glycemic levels[3-5].

To prevent complications associated with T2DM during this phase, it is crucial to share knowledge to develop skills and attitudes related to self-care, including dietary control, physical activity, glycemic monitoring and control, and correct use of prescribed medications[1,6]. Higher knowledge about the disease increases the likelihood of managing it effectively and adopting positive behaviors during treatment[7-8].

In this regard, insufficient or inadequate knowledge is a factor that impacts diabetes-related self-efficacy, potentially hindering a patient's ability to self-manage, adhere to treatment, and understand the importance of treatment and glycemic regulation. Such difficulties can predispose patients to more severe complications[8].

To address this issue, assessing knowledge about diabetes through scales or instruments is sought. One such instrument is the Diabetes Knowledge Scale (DKN-A), recommended by the Brazilian Diabetes Society. This scale covers various aspects related to general diabetes mellitus knowledge[1]. It is widely used in certain populations, such as in studies with elderly diabetics of both genders[9-10], young diabetics[11], diabetics undergoing dialysis[12] and diabetics from Primary Health Care[13].

In this context, there is a noted gap in the literature regarding the use of the DKN-A instrument specifically for women with T2DM across different life stages. To deepen the understanding of the topic, it is essential to examine knowledge about the disease across different female life cycles. This approach allows for addressing this gap and identifying the specific needs of women with T2DM, contributing to effective educational strategies for self-management of the disease and improved health outcomes for this population.

Thus, this study aimed to analyze the knowledge of women at different stages of the female life cycles regarding type 2 diabetes mellitus.

Methods

This is a cross-sectional study conducted in the municipalities of Jequié and Poções, in the state of Bahia, Brazil, from October 2023 to February 2024. The research report adhered to the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.

Defined by convenience sampling, the sample was included women with T2DM, aged 40 years old or more, residing in the urban areas of the two investigated municipalities. Women with chronic kidney disease and those living in rural areas were excluded from the study. No participants were excluded after data collection commenced.

Women with T2DM were categorized into two groups based on their life cycles: (1) Perimenopause or Pre-menopausal phase, included women aged 40

to 65 years old with generally preserved menstrual cycles, regardless of regularity. And (2) Postmenopause, considered women aged over 65 years old and/or those with confirmed spontaneous amenorrhea for 12 months or more[14].

Data collection involved contact with five Family Health teams, primarily through community health agents (CHAs) from one Basic Health Unit and three Family Health Units, to schedule home visits with women with T2DM. Sixty women were deemed eligible for participation, but only 55 were invited due to difficulties in contacting CHAs for scheduling. Among those invited, nine did not participate due to being absent from home or declining due to time constraints.

Home visits were conducted with CHAs, during which data were collected using a form that included personal, sociodemographic, and clinical information about the disease to characterize the sample. Additionally, anthropometric assessments and the application of a knowledge test about the disease were conducted. Data collection for each participant took between 40 minutes to one hour.

Trained researchers and a qualified professional collected anthropometric data, which included weight, height, body mass index (BMI), and waist circumference. A digital G-tech scale (Glass 7 model, with a maximum capacity of 150 kg) was used to measure body weight. The scale was properly calibrated, and participants were in an orthostatic position wearing light clothing during the measurement. Participants' height was measured with the Sunny ES2060 portable stadiometer, ensuring they were barefoot and standing in an upright position.

Following these procedures, the BMI (weight/height^2) was calculated using Excel (version 2016), based on the classification and values established for adults: underweight (< 18.5 kg/m^2), normal weight (18.5 kg/m^2 - 24.9 kg/m^2), overweight (25 kg/m^2 - 29.9 kg/m^2), and obesity (> 30 kg/m^2)[15]. For people aged over 60, different BMI cut-off points were used due to physiological changes in this age group. These were: underweight (< 22 kg/m^2), eutrophy (22 kg/m^2 - 27 kg/m^2), and overweight (> 27 kg/m^2)[16].

Waist circumference was measured using a non-elastic tape measure from the brand Cescorf, with an accuracy of 0.1 centimeter. The measurement was taken at the midpoint between the iliac crest and the lowest rib. Risk classification for developing cardiovascular diseases followed the parameters established by the World Health Organization: at risk for those with a waist circumference ≥ 80 cm, and not at risk for those with a circumference < 80 cm[15].

To assess the participants' general knowledge about the disease, the Diabetes Knowledge Scale (DKN-A) was used[17]. This instrument, adapted and validated for Portuguese, is a multiple-choice questionnaire with 15 items covering various aspects of general knowledge about diabetes mellitus. It includes five broad categories: 1) Basic physiology, including the action of insulin 2) Hypoglycemia, 3) Food groups and their substitutions, 4) Diabetes management during the occurrence of other illnesses, and 5) General principles of disease care. The scale ranges from 0 to 15, with each item scored 1 for a correct response and 0 for an incorrect one, except for items 13 to 15, which have multiple correct answers that all must be marked to receive a score of 1. A minimum score of eight points is required to indicate a satisfactory level of knowledge[17].

After data collection, the questionnaires were organized for subsequent coding and tabulation using Excel (version 2016). The results were then statistically analyzed using SPSS version 21.0. Descriptive statistics, such as relative and absolute frequencies, were used to describe the qualitative variables of the study. Additionally, the DKN-A questionnaire items were analyzed through relative and absolute frequencies, as well as mean and standard deviation (SD), considering both the total score and the scores for each cycle category. The data followed a normal distribution, verified using the Shapiro-Wilk test. To compare the mean DKN-A scores between the cycles,

an independent samples *t*-test was conducted, with statistical significance set at $p < 0.05$.

This study was reviewed and approved by the Ethics Committee of the *Universidade Estadual do Sudoeste da Bahia* under opinion number 6,339,786/2023, and it received an Ethical Appreciation Presentation Certificate with the number 58910322.3.0000.0055.

Results

The study included 46 women with T2DM, 80.4% of whom resided in Jequié and 19.6% in Poções. The average age was 64.8 ± 11.7 years old. The majority of participants were elderly women over 65 years old, non-white, without a partner, with an income below one minimum wage, living in their own homes, having been diagnosed with T2DM for five years or more, and not engaging in any physical activity. Regarding anthropometric data, the average BMI was 27.6 ± 5.4 kg/m^2, and the average waist circumference was 93.2 ± 15 cm, with most women being overweight or obese and at risk of developing cardiovascular diseases. Most participants demonstrated limited general knowledge about T2DM, with an average score of 6.7 ± 2.3 points (Table 1).

Table 2 presents the DKN-A questions according to categories and frequencies of correct and incorrect answers for each question. Among the 15 items of the DKN-A questionnaire, those with the highest proportion of correct answers were related to blood sugar levels in uncontrolled diabetes (In uncontrolled diabetes, blood sugar is…?), normal capillary blood glucose values (The normal range for blood glucose is…?), and food groups and their substitutions (You can eat as much as you want of the following foods [apple, lettuce and watercress, meat, honey]). The highest proportion of errors was related to the presence of ketones in urine and the correct substitution of French bread.

Table 1 – Sociodemographic and Anthropometric Characteristics and Knowledge about Type 2 Diabetes Mellitus in a Sample of Women (n=46). Jequié and Poções, BA, Brazil, 2024

Variables	n (%)
Age (years old)	
40 - 65	20 (43.5)
> 65	26 (56.5)
Race/Skin color	
White	12 (26.1)
Non-white	34 (73.9)
Marital status	
With a partner	20 (43.5)
Without a partner	26 (56.5)
Family income (minimum wages)	
≤ 1	27 (58.7)
> 1	19 (41.3)
Type of Residence	
Own	42 (91.3)
Rented	4 (8.7)
Physical activity	
Yes	16 (34.8)
No	30 (65.2)
Time since diagnosis DM2(years)	
1 - 4	13 (28.3)
> 5	33 (71.7)
Body Mass Index	
Low weight	5 (10.9)
Eutrophy	17 (37.0)
Overweight/Obesity	24 (52.2)
Waist circumference	
With risk	40 (87.0)
Without risk	6 (13.0)
Knowledge about DM2	
Limited	26 (56.5)
Good	20 (43.5)

DM2: Type 2 diabetes mellitus

Table 2 – Proportion of correct and incorrect responses to the Diabetes Knowledge Scale items in a sample of women with type 2 diabetes mellitus (n=46). Jequié and Poções, BA, Brazil, 2024

No.	Questions	Right	Wrong
		n (%)	n (%)
	Basic physiology		
1	In uncontrolled diabetes, blood sugar is…?	44 (95.7)	2 (4.3)
3	The normal range of blood glucose is…?	34 (73.9)	12 (26.1)
6	The presence of ketones in urine is…?	4 (8.7)	42 (91.3)
7	Which of the following complications is generally not associated with diabetes?	28 (60.9)	18 (39.1)
	Hypoglycemia		
10	If you feel hypoglycemia is starting, you should…?	13 (28.3)	33 (71.7)
12	Hypoglycemia is caused by…?	11 (23.9)	35 (76.1)
	Food groups and their replacements		
4	Hypoglycemia is caused by…?	31 (67.4)	15 (32.6)
5	Rice is primarily composed of…?	30 (65.2)	16 (34.7)
11	You can eat as much as you want of the following foods (apple, lettuce and watercress, meat, honey)	35 (76.1)	11 (23.9)
14	Correct substitutions (French bread/cookie, egg/ground meat, milk/orange juice, pasta/vegetable soup)	10 (21.7)	36 (78.3)
15	Correct substitution for French bread (water cracker, cheese bread, slice of cheese, skip it)	2 (4.3)	44 (95.7)
	Management of diabetes *mellitus* during the occurrence of another illness and general principles of disease care		
2	Identification of complications related to diabetes *mellitus* (coma, glucosuria, late complications)	27 (58.7)	19 (41.3)
8	If a person is taking insulin, has a high blood sugar level or urine sugar level, and also has the presence of ketones, they should…?	16 (34.7)	30 (65.2)
9	If a person with diabetes is taking insulin and becomes ill or cannot follow the prescribed diet, they should…?	15 (32.6)	31 (67.4)
13	One kilogram is…?	11 (23.9)	35 (76.1)

Regarding the female life cycles, 43.5% of the participants were in the climacteric/menopausal period, and 56.5% were in postmenopause. According to Table 3, the average general knowledge score about diabetes mellitus was not statistically different between the evaluated women. Nonetheless, women in the climacteric/menopausal phase had a higher average score compared to those in postmenopause.

Table 3 – Average score of the Diabetes Knowledge Scale for women with type 2 diabetes mellitus in different cycles (n=46). Jequié and Poções, BA, Brazil, 2024

Female life cycles	General Knowledge about Diabetes Mellitus	p-value*
	Mean ± Standard Deviation	
Climacteric/Menopause	7.5 ± 2.8	0.056
Postmenopausal	6.15 ± 1.8	

*Independent samples t-test considering $p < 0.05$

Discussion

Several factors can contribute to effective care management for individuals with T2DM. One key factor is the patients' adequate knowledge of the disease, which, together with glycemic control, can help reduce risk factors associated with inadequate management[7-8]. As observed in the results, insufficient knowledge can lead to difficulties in coping with the disease and influence the self-management of glycemic control, as seen in other studies[8,18].

Moreover, aging is a physiological and chronological phenomenon that causes numerous changes in the body, especially in women undergoing climacteric and post-menopause. Although there was no statistically significant difference in disease knowledge across different cycles, other studies indicate that older age increases the risk of having insufficient knowledge about diabetes mellitus[18-19].

The findings of this study are consistent with those of a study using the same instrument, which included 353 T2DM patients, the majority of whom were female and over 50 years old. In that study, the average knowledge score about diabetes mellitus was below the satisfactory threshold (7.77 points), particularly regarding disease management and nutritional aspects[19]. Similarly, in a sample of 108 people (39.8% women) with an average age of 47.7 years, participants had a knowledge score of 7.87, also deemed unsatisfactory[20].

Understanding the basic physiology of T2DM is crucial for preventing complications, as it aids in the management of disease care. On one hand, this study showed a higher proportion of correct answers related to normal capillary glucose values and the disease when uncontrolled. On the other, responses about the presence of ketones in the urine due to poor disease control had one of the highest error rates. This may be because the term "ketone" is rarely used in everyday language by health care professionals and people with diabetes mellitus. A similar result was found in a study conducted with 202 older adults, the majority of whom were women (73.3%)[9]. In another study, T2DM patients showed satisfactory knowledge in the "Physiology" category[19].

Managing T2DM mainly involves the appropriate conduct for glycemic control. The results of the present study regarding disease management are concerning, particularly due to the lack of knowledge about hypoglycemia and insulin application during illness. In a previous study, most aged T2DM patients treated in Primary Care, besides being unaware of how to manage hypoglycemia, did not know how to identify its causes[9]. This lack of knowledge about T2DM management may indicate a difficulty among Primary Care health professionals in promoting skills and knowledge about the disease in a clear and practical manner[21].

Moreover, the use of insulin by people with T2DM is indicated when there is significant depletion of pancreatic beta cells, commonly used as the disease progresses. When starting insulin treatment, the person must receive guidance on its correct use, doses, schedules, and how to identify symptoms of deficiency or excess in the body[1]. Moreover, the use of insulin by people with T2DM is indicated when there is significant depletion of pancreatic beta cells, commonly used as the disease progresses[19]. Similarly, another study evaluating self-care in people with T2DM observed greater adherence to recommended medication activities — taking oral hypoglycemics in the indicated amount and taking insulin injections[22].

Nutritional care in diabetes can be a challenging part of disease management, requiring lifestyle change strategies. In this sense, proper nutrition positively impacts glycemic goals, with a significant reduction in glycated hemoglobin, in addition to preventing complications[6]. Therefore, the lack of knowledge about nutritional aspects related to correct food exchanges and substitutions is a concerning result of the study. Previous research showed insufficient comprehension of nutritional issues[19], with only 2% of the 202 elderly people with diabetes treated in Primary Care correctly substituting French bread[9].

Given the above, the results indicate the need to use health education as an important tool to increase people's knowledge about T2DM. Educational programs are effective in expanding this understanding and consequently improving biochemical and anthropometric indicators, as well as promoting empowerment and decision-making skills among T2DM patients[6]. From this perspective, the active participation of different health professionals in Primary Health Care in the development of educational activities tailored to the specificities and context of communities is an important intervention in the care of T2DM patients[23].

Study limitations

In terms of limitations, this is a cross-sectional study conducted during a period when the health units included in the research might have had many women with limited knowledge about T2DM, which suggests the possibility of prevalence bias, even though this measure was not estimated. Additionally, the sample size may have influenced the lack of statistical significance when analyzing the difference in average knowledge scores about T2DM. Moreover, difficulties encountered in data collection — such as scheduling home visits, time required to complete the questionnaires, and conducting anthropometric assessments — can be considered limitations of this investigation. Despite these limitations, this study used a validated questionnaire for data collection, ensuring the reliability of the research.

Contributions to practice

The results of this research are relevant for the care of individuals with T2DM within the scope of Primary Health Care. The findings can provide essential information for improving and strengthening health education for diabetes mellitus patients. The goal is for patients to maintain proper disease management, achieve better clinical and anthropometric outcomes, prevent complications, and, most importantly, address gaps in knowledge about the disease at different life stages.

These data can impact the training of health professionals who serve this population, making it essential to understand each individual's reality during the care process in managing the disease. Planning interventions and educational strategies aimed at the training and self-care of people with T2DM enables behavior and attitude changes, promoting healthy food choices and a better quality of life.

Conclusion

It was observed that women with T2DM have little knowledge about the disease regardless of their life cycle. The mean score of women in the climacteric/menopausal stage was higher compared to those in postmenopause; however, this difference was not statistically significant. The lack of knowledge about the presence of ketonuria, correct food substitutions, and diabetes management concerning hypoglycemia care deserves attention.

These results highlight gaps in disease knowledge among women with T2DM, which can support the development of educational actions aimed at health promotion, with healthy habits and food choices important for disease treatment.

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Authors' contribution

Conception and design or analysis and interpretation of data, writing of the manuscript or critical review of relevant intellectual content and responsibility for all aspects of the text in ensuring the accuracy and completeness of any part of the manuscript: Ferreira CGS. Conception, data design and writing of the manuscript: Matos TB. Data conception and de-

sign: Cunha SS, Santos MLBS, Santos LG. Relevant critical review of the intellectual content and final approval of the version to be published: Milagres MP.

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