

Educational technologies to promote the quality of life of people with diabetes: quasi-experimental study

Tecnologias educacionais para promoção da qualidade de vida de pessoas com diabetes: estudo quase-experimental

Tecnologías educativas para promover la calidad de vida de personas con diabetes: estudio cuasi-experimental

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ABSTRACT

Objective: to verify the effect of educational technologies on the quality of life of people with diabetes.

Method: quasi-experimental study, before-and-after type, developed with a group of 34 people. Six interventions were carried out, in groups or individually, using educational technologies, such as clinical simulators and physical educational games. A questionnaire was used to extract sociodemographic and clinical data. To assess quality of life, the Diabetes Quality of Life Measure (DQOL) was applied at the initial (T0) and final (T1) moments. The paired Student's t-test was used to compare the mean scores at T0 and T1, adopting a significance level ≤ 0.05 .

Results: the mean overall DQOL score revealed an increase from 142.7 (± 11.8) to 162.2 (± 9.1), with a statistically significant difference ($p < 0.001$). The domains of satisfaction, impact and concerns related to diabetes also showed an increase with statistical difference. There was a significant reduction in postprandial blood glucose levels after the interventions, with a statistically significant difference ($p < 0.001$).

Conclusion: the use of educational technologies in educational interventions demonstrated an improvement in the quality of life of people living with diabetes.

Descriptors: Diabetes mellitus. Quality of life. Educational technology.

RESUMO

Objetivo: verificar o efeito de tecnologias educacionais na qualidade de vida de pessoas com diabetes.

Método: estudo quase-experimental, do tipo antes e depois, desenvolvido com grupo de 34 pessoas. Foram realizadas seis intervenções, em grupo ou individualmente, empregando-se tecnologias educacionais, como simuladores clínicos e jogos educacionais físicos. Utilizou-se um questionário para extrair os dados sociodemográficos e clínicos. Para avaliação da qualidade de vida, foi aplicado o *Diabetes Quality of Life Measure* (DQOL), nos momentos inicial (T0) e final (T1). Foi utilizado o teste *t-student* pareado para comparar as médias dos escores nos tempos T0 e T1, adotando nível de significância $\leq 0,05$.

Resultados: as médias do escore geral do DQOL revelaram aumento de 142,7 $\pm 11,8$ para 162,2 $\pm 9,1$, com diferença estatisticamente significativa ($p < 0,001$). Os domínios de satisfação, impacto e preocupações relacionadas ao diabetes também mostraram aumento com diferença estatística. Houve redução significativa nas médias das glicemias pós-prandiais após as intervenções ($p < 0,001$).

Conclusão: o uso de tecnologias educacionais nas intervenções educativas evidenciou uma melhora na qualidade de vida das pessoas que vivem com diabetes.

Descritores: Diabetes mellitus. Qualidade de vida. Tecnologia educacional.

RESUMEN

Objetivo: verificar el efecto de las tecnologías educativas en la calidad de vida de las personas con diabetes.

Método: estudio cuasi-experimental, antes y después, desarrollado con un grupo de 34 personas. Se realizaron seis intervenciones, grupales o individuales, utilizando tecnologías educativas, como simuladores clínicos y juegos físicos educativos. Se utilizó un cuestionario para extraer datos sociodemográficos y clínicos. Para evaluar la calidad de vida se aplicó la *Diabetes Quality of Life Measure* (DQOL) en los momentos inicial (T0) y final (T1). Se utilizó la prueba *t* de Student pareada para comparar las puntuaciones medias en los tiempos T0 y T1, adoptando un nivel de significancia $\leq 0,05$.

Resultados: la puntuación media global DQOL reveló un aumento de 142,7 ($\pm 11,8$) a 162,2 ($\pm 9,1$), con una diferencia estadísticamente significativa ($p < 0,001$). Los dominios de satisfacción, impacto y preocupaciones relacionadas con la diabetes también mostraron un aumento con diferencia estadística. Hubo una reducción en los niveles medios de glucosa en sangre postprandial después de las intervenciones, con una diferencia estadísticamente significativa ($p < 0,001$).

Conclusión: el uso de tecnologías educativas en intervenciones educativas mostró una mejora en la calidad de vida de las personas que viven con diabetes.

Descriptores: Diabetes mellitus. Calidad de vida. Tecnología educacional.

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■ INTRODUCTION

Diabetes Mellitus (DM) is one of the most prevalent Non-Communicable Chronic Diseases (NCDs) in the world. According to the International Diabetes Federation⁽¹⁾ (2021), there are approximately 537 million people living with this condition, and this number is projected to reach 783 million people by 2045. DM has multifactorial causality, which includes genetic and environmental factors, such as lifestyle habits.

The chronic nature of DM impacts health systems and requires knowledge to adopt behaviors related to therapeutic management, such as dietary care, practicing regular physical activity, reducing alcohol intake, quitting smoking, and adequate adherence to drug treatment, whether oral or insulin based. Such behaviors aim at glycemic management and the prevention of complications⁽²⁾, which can affect the quality of life (QoL) of people living with this condition.

QoL refers to the individual's perception of their overall well-being and satisfaction, and involves physical, social, mental and spiritual aspects. It is known that QoL in people with DM is lower when compared to those without the disease, since, as it is a chronic condition, it can lead to acute complications, hospitalizations and affect different aspects of the individual's life⁽³⁾.

Factors related to lower QoL include the type of DM, insulin use, time since diagnosis, age group, social status, education level, knowledge about the clinical condition, type of care, among others⁽⁴⁾. Given this problem, strategies to improve the QoL of this population need to be developed to promote knowledge, clarify doubts and encourage adherence to therapeutic care.

Health education represents an important strategy for building this knowledge, consisting of a set of actions aimed at the individual or collective level, which aim to enable the subject's autonomy in the face of their situation and/or health condition⁽⁵⁾.

There are a variety of strategies used in the implementation of health education activities, such as the use of workshops, discussion groups, lectures and consultations⁽⁶⁾. Although these traditional strategies indicate positive results regarding the effectiveness of interventions, the use of active methodologies has shown significant improvements in the knowledge, self-care and QoL of people living with DM⁽⁷⁻⁸⁾.

Among the active methodologies, educational technologies stand out, such as games, simulators, educational videos, training through workshops, interactive practices, didactic folders, serial albums and playful drawings. A research showed that the introduction of technologies for

health education has advanced rapidly, being effective for monitoring and managing DM⁽⁹⁾. Another research with the same objective also indicated a reduction in the risk of foot ulcers, highlighting an improvement in QoL and user satisfaction, as well as a decrease in hospitalizations and other complications arising from DM⁽¹⁰⁾.

In addition to the elements presented, a scoping review recommends future studies with the use of complementary methods for health education, such as educational technologies, in view of the potential improvement in QoL⁽¹¹⁾. From this perspective, this study aims to contribute to expanding the evidence on the impact of educational technologies on the QoL of people with diabetes, as approaches involving such resources for the management of chronic conditions are still in the exploratory phase⁽¹²⁾. Furthermore, the aim is to encourage the implementation of educational technologies, favoring the adoption of new methods that optimize learning and facilitate care management.

Therefore, the question arises: how can educational technologies influence the quality of life of people with diabetes? The objective of the study was to verify the effect of educational technologies on the quality of life of people with diabetes.

■ METHOD

Quasi-experimental, before-and-after study type with a single group. It is part of a larger project entitled "Impact of the use of educational technologies on health promotion practices and the quality of life of people living with diabetes mellitus during and after the COVID-19 pandemic", approved by the Research Ethics Committee, under opinion number 5.722.885/2022 and CAAE: 63949122.4.0000.0154. The study was structured in compliance with the recommendations of the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND).

The population consisted of users with DM followed up by the Family Health Strategy of the city of Cuité, located in Curimataú, Paraíba, in northeastern Brazil. For sample size calculation, the literature's recommendation of 30 participants for intervention studies was considered⁽¹³⁾.

The inclusion criteria were individuals with type 2 DM in their medical records, age ≥ 18 years, and who participated in at least three health education activities in groups or individually. Those who reported difficulties in understanding and answering the questions contained in the data collection instruments were excluded, considering the need for preserved cognition to participate in the research.

The health education activities were conducted in six meetings, with an average interval of 15 to 20 days between them, and each lasting at least ninety minutes. The determination of this period is justified by the need to carry out interventions with a space of two to three weeks and an average of four months, to minimize the intervention forgetting bias, as highlighted in studies summarized in a scoping review⁽¹¹⁾.

The activities were conducted in groups biweekly, in a room at the health unit, following a previously prepared script that included welcoming of the participants, development of the educational activity, and conclusion. To reduce losses, participants who were unable to attend the group activity would notify the community health agents in their respective areas, and the researchers would receive them at their homes. These home visits were conducted in the same week as the group activity, with the same duration, resources, and a similar structure to the collective activity.

The contents addressed were guided by a booklet developed and validated in a previous project⁽¹⁴⁻¹⁵⁾, entitled "Diabetes mellitus: care during and after the COVID-19 pandemic". The booklet addresses individual and collective measures to promote health and improve the QoL of people living with diabetes, justifying its use to guide educational actions.

For the execution of interventions, educational technologies were used, notably clinical simulators and physical educational games developed by the researchers, aiming to stimulate users' reflection and agency regarding health promotion and QoL. Chart 1 presents the content covered in each intervention and the main resources used in each of them.

Data collection took place in February 2023, which corresponded to the initial moment (T0), and May 2023, corresponding to the final moment (T1). A questionnaire with sociodemographic, clinical and behavioral data was applied, containing the following variables: age, gender, self-reported skin color, marital status, education level, family income, occupation, household arrangement, religion, time since diagnosis, time of DM follow-up, type of service used for DM treatment, coexisting chronic conditions, self-management of healthy eating, engagement in physical activity, use of oral antidiabetic medication or insulin therapy, smoking and alcohol consumption.

QoL was assessed using the Diabetes Quality of Life Measure (DQOL-Brazil). The DQOL-Brazil aims to measure the subjective individual perception of QoL, and its version has been validated for Brazilian Portuguese since 2008. The

choice of this instrument considered its reliability and validity for application in adult patients with type 2 diabetes, as well as its ability to measure changes after therapeutic intervention, whether educational or pharmacological⁽¹⁶⁾.

The instrument consists of 44 items, divided into four domains: "satisfaction" (15 questions), "impact" (18 questions), "concerns: social/vocational" (seven questions) and "concerns related to diabetes" (four questions). It is worth mentioning that the domain "concerns: social/vocational" was not applied as it was not relevant to the study, since people with DM 2 represent, for the most part, an elderly and retired population. These questions are answered using a five-point Likert scale (1 – never or very satisfied, 2 – almost never or quite satisfied, 3 – sometimes or moderately satisfied, 4 – almost always or somewhat satisfied, 5 – always or not satisfied), with values closer to 1 being associated with better health-related quality of life (HRQoL). For data analysis, the Likert scale values were inverted, so that the overall score ranged from 37 to 185, and the higher the value, the better the HRQoL⁽¹⁶⁾. The DQOL was applied at (T0) and one week after the end of the interventions (T1).

The researchers also measured postprandial capillary blood glucose at the beginning of each educational activity and recorded the results in a monitoring table. This table included rows with the names of the participants and columns for the variables action date and blood glucose value. In addition, the values were recorded on a "loyalty card" that was given to the participant.

Statistical processing was performed using IBM® SPSS® Statistical Package for the Social Sciences — Version 22.0. Univariate analysis was presented using mean and standard deviation measures for quantitative variables, and absolute and relative frequency measures for categorical data. In the inferential analysis, the normality of numerical data was verified using the Shapiro Wilk test, and, as the distribution presented normal data, the paired Student's t-test was used to compare the mean scores at times T0 and T1. In all analyses, the significance level adopted was ≤ 0.05 .

■ RESULTS

A total of 34 individuals with DM participated in the study, 24 (70.6%) of whom were female, with an average age of 65.8 years (± 10.16). There was a predominance of married participants (35.3%), incomplete elementary education (58.8%), family income above one minimum wage (55.9%), with an average of 2,058.88 BRL (± 657.80), and retirees (85.3%), as shown in Table 1.

Chart 1 – Contents addressed and resources used in each educational intervention. Cuité, Paraíba, Brazil, 2023.

Intervention	Content	Main resources
First intervention	Importance of healthy eating, vitamin D supplementation, and water consumption.	“Secret box” game, consisting of different images of foods contained in a box, in which users tried to relate the amount of sugar present in these foods based on bags containing varying amounts of sugar.
Second intervention	Care and prevention of COVID-19.	True or false game addressing prevention measures and the relationship between COVID-19 and DM; Joint construction of two posters on factors that prevent and worsen COVID-19 infection.
Third intervention	Maintaining therapy through oral medication and insulin therapy.	“Target shooting” game with questions about common doubts regarding oral medication use; Enlarged medicine boxes of the main oral antidiabetics; Low-cost simulator, built with cardboard and EVA (Ethylene-vinyl acetate) sheets, to simplify the explanation of how insulin works in the body; Enlarged syringe simulators, made of acetate, to explain the fractionation of insulin syringes; Simulator made from a mannequin to demonstrate the technique and sites for insulin application.
Fourth intervention	Importance of regular physical activity for treatment.	Simulator made from cardboard and EVA sheets. A cardboard cart represented insulin, the garage, also made of cardboard, represented a cell, and pieces of EVA corresponded to blood glucose. These materials were used to simulate the action of insulin in transporting glucose to the cell, in addition to illustrating the influence of physical activity on this process.
Fifth intervention	Foot care/prevention of foot ulcers.	Low-cost simulators made from Styrofoam and modeling clay to explain types of foot ulcers and their signs and symptoms.
Sixth intervention	Importance of adequate sleep for diabetes control.	Illustrated poster to explain the sleep cycle; Moment of relaxation and self-care led by a holistic therapist.

Source: Research data, 2023.

Table 1 – Sociodemographic characterization of research participants. Cuité, Paraíba, Brazil, 2023. (n=34)

Variables	n	%
Sex		
female	24	70.6
male	10	29.4
Self-reported skin color		
white	11	32.4
brown	17	50.0
black	6	14.6
Marital status		
married	12	35.3
widowed	9	17.6
consensual union	6	17.6
single	5	14.7
separated	2	5.9
Household arrangement		
lives with someone	30	88.2
lives alone	4	11.8
Religion		
catholic	24	70.6
evangelical	9	26.5
other	1	2.9
Education level		
incomplete elementary school	20	58.8
complete elementary school	5	14.7
complete high school	4	11.8
illiterate	4	11.8
complete higher education	1	2.9

Table 1 – Cont.

Variables	n	%
Income*		
more than one minimum wage	19	55.9
one minimum wage	15	44.1
Occupation		
retired	29	85.3
farmer	2	5.9
unemployed	1	2.9
self-employed	1	2.9
other	1	2.9

Source: research data, 2023. * Minimum wage value in February 2023:1,302.00 BRL.

Regarding clinical and behavioral data, the time since diagnosis and follow-up time ranged from 1 to 30 years, with an average of 7.1 (± 6.6). Most participants (67.6%) used the public service for DM treatment, and 70.6% had arterial hypertension associated with DM. It is worth noting that 16 users (47.1%) reported self-managing a healthy diet, while 23 (67.6%) reported practicing physical exercise regularly. There was a predominance of oral antidiabetic use (91.2%) compared to insulin therapy (8.8%). The data are shown in Table 2.

Table 3 presents the DQOL domains and items at T0 and T1, with a statistically significant difference (p-value <0.001) between the means of the overall score, which showed an increase from 142.7 to 162.2, and the domains of satisfaction, impact and concerns related to diabetes. The satisfaction domain showed an increase in the mean from 55 to 67, while the impact domain went from 71.7 to 78.2, while the domain related to concerns increased from 16 to 16.9. It is worth noting that the increase in values after the interventions indicates an improvement in the participants' QoL.

Table 2 – Clinical and behavioral data of research participants. Cuité, Paraíba, Brazil, 2023. (n=34)

Variables	n	%
Type of service used for DM treatment		
only public service	23	67.6
alternates between public and private service	11	32.4
Coexisting conditions		
hypertension	24	70.6
no comorbidities	10	29.4
Follows a healthy diet		
yes	16	47.1
no	18	52.9

Table 2 – Cont.

Variables	n	%
Engages in physical exercise		
yes	23	67.6
no	11	32.4
Uses oral antidiabetic medication		
yes	31	91.2
no	3	8.8
Uses insulin		
yes	3	8.8
no	31	91.2
Smoking		
yes	1	2.9
no	33	97.1
Alcoholism		
no	34	100.0

Source: research data, 2023

Table 3 – Distribution of domain and item values of the DQOL at initial and final moments. Cuité, Paraíba, Brazil, 2023.

Domains and items – Diabetes Quality of Life Measure	T0		T1		p-value*
	mean	sd	mean	sd	
Satisfaction	55.0	6.4	67.0	4.4	<0.001
Are you satisfied with the time it takes to manage your diabetes?	3.2	1.0	4.4	0.6	<0.001
Are you satisfied with the time spent doing general exams?	3.7	0.7	4.5	0.7	<0.001
Are you satisfied with the time it takes to check your blood sugar levels?	3.7	0.5	4.6	0.5	<0.001
Are you satisfied with your current treatment?	3.2	1.0	4.5	0.5	<0.001
Are you satisfied with the flexibility in your diet?	2.4	0.9	4.2	0.4	<0.001
Are you satisfied with the worry your diabetes causes your family?	3.4	0.9	3.8	0.5	0.001

Table 3 – Cont.

Domains and items – Diabetes Quality of Life Measure	T0		T1		p-value*
	mean	sd	mean	sd	
Are you satisfied with your knowledge about diabetes?	2.1	0.7	4.5	0.6	<0.001
Are you satisfied with your sleep?	3.0	1.1	4.3	0.6	<0.001
Are you satisfied with your social life and friendships?	4.7	0.5	4.7	0.4	0.083
Are you satisfied with your sexual life?	4.7	0.4	4.8	0.4	0.083
Are you satisfied with your work, school, or household activities?	4.5	0.7	4.7	0.5	0.083
Are you satisfied with the appearance of your body?	4.3	0.6	4.5	0.5	0.044
Are you satisfied with the time spent on physical exercises?	3.2	1.2	4.1	0.9	<0.001
Are you satisfied with your leisure time?	3.9	1.0	4.3	0.6	0.001
Are you satisfied with your life overall?	4.2	0.7	4.4	0.7	0.009
Impact	71.7	6.9	78.2	5.6	<0.001
How often do you feel pain related to your diabetes treatment?	3.5	1.2	3.9	0.9	0.002
How often do you feel embarrassed to treat your diabetes in public?	4.6	0.9	4.7	0.6	0.374
How often do you feel physically ill?	2.6	1.0	3.2	0.8	<0.001
How often does your diabetes interfere with your family life?	3.3	1.3	3.5	1.3	0.044
How often do you have a bad night's sleep?	2.7	0.8	3.7	0.5	<0.001
How often do you find that your diabetes limits your social life and friendships?	4.7	0.7	4.7	0.5	0.083
How often do you feel bad about yourself?	3.7	0.9	4.0	0.6	0.003
How often do you feel restricted by your diet?	2.5	0.8	3.9	0.5	<0.001
How often does your diabetes interfere with your sexual life?	4.9	0.3	5.0	0.0	0.184
How often does your diabetes prevent you from driving a car/motorbike or using an electronic device (e.g., cellphone)?	4.7	0.6	4.7	0.5	0.325

Table 3 – Cont.

Domains and items – Diabetes Quality of Life Measure	T0		T1		p-value*
	mean	sd	mean	sd	
How often does your diabetes interfere with your physical exercises?	3.7	0.9	4.2	0.9	<0.001
How often do you miss work, school, or household responsibilities due to your diabetes?	4.7	0.7	4.7	0.5	0.422
How often do you find yourself explaining to yourself what it means to have diabetes?	4.7	0.5	4.9	0.3	0.103
How often do you feel that your diabetes interrupts your leisure activities?	4.6	0.9	4.7	0.6	0.184
How often do you feel embarrassed to tell others about your diabetes?	4.7	0.6	4.8	0.4	0.058
How often do you feel bothered by having diabetes?	3.6	1.1	4.2	0.7	<0.001
How often do you feel that because of diabetes, you go to the bathroom more than others?	4.2	1.0	4.6	0.4	0.003
How often do you eat something you shouldn't instead of saying you have diabetes?	3.3	0.9	4.0	0.5	<0.001
Diabetes-related concerns	16.0	2.2	16.9	1.5	<0.001
How often do you worry about fainting?	3.5	1.1	3.9	0.8	0.001
How often do you worry that your body looks different because you have diabetes?	3.9	0.8	4.6	0.9	0.044
How often do you worry about complications due to your diabetes?	2.8	0.9	3.2	0.6	0.004
How often do you worry that someone will not go out with you because of your diabetes?	4.9	0.3	5.0	0.0	0.184
Overall score	142.7	11.8	162.2	9.1	<0.001

T0 = initial moment

T1 = final moment

*Paired Student's t-test

Source: research data, 2023

Table 4 presents the participants' postprandial blood glucose values at the initial and final moments, observing a statistically significant difference, with p-value <0.001,

indicating a reduction in the average blood glucose levels after the educational interventions.

Table 4 – Postprandial capillary blood glucose value at initial and final moments. Cuité, Paraíba, Brazil, 2023.

Variables	T0		T1		p-value*
	m	sd	m	sd	
blood glucose value	165.5	55.3	132.7	41.0	<0.001

T0 = initial moment

T1 = final moment

*Paired Student's t-test

Source: research data, 2023

DISCUSSION

This study assessed the effect of educational technologies as a health intervention tool on the QoL of people with diabetes. The sociodemographic profile of the participants showed a predominance of female people with DM, over 60 years old, and lower education level, corroborating the findings of a study⁽¹⁷⁾ that presented similar characteristics. These data may be associated with a higher prevalence of diabetes in women and in those aged 60 or over, as evidenced by another author⁽¹⁸⁾. Additionally, as they seek health services more frequently, women have a greater chance of being diagnosed, while the elderly, due to the physiological processes inherent to aging, in addition to lifestyle habits, are more susceptible to developing chronic conditions.

More individuals were observed with incomplete elementary education and income greater than one minimum wage, corroborating the data of a study⁽¹⁹⁾ where the sample predominantly had eight years or less of schooling (78%) and an income of one to two minimum wages (97.3%). Factors such as lower education and low income are associated with a higher prevalence of diabetes, as observed by another author⁽²⁰⁾, since these determinants can limit access to information, hinder self-care, and expose the subject to risk behaviors, such as sedentary lifestyle, poor diet and difficulty in accessing healthcare services.

The average time since diagnosis was 7.1 years, similar to data from a study⁽⁷⁾, in which 51.5% of the population studied had a diagnosis time of less than or equal to 10 years. It is understood that the longer the duration of disease, the higher the risk of developing associated complications.

Lifestyle changes are part of diabetes treatment, with a focus on dietary care and regular physical activity. These behaviors are crucial for managing blood glucose levels and reducing the risk of complications, but they still pose challenges for this population⁽¹⁴⁾. According to the clinical and behavioral profile of the participants, 47.1% reported following an adequate diet, while 67.6% stated that they practiced some physical activity.

The use of educational technologies in interventions positively impacted the participants' QoL, given the statistically significant difference in the average scores across domains and the overall DQOL score after the interventions. In a study that used simulations with health education activities, the educational environment served as a tool to compare and learn strategies for managing life with diabetes⁽²¹⁾. This finding results from the individuals' increased awareness and consequent improvement in self-management of their chronic condition.

The first domain of the DQOL relates to the level of satisfaction with self-management behaviors of the disease, as well as with physical and social issues. The impact domain corresponds to the repercussions of DM on QoL, and may indicate, depending on the score, the presence of adverse events related to the disease, in addition to limiting factors in the physical and social spheres. The "concerns related to diabetes" domain refers to concerns associated with the consequences of the disease on well-being, appearance and social life⁽²²⁾.

In this study, the level of satisfaction after interventions with educational technologies showed a significant increase, indicating an improvement in DM management. Only the items related to social aspects did not show a statistically significant difference, which may be a reflection of effective family support.

Regarding the impact domain, there was an increase in the mean scores after the interventions, configuring a statistically significant result, which represents a decrease in the occurrence of adversities that negatively influence QoL. Most items related to social aspects did not show statistical significance. A study⁽²³⁾ pointed out that more than half of the participants reported problems in this domain, especially regarding physical well-being, which appears to be associated with greater interference of diabetes in the physical sphere, when compared to psychological and social issues.

A study⁽²⁴⁾ highlights that people living with DM exhibit habits that negatively influence glycemic management and, consequently, QoL, such as non-adherence to healthy

eating, weight gain, sedentary behavior and withdrawal from health services. Thus, interventions based on educational technologies encouraged changes in such practices, as evidenced by the results of the DQOL domains, which showed a statistically significant difference after the interventions.

Regarding the domain of concerns about diabetes, there was also a statistically significant difference. Thus, it is understood that reducing concerns about one's clinical condition, through increased awareness, can reduce anxiety, blood pressure, negative thoughts and improve sleep, resulting in a positive impact on QoL⁽²⁵⁾.

Educational interventions associated with the use of educational technologies have shown positive outcomes in the QoL of people living with DM; however, a systematic review that gathered studies that evaluated the effect of types of intervention identified that there was no statistically significant difference in QoL, except in those involving pharmacological interventions⁽²⁶⁾. This may be associated to the participants' profiles, the different types of resources used in the interventions, as well as the diversity of tools for evaluating quality of life, which may not be sensitive to certain aspects and complicate the interpretation and comparison of results.

Regarding the average postprandial blood glucose levels before and after the educational interventions, a statistically significant difference was observed, since there was a reduction from 165.5 to 132.7 mg/dL. These glycemic values are in line with the DM treatment goals⁽²⁷⁾, indicating better management of the clinical condition and a decreased risk of developing complications, contributing to improved QoL, as identified by a systematic review highlighting the relationship between metabolic management and QoL⁽²⁶⁾.

The reduction in the average blood glucose levels of participants after the interventions suggests a positive impact of educational technologies as a resource for promoting QoL. This result is consistent with data from a randomized controlled trial conducted in Iran, in which six months after the educational sessions, the intervention group showed a reduction in the average fasting blood glucose level from 174 to 137 mg/dL⁽²²⁾.

A systematic review and meta-analysis of randomized clinical trials indicated that the use of educational games enhanced glycemic management, being a promising strategy for supporting people living with diabetes and improving their self-management behaviors⁽²⁸⁾. This underscores the importance of combining educational technologies in health education activities to enhance diabetes self-management by raising awareness of risks and promoting accountability and healthier lifestyle habits⁽²⁹⁾.

The complementary use of different educational strategies in health education activities, such as low-cost simulators and games, provided support for the process of support and knowledge sharing. This data is validated in a scoping review⁽¹¹⁾ that suggests the combination of an educational session with the use of complementary resources, such as videos and booklets, for a meaningful learning approach in QoL.

As implications for clinical practice, the use of low-cost simulators and physical games to support health education activities stands out, as well as low-cost and easy-to-replicate strategies. These elements make this activity comprehensive for the different realities of care in Primary Health Care, which contributes to an innovative and stimulating practice, aiming at qualified care.

Regarding study limitations, convenience sampling and the inability to assess long-term QoL after the interventions were noted.

■ CONCLUSION

The use of educational technologies as an educational intervention tool showed an improvement in the QoL of people living with diabetes, considering the increased average scores of the DQOL. A significant improvement was observed in the averages of the domains satisfaction, impact and concerns related to diabetes. Furthermore, there was a reduction in average postprandial blood glucose levels after the interventions. Thus, employing these resources in health education initiatives showed a positive impact on QoL.

It is hoped that the results of this study will encourage health professionals to incorporate educational technologies into educational activities, to enhance and facilitate learning, contributing to care practices and improving QoL. Future studies are needed to evaluate the long-term effects of these resources on the QoL of people living with diabetes to gather evidence on their use and make it a reality closer to health services.

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