DOI: 10.53660/CLM-4228-24U11

Illustrated eating plan as a strategy for adherence to carbohydrate counting in patients with diabetes mellitus

Received: 30-08-2024 | Accepted: 01-10-2024 | Published: 05-10-2024

Ana Lucia Rocha Faillace
ORCID: https://orcid.org/0000-0002-9293-8455
Faculdad Interamericana de Ciencias Sociales, Brazil
E-mail: alfaillace@gmail.com
Maria Auxiliadora Menezes de Souza
ORCID: https://orcid.org/0000-0003-4762-3742
Federal University of Pará, Brazil
E-mail: mauximenezes@gmail.com

ABSTRACT

The carbohydrate counting method is an effective meal planning tool used in diabetes mellitus (DM) patients that focuses on carbohydrates as the main nutrient that affects the glycemic response. Therefore, this study aims to develop a nutritional therapy with carbohydrate counting, providing the inclusion of patients with DM on insulin therapy. This is a clinical-longitudinal and descriptive study, carried out on patients diagnosed with insulin-dependent type 1 or 2 DM, treated at a reference university hospital, in Belém/Pará. It was found that there was a reduction in weight and BMI until the fourth consultation, with an increase in the fifth. Average fasting glucose and total cholesterol decreased significantly throughout the consultations. However, systolic blood pressure and TGO levels showed variations, highlighting the need for continuous monitoring. This study demonstrated the benefits of technology in helping glycemic control in insulin-dependent patients.

Keywords: Nutritional therapy; Carbohydrate counting; Educational technology; Glycemic control; Adherence to treatment;

RESUMO

O método de contagem de carboidratos é uma ferramenta eficaz de planejamento alimentar usada em pacientes com diabetes mellitus (DM) que foca nos carboidratos como o principal nutriente que afeta a resposta glicêmica. Desta forma, este estudo objetiva desenvolver uma terapêutica nutricional com contagem de carboidratos, proporcionando a inclusão de pacientes com DM em insulinoterapia. Trata-se de um estudo clínico-longitudinal e descritivo, realizado em pacientes diagnosticados com DM tipo 1 ou 2 insulinodependentes, atendidos em um hospital universitário de referência, em Belém/Pará. Verificou-se que houve uma redução no peso e no IMC até a quarta consulta, com aumento na quinta. A glicose média em jejum e o colesterol total diminuíram significativamente ao longo das consultas. No entanto, a pressão arterial sistólica e os níveis de TGO apresentaram variações, destacando a necessidade de monitoramento contínuo. A partir deste estudo comprovou-se os benefícios de uma tecnologia no auxílio do controle glicêmico em pacientes insulinodependentes.

Palavras-chave: Terapia nutricional; Contagem de carboidratos; Tecnologia educacional; Controle glicêmico; Adesão ao tratamento.

INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disease that represents a major public health problem due to its chronic nature and its complications that are strongly associated with the length of exposure to hyperglycemia. People with type 1 or type 2 DM are highly likely to have chronic complications, the most common of which are diabetic neuropathy and peripheral vascular disease, which culminate in the worsening of the condition, better known as diabetic foot (Pereira; Almeida, 2020).

The growth of DM is associated with several factors, mainly inadequate dietary patterns and a sedentary lifestyle, which are very common for chronic non-communicable diseases (NCDs), and are priority topics of the National Health Promotion Policy (NHPP) (Brazil, 2014). One of the main tools for promoting health care is health education, with a broader scope, which helps not only in preventing diseases but also in developing responsibility. They contribute to the transformation of individual practices and behaviors, in addition to the development of the individual's autonomy and quality of life (Janini; Bressler; Vargas, 2019).

Associated with the use of health education, nutritional education linked to the eating plan allows the individual with DM to better understand the influence of food on glycemic homeostasis and prevention of complications (SBD, 2023). The proposed guidelines can influence the success of the treatment of the disease through a partnership between the health professional and the patient, aiming at the development of awareness for self-care and the formation of healthy eating attitudes, habits and practices (Estrela et al., 2017).

The concept that the glycemic effect of meals depends on the total amount of Carbohydrates (HC) rather than the source or type, led to the implementation of the HC counting method in which foods are placed in lists of equivalents, based on the amount and not on the source of the HC, since nutritional therapy with Carbohydrate Counts stands out among the strategies for controlling DM, mainly associated with insulin therapy (Dias, 2022).

This is a food planning tool used in patients with DM that focuses on HC as the main nutrient that affects the postprandial glycemic response. It is a less restrictive, but no less rigid, method that aims to optimize glycemic control based on the smallest variations in glycemic rates. In this method, professionals properly trained in the area of

Nutrition teach the patient with DM to estimate the HC content of the meal, using a list of foods with known HC content (Dias, 2022).

However, the implementation of this tool still poses a major challenge due to the difficulties of differentiated dietary planning. Thus, the development of a technology that helps in better management of the disease has been growing in recent years and its use by this population seems to accompany this growth. The American Diabetes Association states that these advances in technology are welcome and should be adapted to the individuals' capabilities, specific needs and accompanied by educational strategies with technological innovation developed, for a better understanding of the dietary plan, greater glycemic control, probably favoring greater adherence to treatment and increasing the relationship of trust between professionals (Makroum et al., 2022).

The present study is derived from the doctoral thesis entitled “Technological innovation on nutritional therapy with carbohydrate counting for people with Diabetes Mellitus”, from the Doctorate course in Public Health at the Interamerican Faculty of Social Sciences, Brazil.

Therefore, the objective of this study was to evaluate anthropometric and biochemical data, as well as to develop a technological innovation with the Carbohydrate Counting tool for patients with DM using insulin therapy, aiming at strategies for better understanding of Nutritional Therapy and adherence to treatment, using a food plan with photographic records of foods and preparations, associated with educational food interventions.

METHOD

This is a clinical, longitudinal and descriptive study, with a quantitative approach and the development of technological innovation. The sample consisted of 182 patients with insulin-dependent type 1 or type 2 DM, treated at the Nutrition Clinic of the Outpatient Service of the João de Barros Barreto University Hospital (HUJBB) of the Hospital Complex of the Brazilian Company of Hospital Services of the Federal University of Pará (EBSERH/UFPA), in Belém do Pará.

After analyzing the frequency of consultations, it was necessary to exclude patients who attended only one consultation, as it was not possible to monitor the necessary parameters.

For dietary guidance, the Carbohydrate Counting methodology was used, with monitoring of the learning of how to use this tool by the patients in the study. For Carbohydrate Counting, only photographic records of foods and meals containing the amount of carbohydrates were used to compose the Individualized Dietary Plan of the patients, without the use of texts. Carbohydrate intake was monitored using the Food Frequency Questionnaire (FFQ) and 24-hour Recall tools.

In this study, the Chi-square likelihood ratio test for independent samples was used and a significance level of p-value <0.05 was adopted, i.e., if p-value <0.05, H1 is accepted = The observed frequencies differ significantly for the different groups. The Student's t-test was used to compare means with the aim of comparing the results of the anthropometric and biochemical data collected in five medical appointments. The data were tabulated, interpreted, processed and analyzed using descriptive and inferential statistics using the Statistical Package for Social Sciences (SPSS) version 24.0.

An objective nutritional assessment was performed and an identification questionnaire, the 24-hour Recall (R24h) and the FFQ were applied. For objective nutritional assessment, anthropometry was used by measuring the following measurements: Weight (W), Height (H), Body Mass Index (BMI) (WHO, 2000), Arm Circumference (AC) (Frisancho, 1990), Waist Circumference (WC) (IDF, 2005) and Nutritional Diagnosis (ND).

In the nutritional assessment at the follow-up consultation, the current W, BMI (WHO, 2000), AC (Frisacho, 1990), WC (IDF, 2005), equivalence system for assessing food intake and food substitution system were measured. For nutritional therapy, the Carbohydrate Counting method was used, with the health technology tool, consisting of an illustrated food plan created by the author for this research. Patients were instructed/trained to use two different methods of Carbohydrate Counting (choice or substitution method and carbohydrate gram counting method) that were adapted according to the patient's understanding, and were correlated with the use of insulin and the verification of capillary blood glucose by the team nurse.

New approaches to nutritional therapy were implemented, starting from a more illustrative perspective using photographic records, grouping different foods and preparations according to household measurements and carbohydrate quantities in grams. These groups were divided into foods characteristic of small or large meals. A list of food substitutions was also created according to the amount of carbohydrates in grams of the

food. The identification of free use of foods in the form of smaller amounts of CHO was in green, as a guide to control the choice of food to be replaced on the menu.

Six quarterly conversation circles were held for 18 months, with three cycles (6 months each cycle) of the project. The fourth cycle no longer took place due to the pandemic. The discussion groups aimed to strengthen relationships between researchers and patients to provide possible clarifications regarding the Carbohydrate Counting tool and its daily practice in glycemic control, using conversation maps as an educational tool (IDF, 2008), in addition to other topics that could be addressed regarding drug therapy, such as types of insulin available and control of the quantities of units prescribed and administered according to the result of the carbohydrate count to be consumed or already consumed.

This project was submitted and approved by the HUJBB Ethics and Research Committee under no. 77243917.1.0000.0017 and followed the standards for research with human beings of the Ministry of Health according to Resolution 466/2012.

RESULTS

Anthropometric data of insulin-dependent diabetic patients

In the first consultation, 79 patients with a mean height of 1.57 m (± 0.09) were evaluated. The minimum height was 1.40 m and the maximum was 1.70 m. The median indicates that 50% of the patients are up to 1.56 m tall. In the second consultation, 26 patients with a mean height of 1.55 m (± 0.07) were evaluated. The minimum height was 1.41 m and the maximum was 1.69 m. The median shows that 50% of the patients are up to 1.55 m tall. In the third consultation, 12 patients with a mean height of 1.55 m (± 0.05) were evaluated. The minimum height was 1.48 m and the maximum was 1.64 m. The median indicates that 50% of the patients are up to 1.56 m tall.

In the fourth consultation, 7 patients with a mean height of 1.58 m (± 0.05) were evaluated. The minimum height was 1.49 m and the maximum was 1.64 m. The median shows that 50% of the patients are up to 1.57 m tall. In the fifth consultation, 3 patients with a mean height of 1.63 m (± 0.01) were evaluated. The minimum height was 1.62 m and the maximum was 1.64 m. The median indicates that 50% of the patients are up to 1.63 m tall.

Regarding the mean weight, there was a reduction until the fourth consultation, however, there was an increase in the fifth consultation, where the mean was 86.3 kg (± 12.3) among the three patients evaluated. The mean body mass index (BMI) was also higher in the fifth consultation, with 32.8 (± 5.22). The AC means reduced significantly until the fourth visit, but increased at the fifth, with a mean of 32.8 (± 1.61) (Table 1).

Table 1 - Distribution of insulin-dependent diabetic patients according to anthropometric data.

Consultation		Stature (m)	Current Weight (kg)	BMI (kg/m²)	AC (cm)	WC (cm)	GET
1st Consultation	N	79	79	78	78	79	56
	Absent	7	7	8	8	7	30
	Mean	1.57	73.1	29.7	33.0	99.7	1850
	Median	1.56	71.3	29.4	32.0	101	1873
	± SD	0.09	14.2	4.86	7.70	11.7	421
	Minimum	1.40	42.1	18.2	25.4	71.5	1.80
	Maximum	1.70	118	46.1	90.0	128	2500
2 st Consultation	N	26	26	26	24	26	14
	Absent	60	60	60	62	60	72
	Mean	1.55	72.9	30.2	32.7	100	1893
	Median	1.55	71.8	30.4	33.8	102	1842
	± SD	0.07	15.5	5.02	3.53	13.6	106
	Minimum	1.41	49.9	22.1	24.0	77.0	1797
	Maximum	1.69	98.1	40.8	40.0	120	2089
3 st Consultation	N	12	12	12	12	12	6
	Absent	74	74	74	74	74	80
	Mean	1.55	69.3	28.8	31.4	96.8	1841
	Median	1.56	67.4	28.6	32.8	98.3	1844
	± SD	0.05	14.5	5.22	3.18	13.0	31.0
	Minimum	1.48	52.4	22.1	24.1	79.0	1790
	Maximum	1.64	94.0	38.5	34.5	120	1884
4 st Consultation	N	7	7	7	7	7	2
	Absent	79	79	79	79	79	84
	Mean	1.58	73.3	28.9	31.0	98.0	1864
	Median	1.57	72.0	26.8	30.2	98.0	1864
	± SD	0.05	16.8	5.84	4.04	18.0	48.3
	Minimum	1.49	52.6	21.6	25.0	76.0	1830
	Maximum	1.64	93.4	35.6	35.0	120	1898
5 st Consultation	N	3	3	3	3	3	1
	Absent	83	83	83	83	83	85
	Mean	1.63	86.3	32.8	32.8	109	1900
	Median	1.63	93.1	35.0	33.5	107	1900
	± SD	0.01	12.3	5.22	1.61	10.1	-
	Minimum	1.62	72.1	26.8	31.0	100	1900
	Maximum	1.64	93.6	36.5	34.0	120	1900
P-Value		0.000	0.000	0.000	0.000	0.000	0.000

Source: Research protocol (2022).
Note 1: The results are based on non-empty rows and columns in each innermost subtable.
Note 2: The statistical test does not consider the frequency of the "SI - No information" group.
(1) Student's t-test for comparison of means (p-value <0.05).
*Significant values; NS - Non-Significant values.
Test interpretation:
H0: The observed means do not differ significantly between the groups and categories.
Ha: The observed means differ significantly between the groups and categories.
Decision: Since the computed p-value is less than the significance level alpha = 0.05, the null hypothesis H0 should be rejected and the alternative hypothesis Ha accepted.

Biochemical data of insulin-dependent diabetic patients

Table 2 shows the distribution of insulin-dependent diabetic patients according to biochemical data. It can be seen that in the first consultation, a total of 15 patients were assessed for blood pressure measurement, so that the average systolic pressure was 13 mmHg ± 21.4 mmHg, the minimum pressure of these patients is 10 mmHg and the maximum is 18 mmHg, the median indicates that 50% of patients have up to 12 mmHg of systolic pressure. It can be seen that in the first consultation, the average fasting glucose was 205 mg/dL ± 89.9 mg/dL, the minimum glucose of these patients is 50 mg/dL and the maximum is 446 mg/dL, the median indicates that 50% of patients have up to 193 mg/dL of fasting glucose. In the fifth consultation, it was found that only 3 patients were evaluated, so that the average fasting glucose reduced to 150 mg/dL.

It was found that in the first consultation, the average total cholesterol (TC) was 199 mg/dL ± 61.3 mg/dL, the minimum total cholesterol of these patients was 29 mg/dL and the maximum was 355 mg/dL, the median indicates that 50% of the patients had up to 188 mg/dL of total cholesterol. In the fifth consultation, it was found that only 3 patients were evaluated, so that the total cholesterol reduced to 159 mg/dL. It was found that in the first consultation, the average SGOT was 27.8 U/L ± 26.2 U/L, the minimum SGOT of these patients was 9 U/L and the maximum was 20.8 U/L, the median indicates that 50% of the patients had up to 22 U/L of SGOT. In the fifth consultation, it was found that only two patients were evaluated, so that the average TGO was 20.0 U/L.

Biochemical data of insulin-dependent diabetic patients

Table 2 shows the distribution of insulin-dependent diabetic patients according to biochemical data. It can be seen that in the first consultation, a total of 15 patients were assessed for blood pressure measurement, so that the average systolic pressure was 13 mmHg ± 21.4 mmHg, the minimum pressure of these patients is 10 mmHg and the maximum is 18 mmHg, the median indicates that 50% of patients have up to 12 mmHg of systolic pressure. It can be seen that in the first consultation, the average fasting glucose was 205 mg/dL ± 89.9 mg/dL, the minimum glucose of these patients is 50 mg/dL and the maximum is 446 mg/dL, the median indicates that 50% of patients have up to 193 mg/dL of fasting glucose. In the fifth consultation, it was found that only 3 patients were evaluated, so that the average fasting glucose reduced to 150 mg/dL. It was found that in the first consultation, the average total cholesterol (TC) was 199 mg/dL ± 61.3 mg/dL, the minimum total cholesterol of these.

Table 2: Distribution of insulin-dependent diabetic patients according to biochemical data.

Consultation		PS	PD	GJ	CT	HDL	LDL	N-HDL	TG	HbA1C	TGO	TGP	Urea	Creati-nine
1st Consultation	N	15	15	79	72	71	67	64	72	46	62	64	54	61
	Absent	71	71	7	14	15	19	22	14	40	24	22	32	25
	Mean	13.0	74.6	205	199	42.9	116	157	200	9.93	27.8	36.3	40.2	2.23
	Median	12.0	79.0	193	188	41.0	106	147	159	9.70	22.0	26.5	35.5	0.800
	± SD	21.4	8.30	89.9	61.3	11.8	47.6	57.0	125	2.31	26.2	32.0	27.4	8.89
	Minimum	10.0	60.0	50.0	29.0	26.0	32.0	14.0	40.0	5.60	9.00	13.0	3.00	0.400
	Maximum	18.0	90.0	446	355	99.0	244	298	739	14.4	208	170	217	69.8
2st Consultation	N	1	1	25	26	23	22	21	25	0	17	20	16	15
	Absent	85	85	61	60	63	64	65	61	86	69	66	70	71
	Mean	17.3	78.0	182	192	42.2	109	148	184	-	22.6	24.1	48.1	0.740
	Median	17.3	78.0	160	176	39.0	99.0	137	149	-	22.0	21.5	45.5	0.700
	± SD	-	-	92.3	48.3	11.9	37.1	45.9	88.8	-	9.30	7.81	18.7	0.168
	Minimum	17.3	78.0	70.0	111	22.0	44.0	74.0	48.0	-	12.0	16.0	20.0	0.500
	Maximum	17.3	78.0	427	281	80.0	173	245	426	-	50.0	47.0	102	1.00
3st Consultation	N	0	0	12	12	11	11	10	12	2	12	12	9	7
	Absent	86	86	74	74	75	75	76	74	84	74	74	77	79
	Mean	-	-	177	167	41.3	87.7	126	199	8.50	22.1	27.9	41.9	0.657
	Median	-	-	177	161	36.0	85.0	120	206	8.50	18.0	24.0	41.0	0.600
	± SD	-	-	77.5	35.1	15.3	29.6	29.3	126	0.70	11.2	9.55	17.3	0.078
	Minimum	-	-	100	128	24.0	51.0	93.0	34.0	8.00	12.0	18.0	15.0	0.600
	Maximum	-	-	373	255	83.0	160	172	377	9.00	54.0	46.0	66.0	0.800
4st Consultation	N	0	0	7	6	5	4	5	7	1	6	6	3	3
	Absent	86	86	79	80	81	82	81	79	85	80	80	83	83
	Mean	-	-	158	167	36.8	92.5	126	160	6.00	19.5	27.3	43.7	0.767
	Median	-	-	174	167	36.0	88.5	116	125	6.00	20.0	28.0	41.0	0.700
	± SD	-	-	49.8	44.4	7.29	38.3	48.6	130	-	3.62	5.61	4.62	0.208
	Minimum	-	-	57.0	105	28.0	50.0	69.0	53.0	6.00	14.0	19.0	41.0	0.600
	Maximum	-	-	210	234	46.0	143	192	416	6.00	24.0	34.0	49.0	1.00
	N	0	0	3	3	3	3	3	3	1	2	2	3	2

5st Consultation	Absent	86	86	83	83	83	83	83	83	85	84	84	83	84
	Mean	-	-	150	159	33.3	79.0	126	264	10.0	20.0	101	79.0	1.10
	Median	-	-	150	157	28.0	60.0	105	247	10.0	20.0	101	49.0	1.10
	± SD	-	-	58.0	44.0	16.7	35.5	51.2	49.3	-	25.3	89.8	57.2	0.141
	Minimum	-	-	92.0	116	20.0	57.1	88.0	226	10.0	21.0	37.0	43.0	1.00
	Maximum	-	-	208	204	52.0	120	184	320	10.0	379	164	145	1.20
P-Value		**0.001***	**0.000***	**0.000***	**0.000***	**0.000***	**0.002***	**0.012***	**0.001***	**0.000***	**0.0000***	**0.000***	**0.000***	**0.000***

Note: Systolic pressure – PS; Diastolic pressure – PD.

Source: Research protocol (2022).
Note 1: The results are based on non-empty rows and columns in each innermost subtable.
Note 2: The statistical test does not consider the frequency of the “SI - No information” group.
(1) Student's t-test for comparison of means (p-value <0.05).
*Significant values; NS - Non-Significant values.
Test interpretation:
H0: The observed means do not differ significantly between the groups and categories.
Ha: The observed means differ significantly between the groups and categories.
Decision: Since the computed p-value is less than the significance level alpha = 0.05, the null hypothesis H0 should be rejected and the alternative hypothesis Ha accepted.

They are described on an A4 sheet of paper, with the title Food Plan in the header, with the corresponding calories and the code representing the recipient patient, in addition to the date of the prescription, for example: FOOD PLAN

1,500 Kcal Code: Date: / / and in the footer the signature and stamp of the prescribing professional.

They are presented in a spreadsheet containing the meal times, which are represented by a clock, without hands, to be completed according to each individualized prescription of the patient. The portions (measurements) of the food are arranged in drawings such as: a spoon, indicating the unit in grams, being the total of how many spoons will be needed according to the prescribed quantity; the palm of the hand representing the quantity of protein to be ingested; slices referred to in grams by the size of the thumb; food (butter) on the tip of a knife; a glass to represent the quantity of liquid food; plates with vegetables indicating the need to color the meal and thus diversify the food with the nutrients necessary for a healthy diet. As an example, breakfast is represented by a cup of coffee, a glass of milk, a French roll, with butter on the tip of a knife (which represent the prescribed quantities).

The Meal Plans present in the last column the amount of Carbohydrates in grams, which represent the nutrient (Carbohydrate) contained in each food or meal and at the end of the column, the Total Carbohydrates prescribed, for example: TOTAL CHO = 214 g.

The Meal Plans were prepared in various total calories, such as 1300 Kcal, 1500 Kcal, 1800 Kcal, 2000 Kcal, 2300 Kcal, 2500 Kcal and 2800 Kcal. To complement the improvement in food choice, a Substitution List was prepared, containing two pages. The Meal Plans can be accessed through the following link: https://drive.google.com/drive/folders/166SSk9VaDb8N8wO_JYUjA_YikLOWrkjq?usp=sharing

DISCUSSION

DM has a major influence on the lives of those affected, and its clinical manifestation is associated with a deterioration in a person's quality of life, especially when it leads to complications that coexist with other chronic diseases. The main factors that influence the health conditions of people with DM are: higher family income, level of education, adherence to medication, adequate monitoring by health professionals,

obesity, mental disorders, and age (Ferreira, 2021; Sousa et al., 2022; Almeida et al., 2022).

Carbohydrate intake directly influences postprandial glucose levels, and it is the macronutrient of greatest concern in glycemic management. In addition, food choices have a direct effect on energy balance and, consequently, on body weight and on blood pressure and plasma lipid levels (Maeyama et al., 2020).

In addition, diet, which is such an important factor in the glycemic control of people with DM, was one of the aspects most highlighted as a difficulty in the vision of the interviewees, corroborating the present study, ratifying several studies that have shown that few patients follow the recommended diet (Maeyama et al., 2020).

In the study by Louzada et al. (2023), the results found refer to the exponential growth in the consumption of ultra-processed foods in relation to natural foods, reported due to the high cost of healthy products in contrast to the low cost and accessibility of unhealthy foods, which increasingly influences the intake of these, which corroborates the numbers found in the present study. Furthermore, reducing investments in primary care and ending policies that facilitate access to medication should be prioritized, given that reduced access to effective treatment has a significant impact on the clinical and epidemiological profile of the population, worsening complications and comorbidities and increasing the need to use highly complex services in the medium and long term (Muzy et al., 2021).

One of the biggest challenges for caring for people with DM in terms of diet, in addition to food quality, is considering the flavor that healthy foods can provide. In this sense, the search for healthy diets that consider culture, social status, and one's own preference for certain foods should be part of the educational and therapeutic process, which does not necessarily need to be restricted to the person with DM, but can be extended to the entire family and social environment (Maeyama et al., 2020).

Regarding laboratory biochemical tests, corroborating the present study, the results were above normal values for most participants, indicating inadequate metabolic control, as shown by Silva et al. (2020), who found altered fasting blood glucose levels in 50% of participants (>130 mg/dL). Normal values of glycated hemoglobin and fasting plasma glucose were observed in 17 (10.5%) and 34 (21%) participants, respectively (Gomes-Villas Boas; Foss-Freitas; Pace, 2014). Inadequate glycemic control leads to long-term complications and increases the number of hospitalizations and deaths (Almeida; Almeida, 2018).

In addition to the issue of choosing the type of food, the fractionation of food intake was also put forward as a difficult guideline to follow, mainly due to the habit acquired over years. Several studies have shown that lower dietary fractionation and a large volume of food consumed in main meals lead to a greater body fat reserve due to greater glucose absorption and greater lipogenesis. In contrast, higher fractionation allows for greater postprandial thermogenesis, lower concentrations of total cholesterol and LDL cholesterol, and a lower postprandial insulin peak, which is therefore extremely important for people with DM (Maeyama et al., 2020).

Patients with better metabolic control (considering the reduction in glycated hemoglobin levels - HbA1c) have better QoL (Alshayban; Joseph, 2020; Gonçalves; Bondan, 2021; Almeida et al., 2022). This is mainly related to better disease control, which reduces DM complications. A study conducted by Tonetto et al. (2019) showed that acute and chronic complications of DM are associated with worsening QoL indices (Zurita-Cruz et al., 2018).

In addition, results from numerous studies suggest that nutritional knowledge and health status alone are not enough to ensure adequate eating behavior. Thus, the technology focused on health education, mentioned above, was developed, which is not restricted to the informative role, but had as its main function to generate autonomy, which implies, in addition to knowledge, the development of skills and attitudes. It is necessary to adopt a communication style centered on the patient, considering their preferences, their level of literacy and cultural barriers that can influence care (Racgp, 2016).

Through the perspective of the organization of lines of care, health education can be mediated by the use of health technologies, defined as a set of products designed to consolidate the work process in health, which can be soft or hard (Lisboa; Santos; Lima, 2017).

CONCLUSION

The analysis of anthropometric and biochemical data of insulin-dependent diabetic patients revealed important trends in the control and management of the disease throughout the consultations. Initially, most patients had a stable average height, but there were variations in weight and body mass index, with a reduction until the fourth consultation and an increase in the fifth.

Biochemically, a significant reduction in fasting glucose and total cholesterol levels was observed throughout the consultations, suggesting an improvement in metabolic control. However, systolic blood pressure showed great variation, indicating the need for more rigorous monitoring. These findings highlight the importance of continuous and individualized monitoring to optimize results in the management of DM.

Furthermore, this study demonstrated the benefits of a health technology in assisting with glycemic control in insulin-dependent patients, as it was demonstrated that patients, through regular use of the Illustrated Food Plan, associated with other control measures, obtained results of better adherence to treatment due to greater understanding of the food plan, proven by improvements in anthropometric measurements and laboratory test results.

REFERENCES

ALMEIDA, Jenifer Souza de et al. Efeito da assistência ambulatorial nutricional sobre a qualidade de vida de pacientes com diabetes mellitus tipo 1. Brazilian Journal of Health Review, v. 5, n. 1, p. 1322-1334, 2022. Disponível em: https://doi.org/10.34119/bjhrv5n1-115

ALMEIDA, Jéssica Santos de; DE ALMEIDA, Janie Maria. A educação em saúde e o tratamento do diabetes mellitus tipo 2 em uma unidade de família. Revista da Facul- dade de Ciências Médicas de Sorocaba, v. 20, n. 1, p. 13-17, 2018. Disponível em: https://doi.org/10.23925/1984-4840.2018v20i1a4

ALSHAYBAN, Dhfer; JOSEPH, Royes. Health-related quality of life among patients with type 2 diabetes mellitus in Eastern Province, Saudi Arabia: A cross-sectional study. PloS one, v. 15, n. 1, p. e0227573, 2020. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6953887/

BOAS, Lilian Cristiane Gomes-Villas; FOSS-FREITAS, Maria Cristina; PACE, Ana Emilia. Adesão de pessoas com diabetes mellitus tipo 2 ao tratamento medicamentoso. Revista Brasileira de Enfermagem, v. 67, p. 268-273, 2014. Disponível em: https://www.scielo.br/j/reben/a/VMNFsyGz3dR67L455HNQF6s/

BRASIL. Ministério da Saúde (BR). Secretaria de Vigilância à Saúde. Secretaria de Atenção à Saúde. Política Nacional de Promoção da Saúde: PNaPS: revisão da Por- taria MS/GM nº 687, de 30 de março de 2006. Brasília: Ministério da Saúde; 2014. https://bvsms.saude.gov.br/bvs/publicacoes/pnps_revisao_portaria_687.pdf

DIAS, Rui Jorge. Contagem de hidratos de carbono por aplicações móveis: relação com o controlo glicémico em diabéticos tipo 1 com e sem bomba infusora de insulina. 2022. https://repositorio-aberto.up.pt/bitstream/10216/141367/2/561523.pdf

ESTRELA, Kelly Cristina Araujo et al. Adesão às orientações nutricionais: uma revisão de literatura. Demetra: alimentação, nutrição & saúde, v. 12, n. 1, p. 249-274, 2017. Disponível em: https://www.e-publicacoes.uerj.br/demetra/article/view/22407

FERREIRA, J. C. V. et al. Qualidade de vida e condições de saúde de pacientes com hipertensão arterial e diabetes mellitus. Enfermagem em Foco, v. 12, n. 1, 2021. Disponível em: https://doi.org/10.21675/2357-707X.2021.v12.n1.3305 Acesso em: 15 set. 2022.

FRISANCHO, A. R. (Ed.). Anthropometric standards for the assessment of growth and nutritional status. Ann Arbor: University of Michigan Press, 1990.

GONÇALVES, Aghata Christie dos Anjos; BONDAN, Luiz Eduardo. Percepção da qualidade de vida em pacientes com diabetes mellitus do programa HIPERDIA da Secretaria Municipal de Saúde do município de Videira SC. Seminário de Iniciação Científica e Seminário Integrado de Ensino, Pesquisa e Extensão, p. e28383- e28383, 2021. Disponível em: https://unoesc.emnuvens.com.br/siepe/article/download/28383/16467

IDF. International Diabetes Federation. IDF Diabetes Atlas. 6a ed. Brussels: International Diabetes Federation. 2014. Disponível em: http://www.idf.org/diabetesatlas Acesso: 01 de novembro de 2021.

JANINI, J. P.; BESSLER, D.; VARGAS, A. B.. Educa- ção em saúde e promoção da saúde: impacto na qualidade de vida do idoso. Saúde em Debate, v. 39, p. 480-490, 2015. Disponível em: https://www.scielo.br/j/sdeb/a/qVjRZj8TT8dGsXgzZySX6pg/?lang=pt

LISBOA, N. A.; SANTOS, N. F.; LIMA, E. I. A importância das tecnologias leves no processo de cuidar na Atenção Primária em Saúde. Textura, v. 10, n. 19, p. 164-171, 2017. Disponível em: https://textura.emnu-ens.com.br/textura/article/view/53 Acesso em: 15 set. 2022.

LOUZADA, M. L. C. et al. Consumption of ultra-processed foods in Brazil: distribution and temporal evolution 2008–2018. Revista de Saúde Pública [online]. v. 57 [Acessado 4 Julho 2024] , 12. Disponível em: https://doi.org/10.11606/s1518-8787.2023057004744

MAEYAMA, M. A. et al. Aspectos relacionados à dificuldade do controle glicêmico em pacientes com Diabetes Mellitus tipo 2 na Atenção Básica. Brazilian Journal of Development, v. 6, n. 7, p. 47352-47369, 2020. Disponível em: https://www.brazilianjournals.com/index.php/BRJD/article/download/13278/11156 Acesso em: 15 set. 2022.

MAKROUM, Mohammed Amine et al. Machine learning and smart devices for diabetes management: Systematic review. Sensors, v. 22, n. 5, p. 1843, 2022. Disponível em: https://pubmed.ncbi.nlm.nih.gov/35270989/

MUZY, Jéssica et al. Prevalência de diabetes mellitus e suas complicações e caracterização das lacunas na atenção à saúde a partir da triangulação de pesquisas. Cader- nos de Saúde Pública, v. 37, 2021. Disponível em: https://www.scielo.br/j/csp/a/B9Fhg54pjQ677YVx9g3mHwL/?format=html

PEREIRA, B.; ALMEIDA, M. A. R. A importância da equipe de enfermagem na prevenção do pé diabético. Revista JRG de Estudos Acadêmicos, v. 3, n. 7, p. 27- 42, 2020. Disponível em: https://revistajrg.com/index.php/jrg/article/view/34

RACGP, The Royal Australian College of General Practitioners. Curriculum for Australian General Practice 2016 –CS16 Core skills unit. East Melbourne, Victoria. Austrália: RACGP, 2016. Disponível em: https://www.racgp.org.au/download/Documents/Curriculum/2016/core-skills-unit_v10.pdf Acesso em: 20 mai. 2022.

SBD (SOCIDADE BRASILEIRA DE DIABETES). Manual de Contagem de Carboi- dratos para pessoas com diabetes. Departamento de Nutrição da Sociedade Brasi- leira de Diabetes. Disponível em http://www.diabetes.org.br/publico/images/manual- de-contagem-de-carboidrato2016.pdf Acesso em: 11 set. 2022.

SOUSA, Á. A. D. et al. Validação do instrumento reduzido Diabetes-21 para avaliação da qualidade de vida relacionada à saúde em pessoas com diabetes. Epidemiologia e Serviços de Saúde, v. 31, n. 1, p. 01-18, 2022. Disponível em: https://doi.org/10.1590/S1679-49742022000100004 Acesso em: 15 set. 2022.

TONETTO, I. F. D. A., et al. Quality of life of people with diabetes mellitus. Revista da Escola de Enfermagem da USP, 53. 2019. Disponível em: https://www.revistas.usp.br/reeusp/article/view/155609

WHO. World Health Organization. Body Mass Index. 2000. Disponível em: https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/body-mass-index

ZURITA-CRUZ, Jessie N. et al. Health and quality of life outcomes impairment of qua- lity of life in type 2 diabetes mellitus: a cross-sectional study. Health and quality of life outcomes, v. 16, n. 1, p. 1-7, 2018. Disponível em: https://pubmed.ncbi.nlm.nih.gov/29764429/.