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MOTIVATION AND PERCEIVED CHANGES FOLLOWING A FOOD AND NUTRITION EDUCATION INTERVENTION BASED ON THE DEGREE OF FOOD PROCESSING FOR THE MANAGEMENT OF TYPE 2 DIABETES MELLITUS

MOTIVAÇÃO E MUDANÇAS PERCEBIDAS APÓS UMA INTERVENÇÃO DE EDUCAÇÃO ALIMENTAR E NUTRICIONAL BASEADA NO GRAU DE PROCESSAMENTO DOS ALIMENTOS PARA O MANEJO DO DIABETES MELLITUS TIPO 2

MOTIVACIÓN Y CAMBIOS PERCIBIDOS TRAS UNA INTERVENCIÓN DE EDUCACIÓN ALIMENTARIA Y NUTRICIONAL BASADA EN EL GRADO DE PROCESAMIENTO DE LOS ALIMENTOS PARA EL MANEJO DE LA DIABETES MELLITUS TIPO 2

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ABSTRACT

To explore motivations and perceived changes after Food and Nutrition Education (FNE) intervention based on the degree of food processing among individuals with type 2 diabetes mellitus (T2DM) and its implications for glycemic control. Qualitative study included two Focus Groups (FG) with 12 individuals with T2DM, aged 20–70 years, assisted by Primary Health Care and enrolled in a 16-week clinical trial involving FNE intervention. The FGs followed a semi-structured guide, were audio-recorded, fully transcribed, and analyzed via Bardin's content analysis. Data collection ceased upon thematic saturation. Most participants were women (75%). Knowledge acquisition was the most frequently reported motivation for participation in the activities (FG1: 72.7%; FG2: 50%). The themes most frequently identified in FG1 were "optimizing time in the kitchen" and "making full use of food" (35.3%), whereas "the meaning of eating" emerged as the predominant theme in FG2 (41.6%). Regarding perceived changes in daily life, greater confidence in food choices (23.5%) and increased knowledge (23.5%) emerged in FG1, while changes in food consumption practices were more frequently reported in FG2 (25.7%). Participants perceived that the FNE intervention increased their knowledge about food processing and diabetes, supporting disease self-management.

KEYWORDS: *Type 2 Diabetes Mellitus. Primary Health Care. Food and Nutrition Education. Processed Food. Qualitative Research.*

RESUMO

Explorar as motivações e as mudanças percebidas após uma intervenção de Educação Alimentar e Nutricional (EAN) baseada no grau de processamento dos alimentos entre indivíduos com diabetes mellitus tipo 2 (DM2) e suas implicações no controle glicêmico. Estudo qualitativo que incluiu dois Grupos Focais (GF) com 12 indivíduos com DM2, com idades entre 20 e 70 anos, acompanhados pela Atenção Primária à Saúde e incluídos em um ensaio clínico de 16 semanas envolvendo um programa de EAN.

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Os grupos focais seguiram um roteiro semiestruturado, foram gravados em áudio, transcritos integralmente e analisados por meio da análise de conteúdo de Bardin. A coleta de dados foi encerrada após saturação temática. A maioria dos participantes era do sexo feminino (75%). A aquisição de conhecimento foi a motivação mais frequentemente relatada para participação nas atividades (GF1: 72,7%; GF2: 50%). Os temas mais frequentemente identificados no GF1 foram "otimização do tempo na cozinha" e "aproveitamento integral dos alimentos" (35,3%), enquanto "o significado de comer" emergiu como tema predominante no GF2 (41,6%). Em relação às mudanças percebidas no cotidiano, maior confiança nas escolhas alimentares (23,5%) e aumento do conhecimento (23,5%) foram observados no GF1, enquanto mudanças nas práticas de consumo alimentar foram mais frequentemente relatadas no GF2 (25,7%). Os participantes perceberam que a intervenção de EAN aumentou o conhecimento sobre processamento de alimentos e diabetes, apoiando o autocuidado da doença.

PALAVRAS-CHAVE: Diabetes Mellitus Tipo 2. Atenção Primária à Saúde. Educação Alimentar e Nutricional. Alimento Processado. Pesquisa Qualitativa.

RESUMEN

Explorar las motivaciones y los cambios percibidos tras una intervención de Educación Alimentaria y Nutricional (EAN) basada en el grado de procesamiento de los alimentos en individuos con diabetes mellitus tipo 2 (DM2) y sus implicaciones en el control glucémico. Estudio cualitativo que incluyó dos grupos focales (GF) con 12 individuos con DM2, de entre 20 y 70 años, atendidos en la Atención Primaria de Salud y participantes de un ensayo clínico de 16 semanas que incluyó intervenciones de Educación Alimentaria y Nutricional (EAN). Los grupos focales siguieron una guía semiestructurada, fueron grabados en audio, transcritos íntegramente y analizados mediante el análisis de contenido de Bardin. La recolección de datos finalizó tras la saturación temática. La mayoría de los participantes fueron mujeres (75%). La adquisición de conocimientos fue la motivación más frecuentemente reportada para la participación en las actividades (GF1: 72,7%; FG2: 50%). Los temas más frecuentemente identificados en el GF1 fueron "optimización del tiempo en la cocina" y "aprovechamiento integral de los alimentos" (35,3%), mientras que "el significado de comer" emergió como el tema predominante en el GF2 (41,6%). En cuanto a los cambios percibidos en la vida cotidiana, una mayor confianza en las elecciones alimentarias (23,5%) y un aumento del conocimiento (23,5%) se observaron en el GF1, mientras que los cambios en las prácticas de consumo alimentario fueron más frecuentemente reportados en el GF2 (25,7%). Los participantes percibieron que la intervención de EAN aumentó el conocimiento sobre el procesamiento de alimentos y la diabetes, apoyando el autocuidado de la enfermedad.

PALABRAS CLAVE: *Diabetes Mellitus Tipo 2. Atención Primaria de Salud. Educación Alimentaria y Nutricional. Alimento Procesado. Investigación Cualitativa.*

1. INTRODUCTION

Health education within Primary Health Care (PHC) is effective in enhancing glycemic control in individuals with Type 2 Diabetes Mellitus (T2DM) (Botes; Majikela-Dlangamandla; Mash, 2013; Chrvala; Sherr; Lipman, 2016). However, the success of these interventions is deeply intertwined with lifestyle and psychosocial variables, sociodemographic factors, and the structure of health care services (Anthony *et al*., 2012; Fort *et al*., 2013; Odgers-Jewell *et al*., 2017), which can act as either barriers or facilitators to how patients adhere to disease self-management and Food and Nutrition Education (FNE) programs (Fort *et al*., 2013).

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Previous studies have shown that FNE interventions improve individuals' perceptions of the fundamental role of dietary choices in achieving optimal glycemic control (Chen *et al*., 2014; Dehghan *et al*., 2024; Tete *et al*., 2021). However, there is no standard regarding behavioral approaches, whether interventions target individuals or communities, or the duration of the intervention (Shiferaw *et al*., 2021). Interventions focused on the degree of food processing are essential for promoting knowledge and empowering individuals to identify and prioritize whole foods over ultra-processed products, which are nutritionally unbalanced and contain high levels of artificial additives (Brasil, 2014; Bortolini *et al*., 2019).

An approach to the FNE based on the NOVA classification, which categorizes foods into unprocessed or minimally processed, processed culinary ingredients, processed, and ultra-processed (Monteiro *et al*., 2016), is supported by evidence showing that dietary patterns characterized by a higher contribution of foods with lower degrees of processing are associated with better metabolic outcomes (Carvalho *et al*., 2020; Santos *et al*., 2023). Conversely, increased consumption of ultra-processed foods is associated with adverse outcomes, including poorer metabolic control, cardiovascular outcomes, and increased mortality (Chen *et al*., 2020; Schnabel *et al*., 2019; Micha *et al*., 2017).

Dietary changes grounded in Cognitive-Behavioral Theory (Lang; Ciacchi, 2021) may contribute to improved dietary self-management behaviors among individuals with T2DM. Therefore, exploring the qualitative dimensions of perceptions and understanding among individuals with T2DM through an interpretive approach (Swift; Tischler, 2010; Liu *et al*., 2018) allows for a deeper comprehension of the meanings and desires they attribute to their experiences (Hill; Ellis; Gillison, 2022). This, in turn, helps identify barriers to adherence to educational interventions and, consequently, to effective disease management (Schäfer *et al*., 2014).

In this context, the present study explores the experiences of individuals with T2DM who participated in a randomized clinical trial (RCT), analyzing their involvement in an FNE program focused on improving food choices based on the degree of food processing for diabetes management. By capturing the participants' perspectives, it seeks to deepen the understanding of the mechanisms through which FNE programs can promote meaningful dietary changes and contribute to better glycemic control.

2. METHODS

2.1. Study design

This study comprises a qualitative analysis nested within an RCT conducted with adults and older adults diagnosed with T2DM. All participants were registered in PHC services within the Brazilian Unified Health System (SUS) in Aracaju, Sergipe, Brazil.

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The study was approved by the Research Ethics Committee of the Federal University of Sergipe (Opinion No. 5,173,073) and conducted in accordance with the Declaration of Helsinki. All participants provided written informed consent. This study was reported following the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines (Tong; Sainsbury; Craig, 2007).

2.2. Eligibility Criteria and FNE Intervention Protocol

Eligibility criteria included adults and older adults aged 20–70 years, of both sexes, with a previous diagnosis of T2DM and registered at Basic Health Units. Exclusion criteria comprised participation in FNE or other nutritional interventions, pregnancy, enteral nutrition, recent surgery, and conditions affecting food intake, including head and neck cancer, HIV infection, and chronic obstructive pulmonary disease.

Participants were randomly assigned (stratified by sex and age) to an intervention or control group. The intervention group received standard PHC care plus FNE activities and materials on food processing, while the control group received conventional PHC care only. Simple randomization was performed via Randomize® software, selecting 10 Basic Health Units to ensure geographic representativeness across Aracaju city.

The FNE intervention was organized into four cycles, totaling eight sessions (Table 1). The sessions were conducted in selected Basic Health Units every two weeks, each lasting 60 minutes, over a follow-up period of 16 weeks. The FNE intervention included theoretical and practical content delivered through dynamic, interactive strategies to facilitate learning, alongside the provision of educational materials.

These activities were developed based on the *Dietary Guidelines for the Brazilian Population* (Brasil, 2014) and the reference framework for FNE intervention (Brasil, 2012), complemented by nutritional recommendations from major guidelines for the management of T2DM (Ramos *et al*., 2023; Elsayed *et al*., 2023). Cognitive-behavioral therapy was used as the primary educational approach, as behavioral change was a central objective of the FNE activities (Lang; Ciacchi, 2021).

2.3. Sociodemographic characterization

A structured questionnaire was administered to collect information on demographic and socioeconomic characteristics, ethnic or racial background, duration of T2DM diagnosis, type of treatment, and comorbidities.

Table 1. Summary of the thematic content covered in the nutritional education interventions

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Cycles	Objectives
Cycle 1 - The Food Guide for the care of T2DM	
Intervention 1	To present the Dietary Guidelines for the Brazilian Population and clarify the degrees of food processing and their implications for diabetes management and control.
Intervention 2	To relate carbohydrate classification—considering the degree of food processing—with glycemic control in T2DM.
Cycle 2 - Peel more, unwrap less	
Intervention 3	To address nutritional labeling, emphasizing food identification according to the degree of processing by the NOVA classification.
Intervention 4	To present the concepts of diet, light, and zero-calorie foods, demonstrating the nutrient quantities in modified foods compared to their traditional versions.
Cycle 3 - The Cost of Food	
Intervention 5	To present the differences in cost and nutritional value among foods according to their degree of processing.
Intervention 6	To address distinct strategies for reducing the degree of food processing in the diet.
Cycle 4 - Time for Your Meal	
Intervention 7	To relate time spent on food-related activities to the degree of food processing.
Intervention 8	To present the methods and advantages of total food utilization, encouraging full sensory awareness when eating.

Abbreviation: T2DM, Type 2 diabetes mellitus

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2.4. Focus group

Perceptions of the FNE intervention, including experiences and expectations, were explored using a face-to-face focus group (FG) methodology, conducted by a trained female nutritionist with experience in qualitative research. The researcher was part of the team responsible for implementing the FNE activities within the intervention.

Participants were included if they attended at least 50% of the meetings. The sample size for the qualitative analysis followed literature recommendations suggesting four to 15 participants (Gondim, 2002; Iervolino; Pelicioni, 2001; Trad, 2009). Participants were allocated to two focus groups (FG1 and FG2) based on the geographical location of basic health units to facilitate travel.

The FG discussions were audio-recorded using voice recording applications and lasted approximately 60-90 minutes each, in a private and quiet room within the Basic Health Units, in an environment free from interruptions. The semi-structured interview guide included questions exploring participants' experiences and expectations regarding the FNE activities: (a) "What motivated you to participate in the meetings?"; (b) "Which theme did you like most?"; and (c) "Did you notice any changes in your daily life after participating in the meetings?". Data collection continued until thematic saturation was reached.

2.5. Data analysis

Following the FG sessions, audio recordings were transcribed based on standards by Onwuegbuzie et al. (2009) (Supplementary Table 1), using Descript® for transcription and Express Scribe for audio review. Once the text corpus was constructed, content analysis was conducted manually following Bardin's approach (Bardin, 1977).

A preliminary floating reading was performed for pre-analysis, followed by material exploration. Sentences and meaningful excerpts served as units of analysis for coding, where identified keywords led to initial categorization (Trad, 2009). An inductive-deductive approach combined predefined literature categories with themes emerging from the data. Codes were organized into recording units based on keywords for initial categorization, then refined into intermediate and final thematic groupings (Silva; Gobbi; Simão, 2011). To enhance rigor, two researchers independently analyzed each stage, resolving discrepancies through consensus. Analyses also compared pre-existing categories, considering their similarities and differences. Additionally, the frequencies of emerging themes were quantified as percentages (Silva; Fossá, 2015) and used exclusively as descriptive information to indicate the recurrence of themes identified in participants' narratives. These values were considered complementary information to support the interpretation of qualitative findings, considering the exploratory nature of the study.

In the Results section, participants were identified using alphanumeric codes (where 'ED' represents the participant's unique ID) followed by the FG number to ensure anonymity. Sociodemographic characteristics are presented as means, standard deviations (SD), and

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relative frequencies. Excel® software was used for data tabulation of numerical variables and initial organization of qualitative data.

3. RESULTS

Out of the 31 individuals who participated in at least 50% of the FNE intervention within the RCT, 16 individuals were invited to participate in two FGs, with eight participants assigned to each group. However, four individuals from FG1 did not attend. Thus, 12 individuals participated, distributed between FG1 (n=4) and FG2 (n=8). All participants had attended at least 60% of the FNE intervention sessions before participating in the focus groups.

The FG participants were predominantly women (75%) and individuals who self-identified as *pardos* (mixed race, 75%). Most families earned between one and three minimum wages (92%), and over a third of the participants had not completed primary education (33%). The average time since T2DM diagnosis was 5.2 years (SD: 3.3). Regarding health status and management, hypertension (83%) and dyslipidemia (50%) were the most prevalent comorbidities, and the use of oral antidiabetic medications, either alone (42%) or combined with diet (42%), was the standard treatment for the majority of the participants (data not shown).

Intermediate and final categories emerged from the analysis of the participants' discourses regarding the research questions, as shown in Table 2. The first question, “What motivated you to participate in the FNE action meetings?”, yielded three final categories in FG1 and four in FG2, with the category “Knowledge” being common to both groups. The quotes that best illustrate these categories are presented below:

Knowledge

"It's... curiosity, right? I had many questions regarding nutrition. We hear so many myths like, 'Oh, now you can't eat this,' or 'now you can't eat that.' 'Oh, you're deprived of such things,' 'you're forbidden to eat that,' right? We hear a lot of things, so when the opportunity came, [I thought], 'I'll see what it's all about.' And I was very well received." (ED50–FG1)

Social and emotional support

"I had to come [all the way] from Ceará because I knew [the researcher's name] would call, right? Look... my wife answered [the phone] and said, 'Look, the girls called, are you going to go?' So I said, 'I am! I'll do everything I can to get there.' That's why [I had] this motivation... you know? Several times I was traveling, but I made sure to come." (ED11–FG1)

Dissemination of knowledge

"Now, one thing I liked about you all was that whatever you conveyed to me here, I passed on to my family. And my entire family got [the information] step-by-step. In fact, for every

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single recipe you provided on the calendar, they all made a copy and kept it at home." (ED120–FG1)

Social experiences during the intervention

"And [it was a way] to distract myself as well, because being there is a distraction; you're talking, you're chatting among friends. It's very good, very enjoyable, isn't it?" (ED83–FG2)

Educational support

"The material that we take home is good so that we can read it from time to time, right? [...] because the time we spend with them is very brief. But they gave us very important material, [and] if we get home and look [at it]..." (ED24–FG2)

For the second question, “Which theme did you like the most?”, Cycle 4 was the most frequently mentioned in both groups. Specifically, the theme “Time optimization in the kitchen” was the favorite for FG1, whereas for FG2, it was “Total Food Utilization and the Senses of Eating.” However, all cycles were highlighted by the participants."

Cycle 1

"I... became more interested, I think I... identified more with the discovery of fresh, processed, right? And ultra-processed foods. There was a clear difference, and I used to have a lot of doubts about it..." (ED50–FG1)

Cycle 2

"Yeah... I didn't have this habit, and I learned [it] from you all, and today... well... I usually check [the labels]. [...] 'Look, don't buy that brand because... there are things [in it] you can't have.' [...] Because of the label, I learned from you all how to read [them], to know what is allowed and what is not." (ED4–FG1)

Cycle 3

"I liked the one about the supermarket." (ED71–FG1)

Cycle 4

"I liked all of them in general. But to put it simply: I liked the senses of eating..." (ED24–FG2)

All

"I liked all of them. I was looking here at the interventions and trying to think about the one I liked the least [(background noise)]. It was marvelous! Everything was like that—everything was interesting for our daily lives, for our learning. Each one complemented the other, so I can't say which one was the best or which one was the worst; I think they were ALL very important." (ED69–FG2)

The difference in the groups' discourse was more noticeable regarding the third question: “Did you notice any changes in your day-to-day life after participating in the meetings?” For this

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question, both the intermediate and final categories were partially distinct, including in terms of quantity; FG1 yielded seven final categories, whereas FG2 yielded 11. In Group 1, the main changes reported fell into the categories “Confidence in food choices” and “Knowledge,” while for Group 2, the predominant category was “Change in food consumption.”

Diet Adaptation in the Family Routine

"Most of the time, [people with diabetes] can't, um... eat or buy food according to their needs. So, we have to learn from you all how to adapt. That's what happens in my house... um... I have to adapt things so that I can eat without sacrificing the others, who aren't [diabetic], right?" (ED4–FG1)

Whole food utilization

"[...] but one [thing] that really resonated with me was recycling certain foods—[like] carrot peels, um... like making [something] from stems, all those things you all taught me. What I [actually] make are those... potato chips... baked, cassava chips, you know? Those little things. That's what resonated with me, things I didn't do before." (ED120–FG1)

Knowledge

"Many things were clarified, right? A lot of things that I was afraid to eat, [so] I didn't eat them, right? [...] Today I already know what I can eat and what I can't [...]" (ED50–FG1)

Development of food-related awareness and autonomy

"I became more [mindful] about eating, you know, regarding... because sometimes I ate more with my eyes. Sometimes I wasn't [even] hungry, I ate more with my eyes, like... as if I were anxious. I saw it, I wanted it, I ate. After our meetings, I became more educated." (ED71–FG2)

Introduction of Label Reading

"[...] shopping... I'm going to do the shopping, right? Something I didn't do [before], and today I go, I arrive, and I observe, [I] pick... Before, I used to say: 'I'll take this one because it's affordable,' [and] just like that, [(background noise)] it has a wonderful price. Not today; today I look." (ED120–FG1)

Changes in dietary practices

"I used to eat everything, but now I eat properly: my vegetables, my fruits..." (ED70–FG2)

Diabetes management

"There are times when I wake up like this... I went to the doctor here last week, [and] I myself saw that it's dropping—[my] blood sugar—too much. So I already reduced [by] one tablet; it was three, [and] now I'm taking two because it was dropping too much." (ED71–FG2)

Food choice autonomy

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"And today, [...] we already have greater confidence because we have better knowledge. With you all, we learned to clear up many doubts, as Ms. ED50 said, and that brings greater confidence." (ED4–FG1)

Table 2. Percentage distribution of response categories emerging from the discourses.

Questions	Focus Group 1			Focus Group 2		
	Final Category	Intermediate Category	N (%)	Final Category	Intermediate Category	N (%)
What motivated you to participate in the meetings of the FNE intervention?	Knowledge	1. Knowledge about nutrition 2. Seeking more knowledge	8 (72.7)	Knowledge	1. Knowledge about nutrition 2. Knowledge about T2DM 3. Willingness to learn 4. Desire to learn more	9 (50.0)
	Positive experiences with the intervention	1. Affective environment 2. Commitment to the researchers	2 (18.2)	Social and emotional support	1. Affective and social interaction 2. Affective bond	3 (16.7)
	Dissemination of knowledge	1. Knowledge transfer to others	1 (9.1)	Social experiences during the intervention	1. Social interaction	4 (22.2)
				Educational support	1. Educational materials	2 (11.1)
What theme did you like the most?	Cycle 1	1. Degree of processing 2. Processing of carbohydrates	4 (23.5)	Cycle 1	1. Degree of processing 2. Processing of carbohydrates	4 (16.7)
	Cycle 2	1. Nutritional labeling	5 (29.4)	Cycle 2	1. Nutritional labeling 2. Diet, light, and zero foods	4 (16.7)
	Cycle 3	1. Cost of food	2 (11.8)	Cycle 3	1. Cost of food	2 (8.3)
	Cycle 4	1. Time optimization in the kitchen 2. Total food utilization	6 (35.3)	Cycle 4	1. Total food utilization and the senses of eating	10 (41.6)
				All	All	4 (16.7)

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Questions	Focus Group 1			Focus Group 2		
	Final Category	Intermediate Category	N (%)	Final Category	Intermediate Category	N (%)
Did you notice any changes in your daily life after participating in the meetings?	Diet Adaptation in the Family Routine	1. Adaptation of meals in the Family routine	1 (5.9)	Adaptation in food storage	1. Changes in food storage practices 2. Change in food preservation	3 (8.6)
	Adaptation in food storage	1. Changes in food storage practices	1 (5.9)	Knowledge	1. Knowledge about nutrition	3 (8.6)
	Knowledge	1. Learning healthy recipes 2. Knowledge about nutrition	4 (23.5)	Development of food-related awareness and autonomy	1. Awareness of food consumption 2. Perception of dietary reeducation	5 (14.3)
	Whole food utilization	1. Total food utilization	1 (5.9)	Improvement in biochemical parameters	1. Glycemic control 2. Reduction in biochemical parameters	3 (8.6)
	Introduction of label reading	1. Introduction of label reading into the routine	3 (17.6)	Weight loss	1. Weight loss	5 (14.3)
	Acquired perceptions	1. Better perception of sensory senses 2. Perception of increased youthfulness 3. Perception of an inadequate habit	3 (17.6)	Changes in food management practices	1. Food hygiene practices	1 (2.9)
	Food choice autonomy	1. Confidence in food choices	4 (23.5)	Changes in dietary practices	1. Improvement in nutritional quality 2. Change in the quality and quantity of food 3. Change in food consumption 4. Reduction in food consumption	9 (25.7)

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Questions	Focus Group 1			Focus Group 2		
	Final Category	Intermediate Category	N (%)	Final Category	Intermediate Category	N (%)
					5. Reduction in alcohol consumption	
				Changes in physical activity practices	1. Improvement in exercise routine	1 (2.9)
				Changes in food-related practices	1. Change in food shopping routine	1 (2.9)
				Changes in food routine	1. Organization of meals 2. Organization of meal times	3 (8.7)
				Diabetes management	1. Reduction in the use of prescribed medications	1 (2.9)
				Changes in food management	1. Adjustment in food storage 2. Change in food storage and preservation	3 (8.6)

Abbreviations: n, number; T2DM, type 2 diabetes mellitus.

4. DISCUSSION

The experiences of individuals with T2DM revealed that knowledge, confidence in food choices, and positive changes in dietary consumption were attributed to participation in FNE based on the degree of food processing. This was influenced by participants' individual experiences and prior knowledge.

The quest for enhanced knowledge to comprehend T2DM, nutrition, or simply the "desire to learn more" served as motivation for participants of the FG to attend the meeting of FNE interventions. Similarly, Rygg et al. (2010) observed that a lack of information prompted participation in health education initiatives. Insecurity regarding disease knowledge significantly affected T2DM self-management activities, including dietary practices, social engagement, and medication utilization (Rygg *et al*., 2010).

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Conversely, other studies indicate that prior knowledge, specifically within the context of "feeling adequately informed", can deter participation in health education. Additional barriers include unsuitable teaching methods, lack of time, poor health status, lack of encouragement from healthcare teams, and unfavorable locations (Hill; Ellis; Gillison, 2022; Sharifi *et al*., 2022). On the other hand, geographical proximity facilitates attendance (Hill; Ellis; Gillison, 2022), emphasizing the need to adapt interventions to regional characteristics.

Regarding the FNE themes, participants particularly favored topics such as label reading, food products, total food utilization, and recommendations from the food guide. According to the participants, these subjects are rarely discussed by healthcare professionals during routine diabetes monitoring at Basic Health Units.

In this regard, a study conducted with PHC professionals pointed out that they encountered difficulties in conducting health education due to a lack of nutritional knowledge (Pava-Cárdenas *et al*., 2018) and unfamiliarity with pedagogical methodologies (Maia *et al*., 2013). Consequently, literature emphasizes the need for professional training in educational initiatives as well as the integration of nutritionists into these primary care settings (Peterson *et al*., 2015; Carter *et al*., 2022).

Regarding educational approaches, it is essential to move beyond treating individuals as passive listeners, encouraging active interaction with healthcare professionals to the co-construction of knowledge (Bross *et al*., 2022). This dynamic was clearly observed in our study, where social interaction emerged as a pivotal element of the educational actions, as emphasized by the interviewed volunteers.

Methodological aspects of FG design are widely discussed in terms of facilitation, guided versus voluntary participation, the number of participants, and the impact of these variables on content analysis (Tong; Sainsbury; Craig, 2007; Onwuegbuzie *et al*., 2009). Larger focus groups, for example, may offer greater diversity of perspectives, longer duration, and a lower capacity for saturation, whereas smaller groups may contribute to more in-depth and complex individual discussions (Menold; Tausch, 2016). In our study, despite the difference in the number of participants between the groups, all participants had direct experience with the intervention and actively participated in the discussion; the focus group generated sufficiently rich data to address the study's objectives.

Given the topic's complexity, understanding participant priorities and needs is essential (Hill; Ellis; Gillison, 2022) to effectively apply nutritional guidance tools that positively influence food choices (Tramontt *et al*., 2021). Consequently, utilizing diverse technologies, adapted communication, and playful strategies, such as group dynamics, games, and interactive materials, enhances learning and overall experiences (Chen *et al*., 2014). The narratives in our

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study highlight the demand for educational resources featuring clear and accessible language, as illustrated by participant ED24 (FG2), who noted, "...*But they gave us very important material*..."

Furthermore, exploring perceptions regarding FNE intervention helps identify how the applied strategies contribute to strengthening adherence and establishing affective bonds within the group and with researchers. Group-based education prioritizes collective knowledge construction, strengthens bonds with healthcare professionals (Chen *et al*., 2014), allows participants to recognize similarities in their experiences of living with diabetes, and fosters a desire for social connection (Allory *et al*., 2020).

Professionals should remain attentive to the inclusion and adaptation of educational actions to overcome existing barriers (Allory *et al*., 2020; Ockleford *et al*., 2008). These literature findings align with our study, where an "affective environment" and "affectionate and social interaction" emerged as distinct categories that also served as motivations for attending the educational sessions.

A similar study evaluating FNE intervention through FGs with T2DM individuals showed that participation led to weight changes, improved glycemic control, reduced medication, increased self-confidence, and positive behavior changes (e.g., better dietary intake, label reading, exercise, and organized meals) (Dasgupta *et al*., 2014). These changes were also acknowledged by the participants in the current study.

Study limitations include not explicitly questioning participants about barriers faced during the sessions. Furthermore, it is important to acknowledge a potential source of bias, since the researcher who conducted the qualitative interviews was also responsible for implementing the FNE interventions. On the other hand, the relationship of trust that was established may have facilitated open communication and more focused narratives. To minimize these influences, a semi-structured interview guide was used, the interviews were recorded and transcribed, and the analysis was conducted collaboratively by two other researchers to enhance analytical rigor and reflexivity. The strength of this study lies in its novelty, as it is the first qualitative study on the perceptions of individuals with T2DM regarding FNE initiatives focused on the degree of food processing.

The results of this study show that patients' knowledge of food processing and healthier eating habits can promote better dietary choices and, consequently, contribute to improved glycemic control. Combined with quantitative data, these findings underscore the need for innovative PHC strategies that consider population characteristics, empowering individuals as primary agents of their care and fostering dietary autonomy aligned with clinical treatment. Prioritizing FNE based on the degree of food processing as a central pillar can strengthen health services by improving diabetes self-management, thereby contributing to the reduction of metabolic complications and healthcare costs.

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CONCLUSION

Participants perceived FNE intervention as an opportunity to acquire nutrition knowledge, develop autonomy in their food choices, and strengthen self-management practices. Exploring their perceptions was essential to understanding how this strategy may contribute to raising awareness about the degree of food processing and supporting healthier dietary practices. Furthermore, participants' narratives highlight that individuals with T2DM may benefit from access to high-quality, evidence-based information to reduce uncertainties related to self-management and support more autonomy in making food choices aligned with clinical treatment. These findings emphasize the critical importance of integrating educational practices that address food processing within PHC; however, further studies using quantitative and longitudinal approaches are needed to assess their effects on clinical outcomes, including glycemic control.

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