Pharmacotherapeutic follow-up of patients with type 2 diabetes: Application of the

Dáder method in primary health care

Acompanhamento farmacoterapêutico de pacientes com diabetes tipo 2: Aplicação do método

Dáder na atenção primária à saúde

Seguimiento farmacoterapéutico de pacientes con diabetes tipo 2: Aplicación del método Dáder en la atención primaria de salud

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Abstract

Introduction: Type 2 diabetes mellitus (T2DM) is a prevalent chronic disease in primary healthcare (PHC) and is often associated with poor treatment adherence and unsatisfactory clinical outcomes. Objective: To assess the impact of a structured pharmacotherapeutic follow-up based on the Dáder method on the clinical indicators of patients with T2DM in Family Health Strategy (FHS) units. Methods: This was a prospective, longitudinal, and quantitative study involving 21 patients diagnosed with T2DM, assisted by a resident pharmacist in two FHS units in southern Mato Grosso, Brazil. The interventions followed the five stages of the Dáder method. Drug-related problems (DRPs), negative outcomes associated with medication (NOMs), capillary blood glucose, fasting blood glucose, and glycated hemoglobin were evaluated. Results: Most DRPs were related to nonadherence (50.87%). Among the NOMs, 80% were due to lack of effectiveness. A non-significant reduction in fasting blood glucose was observed (median, 164–147 mg/dL; p=0.167), along with a significant reduction in glycated hemoglobin (median from 7.8% to 7.5%, p=0.02). A total of 81 interventions were performed, mainly focusing on treatment adherence (35.8%). Conclusion: Pharmacotherapeutic follow-up, even with a small sample size, demonstrated the potential to improve glycemic control and reduce DRPs. These findings reinforce the relevance of pharmacists' role in PHC and in promoting health in patients with chronic diseases.

Keywords: Type 2 Diabetes Mellitus; Drug Therapy; Pharmaceutical Services.

Resumo

Introdução: O diabetes mellitus tipo 2 (DM2) é uma doença crônica prevalente na atenção primária à saúde (APS), frequentemente associada à baixa adesão ao tratamento e a desfechos clínicos insatisfatórios. Objetivo: Avaliar o impacto de um acompanhamento farmacoterapêutico estruturado, baseado no método Dáder, sobre indicadores clínicos de pacientes com DM2 em unidades da Estratégia Saúde da Família (ESF). Métodos: Estudo prospectivo, longitudinal e quantitativo, com 21 pacientes diagnosticados com DM2, acompanhados por um farmacêutico residente em duas unidades de ESF no sul de Mato Grosso, Brasil. As intervenções seguiram as cinco etapas do método Dáder.

Foram avaliados os problemas relacionados a medicamentos (PRMs), os resultados negativos associados à medicação (RNMs), a glicemia capilar, a glicemia de jejum e a hemoglobina glicada. Resultados: A maioria dos PRMs estava relacionada à não adesão (50,87%). Entre os RNMs, 80% foram devidos à falta de efetividade. Observou-se uma redução não significativa na glicemia de jejum (mediana de 164 para 147 mg/dL; p=0,167), e uma redução significativa na hemoglobina glicada (mediana de 7,8% para 7,5%; p=0,02). Foram realizadas 81 intervenções, principalmente voltadas à adesão ao tratamento (35,8%). Conclusão: O acompanhamento farmacoterapêutico, mesmo com uma amostra reduzida, demonstrou potencial para melhorar o controle glicêmico e reduzir os PRMs. Esses achados reforçam a relevância do papel do farmacêutico na APS e na promoção da saúde de pacientes com doenças crônicas.

Palavras-chave: Diabetes Mellitus Tipo 2; Terapia Medicamentosa; Serviços Farmacêuticos.

Resumen

Introducción: La diabetes mellitus tipo 2 (DM2) es una enfermedad crónica prevalente en la atención primaria de salud (APS) y suele estar asociada con baja adherencia al tratamiento y resultados clínicos insatisfactorios. Objetivo: Evaluar el impacto de un seguimiento farmacoterapéutico estructurado, basado en el método Dáder, sobre los indicadores clínicos de pacientes con DM2 en unidades de la Estrategia de Salud de la Familia (ESF). Métodos: Estudio prospectivo, longitudinal y cuantitativo, con la participación de 21 pacientes diagnosticados con DM2, atendidos por un farmacéutico residente en dos unidades de ESF en el sur de Mato Grosso, Brasil. Las intervenciones siguieron las cinco etapas del método Dáder. Se evaluaron los problemas relacionados con medicamentos (PRM), los resultados negativos asociados a la medicación (RNM), la glucemia capilar, la glucemia en ayunas y la hemoglobina glucosilada. Resultados: La mayoría de los PRM estuvieron relacionados con la falta de adherencia (50,87%). Entre los RNM, el 80% se debió a falta de efectividad. Se observó una reducción no significativa en la glucemia en ayunas (mediana de 164 a 147 mg/dL; p=0,167) y una reducción significativa en la hemoglobina glucosilada (mediana de 7,8% a 7,5%; p=0,02). Se realizaron 81 intervenciones, centradas principalmente en la adherencia al tratamiento (35,8%). Conclusión: El seguimiento farmacoterapéutico, incluso con un tamaño muestral reducido, mostró potencial para mejorar el control glucémico y reducir los PRM. Estos hallazgos refuerzan la relevancia del papel del farmacéutico en la APS y en la promoción de la salud en pacientes con enfermedades crónicas.

Palabras clave: Diabetes Mellitus Tipo 2; Terapia con Medicamentos; Servicios Farmacéuticos.

1. Introduction

In Brazil, recent demographic shifts have accelerated population aging. This increase in life expectancy coupled with the widespread adoption of unhealthy lifestyles has contributed to the growing burden of noncommunicable chronic diseases (NCDs) (Sousa et al., 2020). Diabetes mellitus (DM) is a progressive and heterogeneous condition arising from a constellation of metabolic disturbances, characterized primarily by chronic hyperglycemia resulting from impaired insulin secretion and/or action. Proper classification of diabetes is essential to guide appropriate therapeutic strategies. The disease is broadly categorized into type 1 diabetes and type 2 diabetes (T2DM), which accounts for 90-95% of all cases, including gestational diabetes and other specific forms (Petersmann et al., 2019; Sociedade Brasileira de Diabetes [SBD], 2023).

T2DM is associated with severe long-term complications, both microvascular and macrovascular in nature. The complexity of these outcomes has elevated diabetes from a purely clinical concern to a pressing public health issue. Effective prevention and management of these complications require coordinated, interdisciplinary care involving not only physicians, nurses, and nutritionists, but also clinical pharmacists, whose role in promoting adherence and optimizing pharmacotherapy is increasingly recognized as critical (Castro et al., 2021).

Some patients with diabetes require multiple medications simultaneously; this condition is referred to as polypharmacy. The primary goal of managing type 2 diabetes mellitus (T2DM) is to maintain adequate glycemic and metabolic control, thereby improving the quality of life, preventing disease-related complications, and reducing mortality. Treatment should begin as soon as the diagnosis is established, and may include both non-pharmacological measures, such as regular physical activity and healthy eating, and pharmacological therapy, which involves the use of oral antidiabetic drugs and insulin. Importantly, nonpharmacological strategies are not merely complementary but are foundational to effective T2DM

management. Regular physical exercise and a balanced diet play vital roles in maintaining blood glucose levels and preventing the onset of complications.

In addition, self-care practices are essential to supplement clinical interventions and to promote sustained disease control. Empowering patients with the knowledge and tools necessary to manage their condition daily can substantially reduce the disease's long-term burden. Within this framework, health education and pharmaceutical counseling have emerged as central elements in equipping patients to assume an active role in their treatment (Fernandes et al., 2021; SBD, 2023).

Diabetes also has significant economic consequences, beyond its direct clinical impact. The treatment costs, alongside productivity losses stemming from complications, exert considerable pressure on both individual households and the broader economy. Consequently, diabetes-related mortality across Brazilian regions poses a multidimensional challenge to the Unified Health System (SUS) and national socioeconomic development, further underscoring the country's contribution to the global burden of this disease (Garces et al., 2023).

Given the complexity of managing type 2 diabetes mellitus (T2DM), healthcare professionals play an indispensable role. Among the various professionals involved in the treatment and control of diabetes, pharmacists' contributions are often undervalued. However, their role is essential, not only in managing pharmacological therapy but also in educating and guiding patients. In 2002, the World Health Organization recognized pharmacists as the most qualified professional to enhance access to medicines and promote their rational use, emphasizing their ability to collaboratively address treatment-related problems and thereby ensure maximal efficacy and safety (Ivama et al., 2002).

Pharmacotherapeutic follow-up, as part of comprehensive pharmaceutical care, facilitates the management of drug therapy by identifying drug-related problems (DRPs), potential drug interactions, adverse effects, and negative outcomes associated with medication use (NOMs) (Rodrigues et al., 2021). Several methodologies have been developed to support this follow-up process, among which the Dáder method, developed by the Pharmaceutical Care Research Group at the University of Granada, is the most widely adopted and accepted in Brazilian pharmaceutical care practice. The Dáder method aims to construct a detailed pharmacotherapeutic history, assess a patient's therapeutic status at a given point in time, and identify existing DRPs and NOMs. Once identified, targeted pharmaceutical interventions are implemented to resolve these issues, followed by evaluation of clinical outcomes (Dáder et al., 2007).

Within this framework, the present study aimed to describe the pharmacotherapeutic follow-up of patients diagnosed with type 2 diabetes mellitus under the Family Health Strategy in Brazil.

2. Methodology

Study Design

A prospective, longitudinal, interventional study with a quantitative approach was conducted within the scope of primary healthcare in a municipality located in the southern region of the state of Mato Grosso, Brazil. This research followed principles of applied, field-based quantitative investigations as described by Tossi and Petry (2021) and Pereira et al. (2018). Descriptive statistics - including means, standard deviations, absolute and relative frequencies - were used for population profiling (Shitsuka et al., 2014), and appropriate inferential tests were applied to assess clinical outcome variations over time (Vieira, 2021). The study population consisted of individuals of both sexes, selected by convenience sampling, all diagnosed with type 2 diabetes mellitus (T2DM), and registered in two Family Health Strategy (FHS) units. These units served as fieldwork sites for a pharmacist resident enrolled in the multiprofessional family health residency program.

Inclusion criteria were patients aged 18 years or older with a confirmed diagnosis of T2DM who consented to participate in all phases of the study. The exclusion criteria included refusal to participate or relocate to another municipality

during data collection.

Data were gathered through home visits, with each patient being interviewed thrice. These interviews were conducted by a pharmacist researcher between April and November 2023.

To characterize the sociodemographic and clinical profiles of the study population, the following variables were collected: sex, age, self-reported race/ethnicity, level of education, household income, marital status, and presence of comorbidities.

Pharmacotherapeutic Follow-Up

The Dáder method, adapted to the realities and specific needs of the local population, was employed as the framework for pharmacotherapeutic follow-up (Dáder et al., 2007).

The first stage involved inviting the patients to participate in the follow-up service, during which the objectives and expected outcomes of the intervention were clearly explained. Upon agreement, the participants completed a sociodemographic and clinical questionnaire that collected detailed information regarding their medical history and medication use. Patients were asked to present their current medications and were encouraged to share their understanding of the purpose and use of each medication. During this initial consultation, laboratory tests, including fasting blood glucose and glycated hemoglobin, were also performed.

The second stage consisted of analyzing the data obtained during the first interview. A comprehensive therapeutic status profile (estado de situação) was constructed for each patient, allowing for systematic evaluation of their pharmacotherapy in conjunction with their overall health status. This step involved cross-referencing the diagnosed health conditions with pharmacological treatments recorded in the profile.

In the third stage, drug-related problems (DRPs) and negative outcomes associated with medication use (NOMs) were identified. Based on these findings, pharmaceutical interventions were planned and implemented to resolve such issues.

The fourth stage, which corresponded to the second interview, was the intervention phase. An individualized action plan, previously discussed and agreed upon by the patient, was enacted to address the identified NOMs and optimize therapeutic outcomes.

The fifth and final stage, conducted during the third interview, focused on monitoring and evaluating the results of pharmaceutical interventions. Fasting blood glucose and glycated hemoglobin levels were once again measured, allowing assessment of clinical progress and therapeutic effectiveness.

Monitoring of Blood Glucose and Glycated Hemoglobin

Throughout the pharmacotherapeutic follow-up, capillary random blood glucose levels were measured during each home visit using a glucometer (Accu-Chek® Active). It is noteworthy that Resolution No. 499, issued on December 17, 2008, by the Brazilian Federal Pharmacy Council, authorizes pharmacists to perform quantitative determinations of blood glucose levels (Conselho Federal de Farmácia [CFF], 2008).

In addition to point-of-care measurements, all participants underwent fasting blood glucose and glycated hemoglobin testing at both the beginning and end of the study. These laboratory assessments were requested by the physician and aligned with the clinical necessity of monitoring therapeutic outcomes in the management of diabetes.

Classification of DRPs and NOMs

The classification of drug-related problems (DRPs) and negative outcomes associated with medications (NOMs)

followed the framework proposed by the Third Granada Consensus (Dáder et al., 2007). DRPs were defined as circumstances that caused or may cause the emergence of NOM. These include improper medication administration, patient-specific factors, inadequate storage conditions, contraindications, inappropriate dosage, regimen or duration, therapeutic duplication, dispensing or prescribing errors, non-adherence, drug interactions, comorbidities influencing treatment, likelihood of adverse effects, under-treatment of a health condition, and other related factors.

NOMs were defined as undesirable health outcomes resulting from the use or non-use of medications. They were categorized into three domains: necessity (untreated health problems or unnecessary pharmacological treatment), effectiveness (quantitative or qualitative ineffectiveness), and safety (quantitative or qualitative risks to patient health).

Statistical Analysis

All collected data were entered into Microsoft Excel 2016, and quantitative analyses were performed using descriptive statistics: mean, percentage, and standard deviation for parametric data, and median and interquartile ranges for non-parametric data. Inferential statistics were applied using the Wilcoxon signed-rank test to compare paired samples (fasting glucose and glycated hemoglobin at baseline and endline), and the Friedman test was used to assess repeated measures of capillary blood glucose across the three follow-up visits.

The Wilcoxon and Friedman tests were selected because of the non-normal distribution of glucose and glycated hemoglobin data. Statistical significance was defined as P < 0.05. All analyses were conducted using JAMOVI software, version 2.3.

Ethical Principles

All individuals who agreed to participate in this study signed an informed consent form in accordance with the ethical principles established by Resolution No. 466/2012 of the Brazilian National Health Council. The study protocol was reviewed and approved by the Research Ethics Committee of the Federal University of Rondonópolis (approval number: 5.921.316).

3. Results

Of the 25 individuals approached through convenience sampling, two declined to participate, one relocated during the follow-up period, and one withdrew consent after the initial inclusion. Thus, 21 participants completed the pharmacotherapy follow-up. Participants ranged in age from 35 to 78 years (mean = 59 years, standard deviation = ± 10.3), with the majority (38.1%) falling within the 35–55 age range.

Table 1 presents the sociodemographic and clinical profile of the participants according to the variables analyzed. Among the total respondents, 81% were female, 52.4% self-identified as mixed-race (pardo), 61.9% reported having five years or less of formal education, and 47.6% had a monthly household income equivalent to one minimum wage or less. Regarding the duration of type 2 diabetes mellitus diagnosis, the majority (52.4%) had been living with the condition for 5–9 years.

Table 1 - Profile of Patients with Type 2 Diabetes Mellitus Wh	o Underwent Pharmacotherapeutic Follow-Up ($N = 21$),
Rondonópolis, 2023.	

Variable		Ν	%
Age (years)	35 a 55	8	38,1
	55 a 64	6	28,6
	> 65	7	33,3
Sex	Male	4	19
	Female	17	81
Self-declared race	Black	7	33,3
	Mixed race (Pardo)	11	52,4
	White	3	14,3
Marital status	Without partner	9	42,9
	With partner	12	57,1
Educational level (years)	No formal education	2	9,5
	Up to 5	11	52,4
	6 to 15	8	38,1
Household income	Up to 1 minimum wage	10	47,6
	Between 1 and 2 minimum wages	8	38,1
	Between 2 and 3 minimum wages	3	14,3
Time since diagnosis	Less than 5 years	5	23,8
	5 to 9 years	11	52,4
	10 to 19 years	4	19,0
	20 to 29 years	1	4,8

Source: Developed by the authors.

In Table 2, it can be observed that 90.47% of participants had additional comorbidities. The most prevalent conditions were arterial hypertension (76.19%) and dyslipidemia (66.66%).

Table 2 - Main Comorbidities Among Participants with Type 2 Diabetes Mellitus (N = 21), Rondonópolis, 2023.

Comorbidity	N	%	
Hypertension	16	76,19	
Dyslipidemia	14	66,66	
Insomnia	2	9,52	
Obesity	10	47,62	
Osteoarthritis	1	4,76	
Cardiovascular disease	2	9,52	
Thyroid-related disorder	1	4,76	
Anxiety	1	4,76	
Fibromyalgia	1	4,76	

Source: Developed by the authors.

A total of 63 home visits were conducted during the pharmacotherapeutic follow-up process. Of the 21 participants, 20 (95.2%) presented with at least one drug-related problem (DRP), yielding 57 identified DRPs. All DRPs related to the participants' medications were considered, with the most frequent being nonadherence (50.87%), followed by inappropriate

dosage, regimen, and/or duration (14.04%), and incorrect medication administration (26.32%).

Among the 20 participants who exhibited DRPs, 55 negative outcomes associated with medication (NOMs) were identified. They were categorized as follows: 12.7% due to necessity-related issues (9.1% corresponding to untreated health problems and 3.6% to unnecessary medication use), 80% due to effectiveness issues (65.5% classified as quantitative ineffectiveness and 14.5% as qualitative ineffectiveness), and 7.3% due to safety concerns (7.3% representing qualitative safety risks).

An individualized care plan was developed for each participant, resulting in 81 pharmaceutical interventions. The most frequently implemented intervention was aimed at improving treatment adherence, accounting for 35.80% of all actions taken.

The interventions were conducted in three formats: (1) written pharmacist-patient: an individualized care plan was developed and printed for each patient; (2) written pharmacist-patient-physician: when necessary, patients were provided with a written referral for medical consultation and evaluation; and (3) verbal pharmacist-physician: physicians at the health units were available for case discussions and collaborative intervention planning. In addition to information related to pharmacotherapy, patients received counseling regarding T2DM, including diagnosis, non-pharmacological treatment options, and disease self-management strategies.

Figure 1 presents the results of random capillary blood glucose monitoring during the three home visits. As shown in the chart, the median glucose levels during visits 1, 2, and 3 were 203, 196, and 156 mg/dL, respectively (Friedman test, p = 0.565).

Figure 1 - Comparison of random capillary blood glucose levels across the three home visits. Data are expressed as the median \pm interquartile range. p > 0.05, according to the Friedman test. Rondonópolis, 2023 (n = 21).



Source: Developed by the authors.

Despite the absence of statistical significance, the data suggest a downward trend in blood glucose levels over the course of pharmacotherapeutic follow-up, a pattern that was also observed between the initial and final measurements of fasting blood glucose (Figure 2). The median value of this parameter decreased from 164 mg/dL at baseline to 147 mg/dL at the final assessment (Wilcoxon test, P = 0.167; ordinal biserial correlation = 0.357).

Figure 2 - Fasting blood glucose levels were measured at the beginning and end of the study period. Data are expressed as median \pm interquartile range. p > 0.05, as determined using the Wilcoxon test. Rondonópolis, 2023 (n = 21).



Source: Developed by the authors.

With respect to glycated hemoglobin (Figure 3), a statistically significant reduction was observed in the median values, from 7.8% at baseline to 7.5% at the final measurement (Wilcoxon test, p = 0.02; ordinal biserial correlation = 0.600).

Figure 3 - Glycated hemoglobin levels were measured at the beginning and end of the study. Data are expressed as median \pm interquartile range. *p* < 0.05, Wilcoxon test. Rondonópolis, 2023 (n = 21).



Source: Developed by the authors.

4. Discussion

In Brazil, studies indicate that the prevalence of type 2 diabetes mellitus (T2DM) is substantial and has increased steadily in recent years, largely owing to rapid population aging and the widespread adoption of unhealthy lifestyles (Sousa et al., 2020). It is estimated that 9.2% of the population is affected by diabetes, with a higher prevalence among women than among men (Muzy et al., 2021). This disparity may be attributed to greater longevity among women, heightened awareness of physiological changes, and greater tendency to seek medical care, all of which contribute to a higher likelihood of receiving a formal diagnosis (Batista et al., 2020).

A population-based study conducted in São Leopoldo, in the southern region of Brazil, reported that 8.16% of women aged 20–69 years self-reported a diabetes diagnosis (Costa et al., 2020). Furthermore, during the COVID-19 pandemic in 2020, the prevalence of diabetes among women increased more sharply, from 7.8% to 9% (SBD, 2021). Although the present study did not aim to assess diabetes prevalence per se, it is noteworthy that the majority of study participants living with T2DM were women.

Among the patients followed up in this study, 61.9% had five years or less of formal education. The literature consistently highlights the impact of education level on diabetes-related knowledge and patient attitudes. Borba et al. (2019) found that older adults with diabetes and low educational attainment were nearly eight times more likely to have insufficient knowledge about the disease than those with higher levels of education. A limited educational background may hinder diabetes self-management, as patients may struggle to understand the nature of the disease, follow medical advice, and adopt the necessary lifestyle changes. In this context, an adapted educational approach that considers linguistic and cultural barriers is essential for improving patient comprehension and engagement in care, reinforcing the idea that the pharmacist's role extends well beyond medication dispensing (Borba et al., 2019).

Amaral et al. (2021) found that most individuals with inadequate knowledge about diabetes had household incomes at or below the minimum wage, aligning with the socioeconomic profile observed in the present study. The authors further reported that low-income patients face significant barriers in implementing therapeutic plans, including the financial burden of dietary modifications. Additionally, although medications for diabetes are included in the Brazilian Unified Health System (SUS) formulary, stockouts remain frequent. Oliveira et al. (2020) observed that 38% of patients with diabetes in their study encountered difficulties in obtaining prescribed medications due to unavailability at public health service points.

Arterial hypertension (77.27%) and dyslipidemia (68.18%) were the most frequently observed comorbidities among participants with T2DM. These findings are consistent with those reported by Veloso et al. (2020), who identified hypertension, dyslipidemia, and cardiovascular comorbidities as the most common conditions among patients with type 2 diabetes. In their study, hypertension was present in 82% of patients, and dyslipidemia was observed in 62% of patients.

Regarding drug-related problems (DRPs), the most prevalent issues identified in the present study were nonadherence (50.87%); inappropriate dosage, regimen, and/or treatment duration (14.04%); and incorrect medication administration (26.32%). The most frequently implemented intervention, accounting for 35.8% of all cases, aimed to improve treatment adherence. Similar findings were reported by Souza et al. (2020), who observed non-adherence to be the most common DRP in 100% of their sample, which included 13 patients who omitted doses, nine who discontinued medication, and 24 who administered it incorrectly. Patients identified with DRPs in the present study received guidance on the importance of adherence, education about their condition, and in some cases, were advised to consult with their physician for potential therapeutic adjustments. The implementation of individualized care plans and targeted interventions contributed not only to improved treatment comprehension, but also to increased adherence, a reduction in patient-driven medication errors, fewer negative outcomes associated with medications (NOMs), and overall improvements in health and quality of life. These findings align with the study by Correr et al. (2023), which demonstrated that pharmacotherapy follow-up services offered in Brazilian community pharmacies significantly improved medication adherence and glycemic control in patients with T2DM.

Among the identified negative outcomes associated with medications (NOMs), 80% were related to effectiveness, with 65.5% classified as quantitative ineffectiveness and 14.5% as qualitative ineffectiveness. Similar findings were reported by Rossi et al. (2022) in a study involving patients with leprosy, in which 33 NOMs were identified, with effectiveness issues being the most prevalent. Likewise, Santos and Mathias (2020), in a study involving hypertensive and diabetic patients, found that effectiveness-related NOMs accounted for 51.8% of cases. These observations highlight the importance of a comprehensive and individualized approach to the care of patients with diabetes, wherein the pharmacist plays a pivotal role within a multidisciplinary team.

Random capillary blood glucose monitoring was performed during interviews. As shown in Figures 1 and 2, random capillary glucose and fasting blood glucose levels decreased between April and November 2023. The effect size of the reduction in fasting glucose level was considered moderate (ordinal biserial correlation = 0.357). However, despite the numerical reductions observed for both parameters, statistical significance was not reached. This may be attributable to the limited sample size and the relatively short follow-up duration.

Figure 3 demonstrates a reduction in glycated hemoglobin levels, which was both statistically significant and clinically relevant, with a substantial effect size (ordinal biserial correlation = 0.600). Although the absolute reduction in percentage points was modest, its importance should not be understated given that glycated hemoglobin is a critical biomarker reflecting medium- and long-term glycemic control.

An absolute reduction of 0.3% in glycated hemoglobin (HbA1c) level, as observed in this study, is clinically meaningful, particularly within the context of diabetes management and long-term risk reduction. Starting from a baseline median HbA1c level of 7.8%, the decrease to 7.5% reflects a favorable shift, especially considering that 7.8% exceeds the recommended target for most individuals with diabetes (generally <7%). While the final value remains above the optimal threshold, this improvement is notable, especially in light of evidence indicating that each 1% reduction in HbA1c is associated with a 21% decrease in diabetes-related adverse outcomes, 21% reduction in diabetes-related mortality, 14% reduction in myocardial infarction risk, and 37% reduction in microvascular complications (Stratton et al., 2000).

Supporting this finding, Parrini et al. (2020) conducted a study comparing two groups: those who underwent pharmacotherapeutic follow-up and those who did not. The group that received pharmacist-led care achieved an 11.1% relative reduction in HbA1c levels compared to the control group. Similarly, a randomized controlled trial conducted by Javaid et al. (2019) in Pakistan demonstrated that 83 participants receiving pharmaceutical care achieved an absolute reduction of approximately 0.9% in HbA1c levels. These results reinforce the positive impact of structured pharmaceutical follow-up on glycemic control in patients with diabetes, aligning with the outcomes observed in the present study. Recent findings by Blanco-Vega et al. (2024) corroborate this result, showing that pharmacist-led interventions using structured follow-up models significantly reduced HbA1c in patients with T2DM in primary care contexts.

Taken together, the glycemic outcomes observed in this study support the hypothesis that pharmacotherapeutic intervention yields clinical benefits in the management of type 2 diabetes mellitus (T2DM). These findings are consistent with the broader scientific literature on this subject. Achieving glycemic control in T2DM patients requires sustained care practices aimed at improving the patient's overall quality of life. In the present study, a substantial proportion of the interventions (35.8%) focused on enhancing treatment adherence. The most implemented strategy involves the development of illustrated medication plans designed to prevent forgetfulness and optimize dosing schedules.

Adherence is critical for preventing complications associated with T2DM and for enabling patients to maintain a good

quality of life. Botrel et al. (2021) identified significant gaps in adherence among users of Family Health Strategy (FHS) services, noting that low adherence scores were strongly associated with a lack of knowledge about T2DM—an observation that aligns with the findings of this study. Similarly, Lopes et al. (2019) found that only 28% of their study population fully adhered to both pharmacological and non-pharmacological treatment regimens, with adherence to comprehensive therapeutic strategies remaining exceptionally rare.

This study has some limitations. As a longitudinal intervention focused on pharmaceutical care and individualized patient management, it was neither feasible nor practical to include a large number of participants under the direct responsibility of a single pharmacist researcher. Consequently, the small sample size limited the statistical power of the study's findings. Additionally, convenience sampling may introduce selection bias, potentially limiting the representativeness of the sample in relation to the broader target population.

Furthermore, the absence of a comparator group and lack of randomization prevented this study from establishing causal inferences regarding the efficacy of the intervention. These results should be interpreted as hypothesis generating, offering insight into the potential real-world effectiveness of pharmacist-led care and contributing complementary evidence to similar studies in the field.

5. Conclusion

The fact that an intervention centered on pharmacotherapeutic follow-up, implemented through the Dáder Method, was associated with a measurable and statistically significant improvement in HbA1c, alongside reductions in capillary and fasting blood glucose levels observed in the sample, serves as a meaningful indicator of the effectiveness of the intervention in optimizing diabetes therapy. The majority of drug-related problems (DRPs) identified in this study were linked to non-adherence, reinforcing the hypothesis that identifying and managing DRPsand, consequently, negative outcomes associated with medication (NOMs)can lead to tangible health benefits for individuals living with T2DM.

The findings also suggest that patient education and guidance regarding diabetes self-management and the appropriate use of medications are critical areas of focus that contribute to improved glycemic control. Furthermore, promoting the rational use of medications, advancing health education, and encouraging the adoption of healthier lifestyles appear to play a significant role in enhancing glycemic regulation and reducing risk factors that may compromise the quality of life of patients with type 2 diabetes.

This study further underscores the pivotal role of pharmacists in the management of noncommunicable chronic diseases (NCDs), such as type 2 diabetes mellitus, particularly within the context of primary healthcare. Pharmacists play a significant role in improving health outcomes, particularly in conditions that require ongoing medication monitoring and therapeutic adjustments.

Moreover, the findings highlight the need for a more integrated approach to T2DM management that extends beyond pharmacotherapy alone. Strategies encompassing patient education, nutritional counseling, encouragement of regular physical activity, and attention to mental health are equally essential. These complementary measures can address modifiable risk factors and enhance the quality of life of patients with diabetes.

Ultimately, the results reinforce the value of individualized pharmaceutical care, aligning with patient-centered care guidelines and pointing to the need for policies that strengthen the integration of pharmaceutical services into primary healthcare. Such policies should promote a multidisciplinary, patient-centered model of care capable of responding more effectively to the complex demands of chronic disease management.

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