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Original scientific paper

Impact of a Pharmacist-Led Multidimensional Advisory Intervention on Cardiometabolic Outcomes in Patients With Type 2 Diabetes Mellitus: A Quasi-Experimental Study

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Abstract: Introduction: Type 2 diabetes mellitus (T2DM) is a major public health challenge, particularly in settings where pharmacists remain primarily dispensing-oriented. This study evaluated the impact of a pharmacist-led multidimensional advisory intervention on cardiometabolic outcomes in patients with T2DM. **Methodology:** A quasi-experimental study with control and intervention groups was conducted in a community pharmacy in Bosnia and Herzegovina. Forty adult patients were allocated to usual care (n=20) or a four-month pharmacist-led programme including nutrition education, lifestyle counselling, physical activity, and continuous support (n=20). Body mass index (BMI), fasting blood glucose (FBG), and blood pressure were measured at baseline and follow-up, while HbA1c was assessed in the intervention group, limiting between-group comparisons. **Results:** Significant reductions in BMI (p=0.002), FBG (p=0.026), and HbA1c (p=0.001) were observed in the intervention group, whereas no significant improvements were detected in the control group. **Conclusion:** These findings provide preliminary evidence that pharmacist-led advisory interventions may improve metabolic control in patients with T2DM.

Keywords: Type 2 diabetes mellitus; community pharmacy; pharmacist-led intervention; lifestyle counselling; body mass index; fasting blood glucose; HbA1c; blood pressure; cardiometabolic risk; chronic disease management

INTRODUCTION

Diabetes mellitus (DM) is one of the most significant chronic non-communicable diseases of the modern era, characterised by a continuously increasing prevalence and substantial public health, economic, and social consequences. According to estimates by the International Diabetes Federation, more than 415 million people worldwide are currently living with diabetes, with projections indicating an increase to approximately 642 million by 2040. Type 2 diabetes accounts for over 90% of all diagnosed cases (Farooqi et al., 2022).

The greatest burden of the disease affects the working-age population, while more than 80% of individuals with diabetes reside in low- and middle-income countries, where access to preventive and therapeutic interventions is often limited (Galicia-Garcia et al., 2020). These epidemiological trends clearly underscore diabetes mellitus as a major and growing challenge for contemporary health systems.

Diabetes mellitus is a chronic condition that requires lifelong treatment, regular monitoring, and sustained patient engagement. Effective management relies on an integrated approach combining pharmacotherapy, continuous medical care, and structured lifestyle modification interventions. Patient education plays a pivotal role in diabetes management by enhancing disease-related knowledge, self-management skills, and responsible health behaviours. Substantial evidence demonstrates that adequate patient education contributes to improved glycemic control, reduced risk of microvascular and macrovascular complications, and overall improvement in quality of life among individuals with diabetes (Ahmed et al., 2021; Khan et al., 2021). The burden of diabetes also extends to psychological and social domains of quality of life, where emotional distress and social functioning are frequently impaired among patients with diabetes mellitus (Grujić-Vujmilović & Gavrić, 2014).

Modern diabetes management is founded on a multidisciplinary, patient-centred approach in which individuals with diabetes are actively involved in therapeutic decision-making and treatment implementation. Within this framework, pharmacists play an increasingly important role owing to their high accessibility, frequent patient contact, and expertise in pharmacotherapy. Globally, pharmacists rank as the third-largest group of health care professionals, following physicians and nurses (Ahmed et al., 2021; Khan et al., 2021).

In well-developed health care systems, pharmacists deliver comprehensive pharmaceutical care, encompassing patient counselling and education, support for medication adherence, and the identification and prevention of drug-related problems. Conversely, in many developing and transitional health systems, pharmacists' roles remain largely confined to medication dispensing, with limited involvement in chronic disease management, despite the growing prevalence and burden of diabetes mellitus (Ahmed et al., 2021; Khan et al., 2021).

As readily accessible health care providers, community pharmacists represent integral members of the multidisciplinary health care team involved in the management of type 2 diabetes mellitus (T2DM). Their accessibility within the community enables early identification of patients requiring additional medical evaluation and facilitates timely referral to appropriate healthcare providers (Hassan et al., 2023; Langhinrichsen-Rohling et al., 2023). Evidence suggests that pharmacist-led interventions and community pharmacy–based models are associated with improved glycaemic control and optimisation of pharmacotherapy, contributing to more individualised management of patients with type 2 diabetes (Jahangard-Rafsanjani et al., 2014; Sharp et al., 2017). Moreover, pharmacist-led medication therapy management and adherence-enhancing interventions have been associated with significant improvements in glycaemic control and broader clinical outcomes among individuals with type 2 diabetes (Taveira et al., 2010).

Pharmaceutical interventions in diabetes management encompass a broad spectrum of activities, including patient counselling on appropriate medication use, identification and prevention of adverse drug reactions and clinically relevant drug–drug interactions, and support for self-monitoring of blood glucose. In addition, pharmacists provide structured education on lifestyle modifications, such as healthy dietary practices, regular physical activity, weight management, and smoking cessation. Effective collaboration between pharmacists and other health care professionals is therefore essential, as a coordinated, multidisciplinary approach increases the likelihood of achieving and maintaining optimal glycemic control and contributes to a reduction in overall cardiometabolic risk (American Association of Diabetes Educators, 2019; Brewster et al., 2020; Cooney et al., 2022; Kent et al., 2013).

In Bosnia and Herzegovina, including the cantons of the Federation of Bosnia and Herzegovina, pharmacists currently have a limited role in the management of diabetes mellitus. The majority of pharmacists are employed in community pharmacies, health care institutions, or pharmaceutical companies, where their professional activities are predominantly focused on medication dispensing and the provision of basic therapeutic information. This practice indicates a substantial underutilization of pharmacists' potential in chronic disease management.

Given the growing body of evidence demonstrating the positive effects of pharmacist-led interventions on glycaemic control, treatment adherence, and health-related quality of life, further development and rigorous evaluation of care models in which pharmacists assume an expanded advisory and educational role within primary care settings appear warranted (Ali et al., 2012; Antoine et al., 2014; Dwiputri et al., 2020; Krass & Hoti, 2019). Such models may be particularly relevant in health systems facing an increasing burden of type 2 diabetes mellitus (T2DM).

The present study aims to assess the impact of pharmacist-led advisory interventions on health outcomes in patients with T2DM, with a specific focus on lifestyle-related counselling targeting dietary habits and physical activity.

Accordingly, the study objectives and hypotheses are defined as follows:

Does the pharmacist-led advisory interventions influence body mass index (BMI) in patients with T2DM?

Hypothesis 1: Pharmacist-led advisory interventions are associated with a statistically significant change in BMI among patients with T2DM.

Does the pharmacist's advisory intervention impact blood pressure regulation in patients with T2DM?

Hypothesis 2: Pharmacist-led advisory interventions result in statistically significant changes in systolic and diastolic blood pressure values among patients with T2DM.

Does the pharmacist's advisory intervention impact glycemic regulation in patients with T2DM?

Hypothesis 3: Pharmacist-led advisory interventions are associated with statistically significant changes in glycemic values among patients with T2DM.

METHODOLOGY

Research Design

This study employed a quasi-experimental, prospective cohort design with control and intervention groups. It was conducted between November 2022 and April 2023 at the Public Health Institution City Pharmacy Cazin.

Baseline anthropometric, clinical, lifestyle, and treatment-related characteristics were collected for both groups prior to the intervention to assess comparability between groups. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, as appropriate, while categorical variables were presented as number and percentage. Between-group comparisons at baseline were performed using the independent-samples t-test or Mann–Whitney U test for continuous variables and the chi-square test or Fisher's exact test for categorical variables. These variables were included for descriptive purposes only and were not considered outcome measures.

Study Participants

Adults of both sexes aged 18 years or older with a confirmed diagnosis of type 2 diabetes mellitus were included in the study. The diagnosis was established by a specialist in internal medicine or a subspecialist in endocrinology.

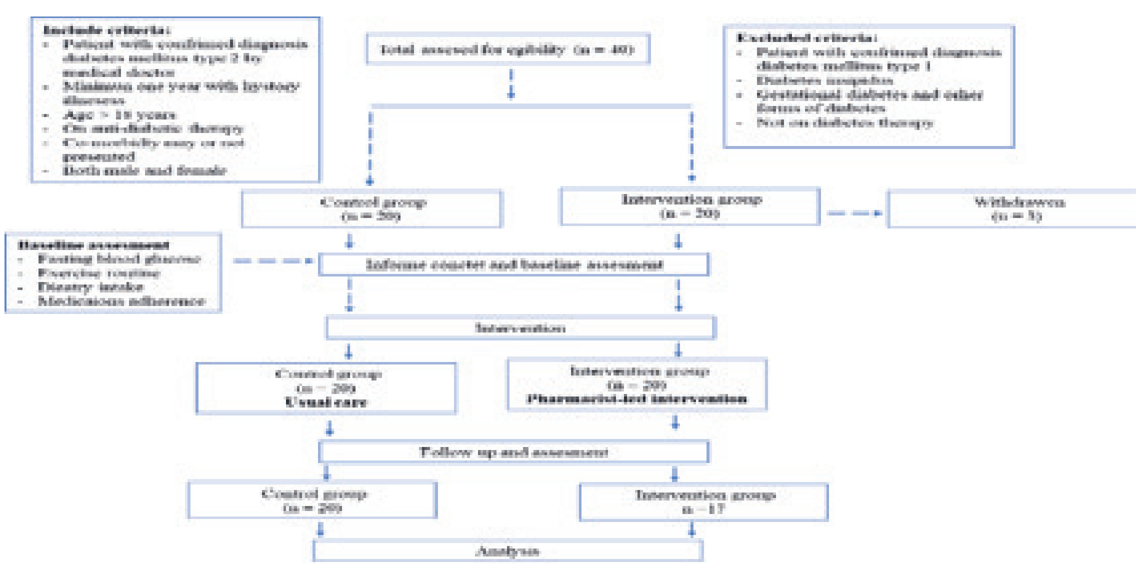


Figure 1. Flow diagram of participant recruitment, allocation, and analysis

Source: Authors

At baseline, the study sample consisted of 40 participants, who were allocated to two groups:

- control group (n = 20), comprising patients who received usual health care without additional pharmaceutical intervention, and
- intervention group (n = 20), comprising patients who, in addition to usual health care, participated in a four-month pharmacist-led education and counselling programme.

Participants were allocated to the control and intervention groups using a non-random, convenience-based sequential assignment, reflecting the real-world setting of community pharmacy practice.

During the study period, three participants from the intervention group withdrew; therefore, the final analysis included 17 participants in the intervention group and 20 participants in the control group (Figure 1).

Inclusion and exclusion criteria

Inclusion criteria were: adults aged ≥18 years with a confirmed diagnosis of type 2 diabetes mellitus, receiving pharmacological treatment, and able to participate in counselling sessions. Exclusion criteria included pregnancy, severe comorbid conditions, inability to participate in follow-up, and patients not receiving diabetes therapy.

Pharmaceutical Intervention Program

The pharmaceutical intervention program was implemented over a four-month period and consisted of structured educational and counselling activities. The intervention included:

- educational lectures on appropriate nutrition for diabetes management,
- workshops focused on healthy lifestyle modification,
- organised physical activity, comprising a total of 6 kilometres of walking during the intervention period,
- continuous online communication via a Viber group,
- individual face-to-face consultations with a pharmacist at the pharmacy.

Data collection and measurement

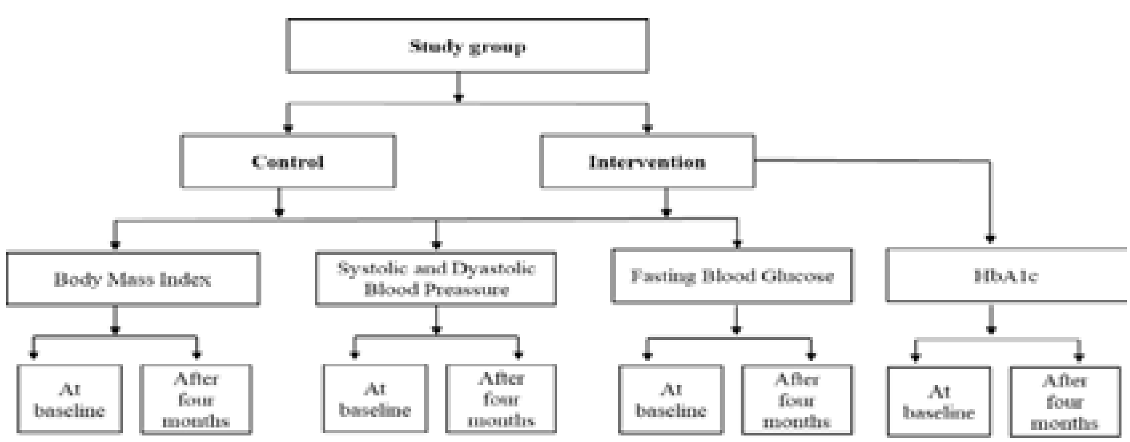


Figure 2. Process of data collection in the control and intervention groups

Source: Authors

Data were collected at two time points: at the beginning of the study (baseline measurement) and after four months. The following variables were measured in both groups (Figure 2):

- body mass index (BMI),
- systolic and diastolic blood pressure
- fasting blood glucose.

Due to logistical and financial constraints, HbA1c was measured only in the intervention group, which limits direct comparison of long-term glycaemic control between groups.

Measurement of anthropometric and clinical parameters

Anthropometric and clinical parameters were assessed at baseline and at the end of the study. Body mass index (BMI) was determined for all participants and calculated using the following formula:

$$Body\ mass\ index\ (BMI) = \frac{Body\ mass\ (kg)}{Body\ height\ (m)^2}\ (1)$$

Body height and mass were measured using standardised anthropometric procedures.

Arterial blood pressure (systolic and diastolic) was measured on the left arm using the standard Korotkov auscultatory method after at least 5 minutes of rest in a seated position. Blood pressure values were expressed in millimetres of mercury (mmHg).

Biochemical Analyses

Blood samples were collected in the early morning after an overnight fast. Fasting blood glucose levels were measured from capillary blood using an Accu-Chek Active glucometer (Roche Diagnostics, Mannheim, Germany) and expressed in millimoles per litre (mmol/L).

Glycosylated haemoglobin (HbA1c) levels were measured exclusively in the intervention group using the Quo-Lab HbA1c analyser (EKF Diagnostics, Cardiff, UK). HbA1c values were expressed as percentages (%) and in millimoles per mole (mmol/mol), in accordance with International Federation of Clinical Chemistry (IFCC) recommendations.

Statistical Data Processing

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 21.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as mean ± standard deviation for normally distributed data or as median with interquartile range (IQR; 25th–75th percentile) for non-normally distributed data. Categorical variables are presented as absolute and relative frequencies.

The normality of data distribution was assessed using the Shapiro–Wilk test. Comparisons of continuous variables before and after the intervention were performed using the paired Student's *t*-test or the Wilcoxon signed-rank test, as appropriate. Differences between groups were analysed using the independent-samples Student's *t*-test or the Mann–Whitney *U* test, depending on data distribution. Categorical variables were compared using the chi-square test or Fisher's exact test, when applicable.

All statistical tests were two-tailed, and statistical significance was set at $p < .05$.

Due to the nature of the intervention, blinding of participants and providers was not feasible; however, outcome measurements followed standardised procedures to minimise bias.

RESULTS

Table 1 presents the sociodemographic and clinical characteristics of the participants. No statistically significant differences were observed between the control and intervention groups regarding gender (p = .549), educational level (p = .128), employment status (p = .250), or place of residence (p = 1.000).

Table 1. Baseline sociodemographic characteristics of participants in the control and intervention groups

Variable		Group		p-value
		Control (n=20)	Intervention (n=17)	
		N (%)	N (%)	
Gender	Male	9 (45.0)	6 (35.3)	.549
	Female	11 (55.0)	11 (64.7)	
Educational attainment	Lower education	10 (50.0)	5 (29.4)	.128
	Secondary education	10 (50.0)	8 (47.1)	
	Higher education (college/university)	0 (0.0)	4 (23.6)	
Employment status	Employed	7 (35.0)	2 (11.8)	.250
	Unemployed	5 (25.0)	5 (29.4)	
	Retired	8 (40.0)	10 (58.8)	
Place of residence	Urban	11 (55.0)	9 (52.9)	1.000
	Rural	9 (45.0)	8 (47.1)	

Source: Authors
Note: Values are presented as n (%) unless otherwise indicated Between-group categorical variables were compared using the chi-square test or Fisher's exact test, and between-group continuous variables using the independent-samples t test or Mann–Whitney U test. M = mean; SD = standard deviation; p-value refers to the comparison before and after the intervention (paired analysis).

Table 2. Baseline clinical characteristics of participants in the control and intervention groups

Variable		Group		p-value
		Control (n=20)	Intervention (n=17)	
		N (%)	N (%)	
Body weight (kg), M ± SD		88.2 ± 10.26	86.76 ± 4.52	.765
Body height (cm), M ± SD		167.30 ± 7.32	170.76 ± 8.62	.195
Fasting Blood Glucose at Diagnosis (mmol/L), median (IQR)		10.0 (8.0–19.0)	15,0 (7.9–19.75)	.869
Physically active (more than 30 minutes daily)		17 (85.0)	14 (82.4)	.587
Meals per day, median (IQR)		3 (3.0-4.0)	4 (4.0-4.75)	.060
Special diet adherence		8 (40.0)	9 (52.9)	.430
Treatment modality	Oral antidiabetic drugs	11 (55.0)	4 (23.5)	.071
	Oral antidiabetic drugs + insulin	6 (30.0)	10 (58.5)	
	Insulin therapy	3 (15.0)	3 (17.6)	

Source: Authors
Note: Values are presented as n (%) unless otherwise indicated. Between-group categorical variables were compared using the chi-square test or Fisher's exact test, and between-group continuous variables using the independent-samples t test or Mann–Whitney U test. M = mean; SD = standard deviation; IQR = interquartile range; p-value refers to the comparison before and after the intervention (paired analysis).

The mean body mass index (BMI) in the control group was 31.54 ± 3.75 at baseline and did not change significantly after four months (31.45 ± 3.70; $p = .724$). In the intervention group, the mean BMI decreased from 29.22 ± 5.05 at baseline to 28.53 ± 4.80 four months after the intervention, and this change was statistically significant ($p = .002$) (Figure 3).

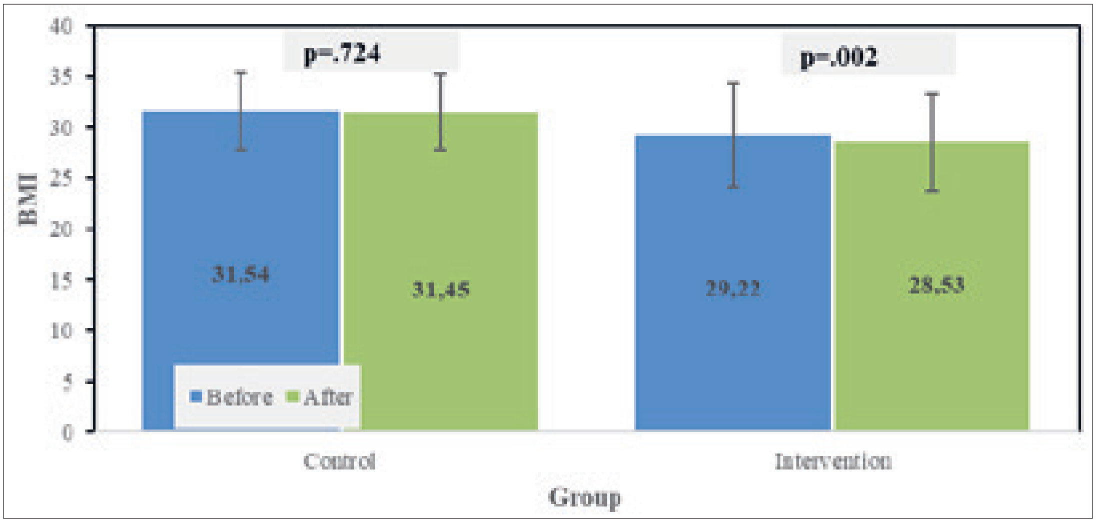


Figure 3. Mean fasting body mass index (BMI) in the control and intervention groups before and after the intervention (n = 20 (control), n = 17 (intervention))

Source: Authors
Note: Results are presented as mean ± standard deviation (*M* ± *SD*); p-value refers to the comparison before and after the intervention (paired t-test / Wilcoxon signed-rank test)

The control group's median fasting blood glucose at baseline was 10.70 (7.85–13.30) and did not change significantly after four months, when it was 10.60 (9.15–12.02) (p = .970). In contrast, the intervention group's median fasting blood glucose decreased significantly from 9.20 (7.20–10.95) before the intervention to 7.60 (6.50–9.50) after the intervention (p = .026) (Figure 4).

The median HbA1c value in the intervention group was 7.85 (6.45–9.37) before the intervention and decreased to 6.85 (6.02–8.00) after the intervention (p = .001) (Table 2).

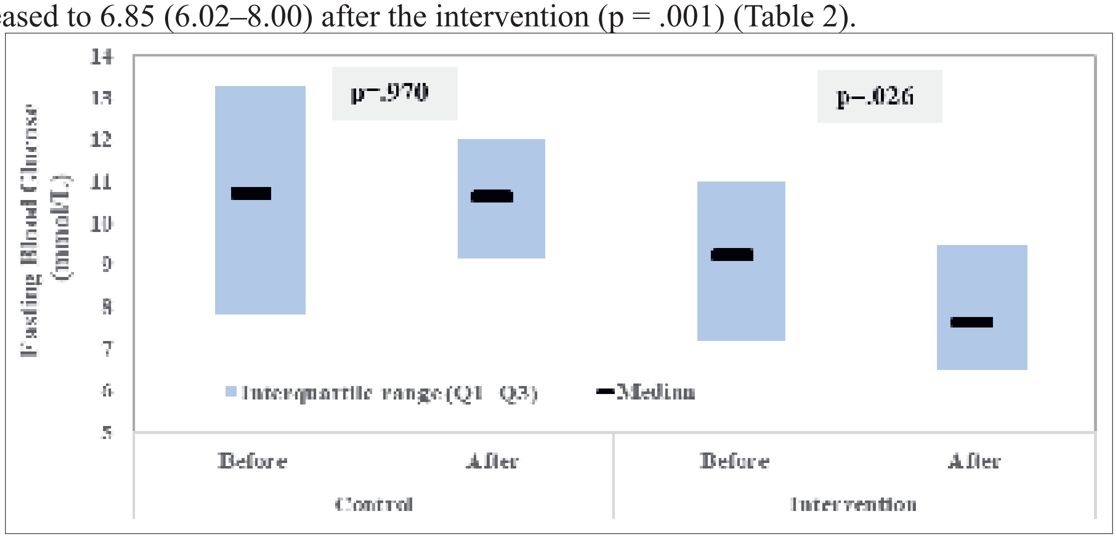


Figure 4. Median fasting blood glucose values in the control and intervention groups before and after the intervention
Source: Authors
Note: Data are presented as median with interquartile range (25th–75th percentiles); p-value refers to the comparison before and after the intervention (paired t-test / Wilcoxon signed-rank test)

In the control group, median systolic blood pressure increased from 138.35 (125.50–155.75) at baseline to 150.0 (140.0–160.0) after four months (p = .005), whereas no change was observed in the intervention group [140.0 (122.5–160.0) vs. 140.0 (136.0–162.5); p = .523] (Figure 5, Panel A).

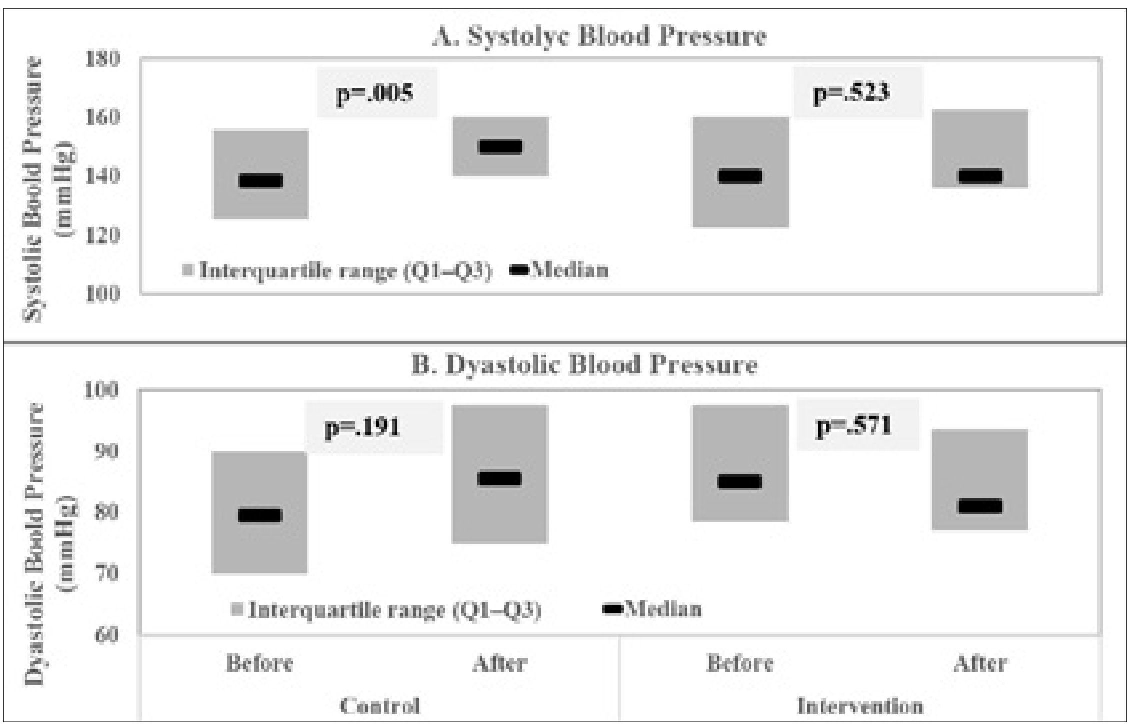
Table 3. Median (interquartile range) HbA1c values in the intervention group before and after the intervention

Time point	HbA1c Medina (%)	Interquartile range (25th–75th)	p-value
Before intervention	7.85	6.45–9.37	.001
After intervention	6.85	6.02–8.00	

Source: Authors
Note: Data are presented as median with interquartile range (25th–75th percentiles); p-value refers to the comparison before and after the intervention (paired analysis).

Median diastolic blood pressure showed no significant changes in either group over time. In the control group, values increased from 79.50 (70.0–90.0) to 85.50 (75.0–97.50) (p = .191), while in the intervention group values decreased from 85.0 (78.50–97.50) to 81.0 (77.0–93.5) (p = .571) (Figure 5, Panel B).

Figure 5. Changes in systolic and diastolic blood pressure in the control and intervention groups over time



Source: Authors
Note: Panel A shows systolic blood pressure, and Panel B shows diastolic blood pressure in the control and intervention groups before and after the intervention. Data are presented as median and interquartile range (25th–75th percentiles). p-values refer to within-group comparisons over time.

DISCUSSION

Diabetes mellitus is a chronic metabolic disease that presents a growing global burden and has significant consequences for morbidity, mortality, and quality of life. Effective diabetes management requires a combination of pharmacological and non-pharmacological strategies, with education and self-care support serving as essential components of long-term disease control. Pharmacists, given their accessibility, frequent patient interactions, and expertise in pharmacotherapy, are well-positioned to deliver advisory and educational interventions. Pharmaceutical interventions have been shown to improve multiple clinical outcomes in individuals with diabetes, including glycaemic control, body mass index, lipid profile, and blood pressure, and to enhance medication adherence and health-related quality of life (Ali et al., 2012; Antoine et al., 2014; Pousinho et al., 2016). Evidence suggests that pharmacist-led interventions are associated with measurable improvements in body mass index and glycaemic control, including reductions in HbA1c, alongside improvements in other cardiometabolic parameters (Ali et al., 2012; Antoine et al., 2014; Pousinho et al., 2016). Previous regional research has shown that diabetes mellitus significantly affects both psychological and social aspects of quality of life, further emphasising the importance of comprehensive patient support models (Grujić-Vujmilović & Gavrić, 2014).

The pharmacists' advisory roles in real-world settings may represent an effective model of patient support, particularly in health systems where pharmacists' involvement in chronic disease management remains underutilised.

In our study, the pharmacist-led intervention consists of nutrition counselling, education and recommending appropriate physical activity.

Our interventions are associated with statistically significant changes in body mass index (BMI) among patients with type 2 diabetes mellitus (T2DM) (H1 accepted). Systematic reviews and meta-analyses have demonstrated that pharmacist-led interventions are associated with significant reductions in HbA1c and improvements in other cardiometabolic parameters, including body mass index (Aguiar et al., 2016; Pousinho et al., 2016). In addition, pharmacists frequently collaborate with other healthcare professionals within multidisciplinary teams. Evidence suggests that coordinated, team-based care models involving pharmacists are associated with improved metabolic and cardiovascular outcomes, indicating that integrated care approaches may enhance intervention effectiveness (Carter et al., 2015; Pousinho et al., 2016). Furthermore, studies have shown that ongoing monitoring and regular touchpoints with pharmacists have been associated with significant improvements in BMI and diabetes-related outcomes (Pousinho et al., 2016; Aguiar et al., 2016).

Hypothesis 2 is partially supported in our findings: the mean systolic blood pressure in the intervention group remains at 140 mmHg, while the mean diastolic blood pressure decreases from 85 to 81 mmHg. These findings indicate that, following the intervention, most patients in the intervention group exhibited systolic and diastolic blood pressure values approaching recommended targets; the observed reduction in diastolic blood pressure is consistent with evidence demonstrating that pharmacist-led interventions contribute to improved blood pressure control within team-based care models (Carter et al., 2009; Santschi et al., 2014). According to contemporary international guidelines, blood pressure targets for patients with diabetes mellitus should be individualised. For most adults, a target of <130/80 mmHg is recommended when it can be safely achieved, whereas less stringent targets (<140/90 mmHg) may be appropriate for older individuals or those with multiple comorbidities (American Diabetes Association, 2024; McEvoy et al., 2024; Williams et al., 2018; World Health Organization, 2021). In evaluating the efficacy of pharmacist-led programs, systematic reviews and randomised controlled trials have reported significant reductions in systolic and diastolic blood pressure, alongside improvements in patient-reported outcomes, including satisfaction and health-related quality of life (Ali et al., 2012; Antoine et al., 2014; Pousinho et al., 2016).

Fasting blood glucose (FBG) is used to assess glycaemic control, and HbA1c levels reflect the average blood glucose concentrations over the past two to three months in patients with T2DM. The intervention was associated with statistically significant changes in fasting blood glucose (FBG) among patients with type 2 diabetes mellitus (T2DM) in the intervention group (H3 accepted).

The literature indicates that diverse interventions, including structured lifestyle modification programmes and pharmacist-led coordinated care models, are associated with statistically significant reductions in fasting blood glucose among patients with type 2 diabetes mellitus (Gong et al., 2021; Langhinrichsen-Rohling et al., 2023; Azmiardi et al., 2021). Additionally, a significant change in HbA1c, an indicator of average glycemia, is observed in the intervention group in the early weeks and months (before intervention 7,85 [6,45–9,37] vs after intervention 6,85 [6,02–8,00]; p=0.001). These findings are clinically relevant because a moderate, as even moderate reduction in HbA1c is associated with a lower risk of diabetic complications and a better health-related quality of life. Multiple studies corroborate that even modest decreases in HbA1c can lead to significant improvements in health outcomes. A 1% reduction in HbA1c has been associated with a 37% decrease in the risk of microvascular complications and a 14% reduction in myocardial infarction risk, underscoring the critical importance of glycaemic control in diabetes management (Stratton et al., 2000). Furthermore, achieving target HbA1c levels can positively influence health-related quality of life (HRQoL), as evidenced by studies linking better glycaemic control with improved patient outcomes and psychosocial well-being (Azmiardi et al., 2021; Sindhu & Jayakumar, 2023). From a public health perspective, integrating pharmacist-led advisory services into chronic disease management may be a cost-effective, scalable strategy to enhance patient-centred diabetes care. Evidence from structured prevention programmes has demonstrated favourable clinical and economic outcomes, particularly among high-risk populations (Grujić-Vujmilović et al., 2025; World Health Organization, 2021).

Strengths and Limitations

This study has several important strengths. Conducting the research in a real-world community pharmacy setting enhances ecological validity and practical relevance, as the findings reflect routine clinical practice rather than controlled experimental conditions. This is consistent with evidence supporting community pharmacy–based models in chronic disease management, particularly diabetes, through expanded pharmacist roles within structured service frameworks (Hassan et al., 2023; Teoh et al., 2024). The multidimensional intervention—integrating structured education, individual counselling, organised physical activity, and digital communication—reflects comprehensive chronic care principles. Similar integrated approaches have been associated with improvements in BMI, glycaemic control, and self-management capacity among patients with type 2 diabetes mellitus (Aguiar et al., 2016; Azmiardi et al., 2021; Pousinho et al., 2016).

The inclusion of a control group strengthened comparative analysis, and clinically meaningful outcomes—including BMI, fasting blood glucose, blood pressure, and HbA1c—were assessed in line with internationally recognised diabetes and cardiovascular risk control targets (American Diabetes Association, 2024; McEvoy et al., 2024; Stratton et al., 2000). Importantly, the study provides context-specific evidence from Bosnia and Herzegovina, where pharmacist-led chronic disease management services remain underdeveloped within primary care structures.

However, several limitations should be acknowledged. The quasi-experimental design without randomisation restricts causal inference and does not exclude residual confounding. The relatively small sample size reduces statistical power and limits generalisability. A four-month follow-up may not adequately capture the long-term sustainability of behavioural and metabolic improvements. Furthermore, HbA1c was assessed only in the intervention group, limiting between-group comparison of long-term glycaemic control. This limitation should be considered when interpreting the magnitude of the intervention effect on long-term glycaemic control.

The potential influence of the Hawthorne effect and the single-site design may further affect external validity. Accordingly, the findings should be interpreted as preliminary evidence from a pilot exploratory study rather than a definitive efficacy trial.

From a health system perspective, these findings support the integration of pharmacist-led advisory services into primary healthcare in Bosnia and Herzegovina. Expanding the role of community pharmacists through structured chronic disease management programmes may contribute to improved access to care, reduced burden on physicians, and more efficient utilisation of healthcare resources. Such task-shifting approaches align with ongoing health system strengthening and primary care reform initiatives in transitional settings.

CONCLUSION

Pharmacist-led advisory interventions delivered in a community pharmacy setting were associated with improvements in key cardiometabolic parameters among patients with type 2 diabetes mellitus. Reductions in BMI, fasting blood glucose, and HbA1c, alongside stabilised blood pressure values, suggest that structured lifestyle-oriented counselling and ongoing support may enhance metabolic control.

Although larger randomised studies with extended follow-up are required to confirm long-term sustainability and broader applicability, these findings provide preliminary support for expanding the role of community pharmacists in chronic disease management. Integrating pharmacist-led services into primary care may represent a feasible and scalable strategy for strengthening patient-centred diabetes management and optimising health system resource utilisation.

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