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Narrative Review: The Effect of Counseling on Adherence in Patients with Type 2 Diabetes Mellitus

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Abstract: This study aimed to evaluate the effect of counseling on medication adherence among patients with type 2 diabetes mellitus through a narrative review of 50 national and international articles published between 2020 and 2025. The narrative review method was conducted by selecting journals from Elsevier, MDPI, PubMed, SpringerLink, Wiley, as well as nationally indexed SINTA journals using relevant keywords.The results of the review indicate that pharmacist-led interventions through counseling, including brief counseling, home pharmacy care, and digital media–based education, consistently improved patient knowledge, enhanced medication adherence, and reduced clinical parameters such as blood glucose levels, HbA1c, and HOMA-IR. These interventions also improved patients' quality of life and disease perception.Based on these findings, it can be concluded that pharmacist-led interventions through structured counseling and pharmaceutical education have a significant positive impact on the management of type 2 diabetes mellitus, particularly in improving patient knowledge, disease perception, and adherence to therapy. Improvements in therapeutic behavior directly contributed to better clinical outcomes, including reductions in blood glucose, HbA1c, HOMA-IR, body weight, and waist circumference after 90 days of intervention. The greatest effects were observed in patients with HbA1c levels > 9%, indicating that high-risk groups derived the greatest benefit from pharmacist involvement in the management of type 2 diabetes mellitus.Future studies are recommended to evaluate the long-term effects of counseling and to standardize adherence assessment instruments. Strengthening pharmaceutical care policies is also recommended to improve the quality and consistency of counseling services and to develop sustainable intervention models in primary healthcare settings.

Keywords: Type 2 Diabetes Mellitus, Adherence, Pharmaceutical Counseling

Introduction

Type 2 diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia, which is an increase in blood sugar level. This can either occur due to insufficient insulin production by the pancreas or due to poor insulin sensitivity of the body's cells. Diabetes progresses slowly and if not properly managed, it can lead to very serious complications such as kidney disease, eye disease, nerve disease, and heart problems (DiPiro et al, 2023). The global prevalence of diabetes continues to increase) (the IDF report in 2025 indicated that 589 million adults were living with diabetes. Indonesia is among the countries with a high burden of diabetes mellitus, with a prevalence of 8.5% and a significant increase observed in the 55–74-year age group (Gulo et al, 2024) (Istiqomah et al, 2025).

The management of type 2 diabetes mellitus is influenced to a great extent by the pharmacological therapy and the level of patient adherence or compliance that is given to it. Non-adherence to treatment is one of the main factors responsible for the inability to maintain blood sugar levels within the desired range, because the patients usually have a poor comprehension of the treatment objectives, the amount of the drug to be taken, and the correct way of using the drug (Syafitri et al, 2023). Other factors, such as adverse drug effects, regimen complexity, and low health literacy, also contribute to poor adherence, making education a critical component of successful diabetes management. Persistent non-adherence increases the risk of macroangiopathic and microangiopathic complications and further worsens patients' clinical conditions (Padmasari et al, 2021) (Patil et al, 2025).

Pharmaceutical counseling serves as an educational intervention that can improve patients' knowledge, self-care skills, and motivation to adhere to therapy. Counseling enables two-way communication between pharmacists and patients to ensure proper medication understanding, including its benefits, risks, and strategies for long-term therapy management (Agusnur, 2025). Research has evidenced that interventions of pharmaceutical counseling can lead to better patient adherence to medications, decrease in blood glucose levels, and noticeable improvements in clinical outcomes. This has placed pharmacists in the position of the key players in the management of type 2 diabetes mellitus (Asnuddin et al, 2024).

Empirical evidence indicates that various counseling models, such as brief counseling, home pharmacy care (HPC), and individual counseling, consistently have a positive impact on medication adherence and glycemic control. According to studies, short counseling sessions have a positive impact on patients with type 2 diabetes mellitus by enhancing their understanding and compliance as well as bringing down their random blood glucose levels (Syafitri et al, 2023). Multifaceted interventions implemented in primary healthcare centers and hospitals have also been proven to significantly reduce HbA1c levels, thereby strengthening the role of pharmacists in the successful management of type 2 diabetes mellitus (Amila & Sembiring, 2021).

The limitations in the implementation of pharmaceutical counseling across various healthcare facilities indicate the need for a more in-depth evaluation of the effectiveness of this intervention in improving patient adherence. The purpose of this study is to assess the influence of pharmaceutical counseling on the compliance rates of patients with type 2 diabetes mellitus. The ultimate goal is to generate scientific evidence that will pave the way for the formulation of intervention strategies that are based on evidence and can be applied in both primary and secondary healthcare services.

Methodology

The study took a narrative review approach and was carried out through a systematic search and analysis of literature concerning the impact of counseling on therapeutic adherence in patients suffering from type 2 diabetes mellitus. The data sources were composed of local and international publications that were specifically articles issued from 2020 to 2025, and they were obtained through Elsevier, MDPI, PubMed, SpringerLink, Wiley, Taylor & Francis, and SINTA where the national indexing is done. The keywords were used in combinations of "pharmacist counseling," "medication adherence," "type 2

diabetes mellitus," "pharmaceutical counseling," "adherence," and "type 2 DM," while Boolean operators AND/OR were utilized. The chosen articles were subjected to a process that started with a first screening of titles and abstracts followed by full-text reading. This process culminated with the determination that 50 articles were eligible for inclusion, which were full-text articles indexed either in Scopus or SINTA, related to the topic, and evaluating counseling interventions on adherence among the patients with type 2 diabetes mellitus.

Data analysis was conducted using a narrative synthesis approach, involving a systematic review of each article to identify types of counseling interventions, adherence measurement instruments, and changes in patient behavior and clinical outcomes following the intervention. Articles that were irrelevant, did not separately report data for type 2 diabetes mellitus, or had low methodological quality were excluded from the analysis. Afterward, the results of the 50 chosen articles were juxtaposed in order to get a thorough image of the efficacy of therapy in enhancing drug adherence in patients with type 2 diabetes mellitus.

Result and Discussion

A thorough investigation was done through a literature review of 50 national and international articles released from 2020 to 2025, which gave an extensive summary of the different counseling methods that were applied to facilitate the adherence to therapy among patients with type 2 diabetes mellitus. The analyzed literature demonstrates diversity in the types of interventions, healthcare facility settings, and patient population characteristics addressed in the studies.

Differences in scope and methodology reflect the wide variation in counseling practices implemented across countries and regions, while also emphasizing that pharmaceutical counseling is an essential component of chronic disease management. This diversity forms the basis for understanding the role of counseling in supporting patient adherence behaviors, prior to a more in-depth examination of the findings from each individual study.

Table 1. The Effect of Counseling on Improving Patient Knowledge

Title	Method	Research Findings	Author
Pengaruh Edukasi oleh Apoteker dengan Method *Brief Counseling* terhadap Pengetahuan, Kepatuhan dan Glukosa Darah Pasien DM Tipe 2 di Puskesmas Kabupaten Pemalang	A quasi-experimental study with a pretest-posttest design and a control group was conducted with 64 patients, consisting of 32 in the control group and 32 in the intervention group) (the DKQ-24 and MGLS were the instruments used for the study.	Brief counseling improved knowledge (12.66 ± 2.43 to 21.75 ± 1.81), enhanced medication adherence (MGLS score decreased from 2.03 ± 0.96 to 0.25 ± 0.51), and reduced blood glucose levels from 177.63 ± 82.4 to 159.0 ± 58.1 ($p < 0.05$).	(Syafitri et al, 2023)
Pengaruh Edukasi Kesehatan Terhadap Pengetahuan	Pre–post design) (structured education delivered through a lesson plan (SAP) and leaflets.	Adherence-related knowledge increased significantly ($p = 0.000$)) (education	(Muhammad et al, 2024)

Title	Method	Research Findings	Author
Kepatuhan Minum Obat Pasien Diabetes Melitus Tipe 2 Di Rumah Sakit Tk II Robert Wolter Mongisidi Manado		strengthened patients understanding of the importance of adherence.	
A randomized controlled trial of a pharmacist-led intervention to enhance knowledge of Vietnamese patients with type 2 diabetes mellitus	A randomized controlled trial (RCT) was conducted with 165 patients suffering from type 2 diabetes mellitus. The participants were divided into two groups: one received pharmacist counseling while the other standard care. Among various outcomes evaluated were patients' knowledge, medication adherence, and fasting blood glucose (FBG).	Counseling significantly improved knowledge ($p < 0.001$), increased the likelihood of medication adherence by nearly tenfold ($p = 0.001$), and improved fasting blood glucose (FBG) control ($p = 0.041$).	(Nguyen et al, 2022)
Impact of clinical pharmacist integration on diabetes management : a prospective cohort	A future cohort study was carried out with the aim of assessing the role of pharmacist interventions in the management of patients with prediabetes (pDG) and diabetes mellitus type 2.	The case of pharmaceutical interventions was that they not only had a positive impact on the prognosis of the disease but also improved the knowledge and perceptions of the patients. Among the patients with HbA1c higher than 9%, those who received the help of a pharmacist got the greatest benefits.	(Kutluay et al, 2025)
Knowledge and Medication Adherence among Type 2 Diabetes Mellitus Patients : A Cross-Sectional Study in Yogyakarta , Indonesia	*Cross-sectional*	Knowledge was significantly correlated with adherence ($p = 0.003$) ($r = 0.357$). Enhanced educational interventions are recommended to improve adherence	(Regitha et al, 2025)

In table 1, Improved knowledge is the most consistent outcome of counseling interventions among patients with type 2 diabetes mellitus. A review of 50 journals demonstrated that pharmacist counseling, structured education, and brief counseling significantly increased

patients' knowledge scores regarding the disease, therapy, and self-management. Research carried out by Regitha et al. (2025) found a significant albeit moderate positive association between knowledge level and adherence (r = 0.357) (p = 0.003). This means that diabetes-related education through organized lectures and pharmacist-led counseling will not only be a means of improving adherence behavior but also an excellent method of increasing the effectiveness of clinical outcomes in primary health care environments. The study by Syafitri et al. (2023) also showed great evidence for this as there was a rise in knowledge scores from 12.66 to 21.75 after counseling. Moreover, the research conducted by Muhammad et al. showed a significant rise in knowledge and adherence with a p-value of 0.000. Nguyen et al. also reported similar results among patients with type 2 diabetes mellitus receiving pharmacist counseling who were considered to have significantly more knowledge than those receiving standard care.

This improvement in knowledge was achieved not only through direct counseling but also through media-based educational approaches, such as booklets, educational SMS messages, messaging applications, and home pharmacy care interventions. Kutluay et al further supported these findings by demonstrating that pharmaceutical interventions improved knowledge scores in both prediabetic and type 2 diabetes mellitus patients. Overall, these findings emphasize that counseling is an essential component in improving health literacy, which serves as the foundation for patient adherence to treatment and the adoption of healthy behavioral changes.

Table 2. Effectiveness of Counseling in Improving Medication Adherence

Title	Method	Research Findings	Author
Modified brief counseling-5A, motivational SMS on medication- taking behavior and compliance among diabetic patients	Quasi-experimental study involving 72 patients) (5A counseling and motivational SMS intervention compared with a control group.	Medication-taking behavior scores increased significantly) (adherence improved by 3.44 points) (the combination of counseling and SMS reminders was effective.	(Saputri et al, 2022)
Pengaruh Konseling Obat Terhadap Kepatuhan Pasien Diabetes Melitus Tipe 2 Di Apotek Reza Farma	Experimental research and the conduct of a pilot trial	Counseling concerning medication had a remarkable impact on the adherence of patients diagnosed with type 2 diabetes mellitus. It was found by comparing the adherence ratings pre- and post-counselling intervention.	(Tanjung et al, 2022)
Medication Adherence Improvement of Patients with Type 2 Diabetes Mellitus	Quasi-experimental pretest–posttest study without a control group involving 43 patients with type 2 diabetes	The score of non-adherence decreased from 3.26 to 0.72, which corresponds to the increase of adherence by 2.54	(Amila & Sembiring, 2021)

Title	Method	Research Findings	Author
	mellitus at Sari Mutiara Hospital) (home care counseling was provided over 24 sessions.	points. There was a significant difference in medication adherence before and after home care counseling (p = 0.000).	
Efektivitas Konseling Apoteker dalam Menurunkan Tingkat Ketidakpatuhan Terapi Diabetes Mellitus	Pre–post test) (MMAS-8.	Pharmacist counseling significantly increased adherence scores (p<0.05) and reduced non-adherence in patients with type 2 diabetes mellitus	(Abidin & Rahmat, 2025)
Impact of Online Diabetes Education Counseling on Treatment adherence and Quality of Life of Type-II Diabetics	Quasi-experimental) (edukasi online 6 bulan) (dinilai HbA1c, RBS, BP, BMI & adherence.	HbA1c, RBS, BP, BMI turun signifikan (p<0,001)) (adherence & kualitas hidup meningkat (p<0,05).	(Ahmed et al, 2025)

In table 2, Adherence is the outcome most frequently positively influenced by counseling. An analysis of 50 journals showed that almost all counseling based interventions significantly reduced non-adherence and increased adherence scores. The study by Panjaitan et al. (2025) reported an increase in the MARS-10 score from 6.49 to 8.08 and a rise in the proportion of adherent patients from 52% to 94.67%. The 5A counseling approach and motivational SMS also improved medication taking behavior, with an increase of 3.44 points (Saputri et al, 2022). In the study by Abidin & Rahmat, the MMAS-8 score increased from 5.22 to 7.12. In an analogous research, Ahmed et al. (2025) reported a noteworthy variation in the MMAS-8 adherence scores between baseline and the six-month follow-up, with a p-value <0.001. Even the most basic interventions, like counseling in community pharmacies, yielded better adherence with p=0.000 (Tanjung et al, 2022).

Home pharmacy care based studies reported similar trends. Amila and Sembiring found an increase in adherence scores of 2.54 points after 24 home visit sessions. In addition, Fatiha et al. (2021) reported that adherence levels increased to 62.8% following counseling interventions. These findings indicate that counseling particularly when delivered in a personalized and continuous manner is an effective pharmaceutical strategy for addressing behavioral barriers such as forgetfulness, low motivation, and limited understanding of the importance of long-term therapy.

Table 3. The Impact of Counseling on Patients Clinical Parameters

Title	Method	Research Findings	Author
Efek Konseling Farmasi pada Kualitas Hidup dan Gula Darah Pasien	Quasi-experimental pre–post study involving 23 patients with type 2 diabetes mellitus at a	Pharmaceutical counseling increased the quality-of-life score from 188.70 to 206.17 and reduced the mean random blood glucose	(Istiqomah et al, 2025)

Title	Method	Research Findings	Author
Diabetes Melitus Tipe 2	primary healthcare center) (quality of life was measured using the DQLCTQ, and random blood glucose levels were assessed through laboratory examination.	level from 337.91 mg/dL to 285.17 mg/dL, with both outcomes showing statistical significance (p = 0.00)	
Self-Management Counseling Increases Compliance in Diabetes Mellitus Patients	Quasi-experimental study involving 79 patients with type 2 diabetes mellitus.	The Self-Management Counseling (SMC) through the application of the Transtheoretical Model (TTM) approach has been demonstrated to be effective in enhancing the adherence of patients with type 2 diabetes mellitus, which also included adherence to diet, physical activity, medication, and diabetes education among others.	(Mulyaningsih et al, 2025)
Effect of Pharmacist Intervention on Medication Adherence and Clinical Outcomes of Type 2 Diabetes Mellitus Outpatients in Primary Healthcare in Indonesia	Quasi-experimental study) (counseling combined with a booklet and SMS reminders for four months.	An increase in adherence as measured by MAQ and pill count, along with significant reductions in HbA1c, LDL, and triglyceride levels, significantly improved fasting blood glucose (FBG) control (p = 0.041).	(Besemah et al, 2021)
Impact of clinical pharmacist integration on diabetes management : a prospective cohort	A prospective cohort study was conducted to assess the effects of pharmacist interventions on patients with prediabetes (pDG) and type 2 diabetes mellitus.	Medical treatment methods contributed to a better prognosis of the disease, patient education and patient perception. Pharmacist interventions were most advantageous to patients with HbA1c over 9% the most.	(Kutluay et al, 20

As shown in Table 3, the counseling's value not only enhances patients' awareness and compliance but also brings about the positive impacts of the treatment on patients with type 2 diabetes mellites. The list of studies supporting the changes in glycemic indices is long, so they even include the fasted plasma glucose (FPG) coming down, random blood glucose (RBG), HbA1c, and HOMA-IR. As per the research conducted by Istiqomah et al. (2025), drug counseling brought about a decrease in blood glucose levels from 337.91 mg/dL to 285.17 mg/dL. Meanwhile, the research by Mulyaningsih et al. (2025) showed that self-

management counseling improved dietary adherence and physical activity, thereby contributing to better glycemic control. Similar effects were reported by Besemah et al, who found significant reductions in HbA1c, LDL cholesterol, and triglyceride levels following counseling interventions combined with reminder SMS messages.

More comprehensive clinical outcomes were observed in the study by Kutluay et al, in which pharmaceutical interventions led to improvements in body weight, waist circumference, fasting glucose, cholesterol levels, HbA1c, and HOMA-IR within a 90-day period. In addition, dietary education interventions Agustini et al significantly reduced carbohydrate intake and blood glucose levels. Overall, counseling has been shown to produce tangible physiological benefits through improvements in therapeutic behaviors, dietary control, and adherence to pharmacological therapy.

Table 4. Barriers and Factors Influencing the Success of Counseling

Title	Method	Research Findings	Author
Pharmacist's perceived barriers in providing counseling services to ambulatory type 2 diabetes mellitus patients : A qualitative phenomenological study in Bali , Indonesia	Qualitative methods (focus group discussions and interviews) were conducted among patients, educators, and healthcare professionals.	Acknowledged educational hurdles (inadequate literacy, lack of support, and limited access) as well as helpful elements (skilled counselors and personalized method) that impact the counseling success and adherence of the type 2 diabetes mellitus patients.	(Jaya et al, 2025)
Evaluation of Counseling Practices and Patient ' s Satisfaction Offered by Pharmacists for Diabetics Attending Outpatient Pharmacies in Al Ahsa	Cross-sectional interviews were conducted to assess counseling and patient satisfaction among diabetes mellitus (DM) patients.	Counseling was found to be less than desirable, especially for type 2 diabetes mellitus patients) (patient satisfaction stood very low (11%).	(Emeka et al, 2020)
Pengaruh Konseling dan Alat Bantu Pengingat Pengobatan terhadap Kepatuhan Minum Obat dan Outcome Klinik Pasien Diabetes Melitus dan Hipertensi	Pretest–posttest experimental study conducted on Prolanis patients with type 2 diabetes mellitus and hypertension at three community health centers) (adherence was measured using MARS.	In the beginning, most of the patients failed to comply with the treatment) (then, after a combination of the pharmacist's advice and the reminder tools, there was a significant rise in the adherence rate, resulting in the patients with diabetes type 2 and hypertension having better clinical outcomes ($p < 0.05$).	(Wibowo et al, 2020)
Adherence to antidiabetic treatment and impaired hypoglycemia awareness in type 2 diabetes mellitus	Multicenter cross-sectional study involving 618 patients) (adherence was assessed using the	High adherence was observed in only 41% of patients) (71% received counseling) (pharmacies	(Peralta et al, 2021)

Title	Method	Research Findings	Author
assessed in Spanish community pharmacies : the ADHIFAC study	MMAS-8 and pharmacy counseling.	played an important role in identifying adherence issues.	

In table 4, Although counseling has been proven effective, its success is influenced by various internal and external barriers. Phenomenological analyses by Jaya et al. (2025) and data reported by Emeka et al. (2020) identified major obstacles, including low health literacy, lack of family support, limited access to healthcare services, economic instability, and time constraints faced by counselors. From the healthcare provider perspective, high workload, inadequate facilities, and insufficient counseling training were also found to be key barriers to the successful implementation of counseling programs.

Factors supporting the success of counseling include individualized approaches, effective therapeutic communication, the use of supportive tools (such as SMS, booklets, and reminders), and family involvement in the educational process. A study by Wibowo et al demonstrated that the combination of counseling and reminder tools yielded better outcomes than counseling alone. Furthermore, research by Peralta et al emphasized that early identification of adherence-related problems within the community enhances the effectiveness of counseling interventions. These findings indicate that the success of counseling depends on the synergy between pharmacists communication skills, patient characteristics, and environmental support.

Table 5. Implications of Counseling for Quality of Life and Holistic Patient Management

Title	Method	Research Findings	Author
Efek Konseling Farmasi pada Kualitas Hidup dan Gula Darah Pasien Diabetes Melitus Tipe 2	Pre–post quasi-experimental study involving 23 patients with type 2 diabetes mellitus at a community health center) (quality of life was measured using DQLCTQ, and random blood glucose was assessed in the laboratory	Pharmaceutical counseling increased the quality of life score from 188.70 to 206.17 and decreased the mean random blood glucose from 337.91 mg/dL to 285.17 mg/dL (both p = 0.00)	(Istiqomah et al, 2025)
Impact of pharmacist counseling on health-related quality of life of patients with type 2 diabetes mellitus : a cluster randomized controlled study	*Cluster RCT*	Health-related quality of life (HRQoL) increased significantly (p = 0.041). The VAS score increased by 2.66 in the intervention group. Counseling improved health perceptions	(Fajriansyah et al, 2020)
Community Service Activities - Counseling And Random Blood Sugar Screening (Type 2 Diabetes Mellitus)	Counseling and community screening	Counseling improved knowledge, awareness, and the ability of the community to manage type 2 diabetes mellitus risk, even though	(Santoso et al, 2023)

Title	Method	Research Findings	Author
		medication adherence was not assessed	
Edukasi Upaya Peningkatan Kualitas Hidup Pasien Diabetes Melitus Tipe 2	Lecture, discussion, and question-and-answer methods	Participants knowledge before education was in the low category (76.6%) and increased to the high category (80%) after education	(Rahman et al, 2025)
Konseling Gizi Dapat Menurunkan Kadar Gula Darah dan Asupan Karbohidrat pada Penderita Diabetes Melitus	*Quasi-experimental.*	Counseling reduced carbohydrate intake and blood glucose levels ($p < 0.05$), and also increased knowledge about diabetes diet	(Agustini et al, 2024)
Pengaruh Asuhan Kefarmasian Terhadap Outcome Klinis dan Kualitas Hidup pada Pasien Diabetes Melitus Tipe 2	Pre–post study involving 38 patients) (counseling and therapy monitoring.	Random blood glucose (RBG) decreased significantly (278 to 179 mg/dL)) (HbA1c decreased significantly) (quality of life (QoL) increased (0.849 to 0.967).	(Khairunnisa et al, 2021)

Table 5 presents evidence from multiple studies that counseling is beneficial not just through acting as a support but has a positive direct influence on patients' and their families' quality of life (QoL) as well. The authors report the results of Istiqomah et al. who noted a rise in quality of life scores from 188.70 to 206.17 after counseling. In the case of Khairunnisa et al. (2021), it was the patients' quality of life that improved, as QoL moved up from 0.849 to 0.967, indicating a clear change. The study conducted by Fajriansyah et al. (2020), also gave similar findings in which, through counseling alone, the health-related quality of life was significantly enhanced ($p = 0.041$). This improvement was associated with reduced anxiety, increased motivation, and enhanced patients' perceived self-control over their disease.

Furthermore, community-based educational interventions have been shown to increase public awareness in preventing complications of type 2 diabetes mellitus (Rahman et al, 2025) (Santoso et al, 2023). The improvement of dietary habits through nutritional counseling has been verified and considered as a direct contribution to the quality of life enhancement. In general, counseling helps the holistic treatment of type 2 diabetes mellitus through the improvement of clinical outcomes, therapeutic behaviors, psychological well-being, and overall quality of life (Agustini et al, 2024).

The present study has primarily the advantage of its large literature coverage which covers 50 national and international journals and includes different types of research such as randomized controlled trials (RCTs), quasi-experimental studies, cohort studies, cross-sectional studies, and qualitative research. The wide variety of methods used in the research

resulted in a more comprehensive understanding of the effects of counseling on the adherence to medication and the clinical parameters of the type 2 diabetes mellitus patients. Many studies consistently reported positive effects of counseling on patient knowledge, adherence, and glycemic control, thereby strengthening the validity of the conclusions drawn in this review. Furthermore, the inclusion of diverse intervention models such as 5A counseling, self-management counseling, home pharmacy care, and education delivered via SMS and mobile applications offers a rich overview of innovative pharmaceutical approaches that have been successfully implemented in real world settings (Amila & Sembiring, 2021) (Syafitri et al, 2023).

Nevertheless, several limitations should be considered. Most of the reviewed studies employed pretest–posttest designs without control groups, making it difficult to fully eliminate potential biases such as the Hawthorne effect or natural changes in patients' conditions over time (Padmasari et al, 2021). Variations in adherence measurement instruments (e.g., MARS, MMAS-8, MGLS, and ProMAS) also introduced data heterogeneity, which complicates direct comparisons across studies. In addition, some studies had small sample sizes, short intervention durations, or did not assess long-term effects, thereby limiting the generalizability of the findings. Structural barriers such as low patient health literacy, limited counseling time, and insufficient supporting facilities frequently reported in qualitative studies by Jaya et al and Emeka et al further indicate that the effectiveness of counseling is highly dependent on the healthcare context. Despite these limitations, they do not diminish the overall conclusion that counseling plays a crucial role in improving medication adherence and clinical outcomes among patients with type 2 diabetes mellitus.

Conclusion

The outcome of the research suggests that it is the interventions of pharmacists that are the main contributors to the better management of type 2 diabetes mellitus, especially in the areas of patients' knowledge, their perception of the disease, and their adherence to therapy, through well-structured counseling and pharmaceutical education. Improvements in therapeutic behavior directly contributed to better clinical parameters, including reductions in blood glucose levels, HbA1c, HOMA-IR, body weight, and waist circumference after 90 days of intervention. The greatest effects were observed among patients with HbA1c levels greater than 9%, indicating that high-risk groups derive the most benefit from pharmacist involvement in disease management. Overall, this study confirms that comprehensive pharmaceutical care encompassing medication review, systematic education, and follow-up is a key component in improving prognosis, enhancing self-management, and improving the quality of care for patients with type 2 diabetes mellitus. Future studies are recommended to evaluate the long-term effects of counseling and to standardize adherence assessment instruments. Strengthening pharmaceutical care policies is also recommended to improve the quality and consistency of counseling services and to develop sustainable intervention models in primary healthcare settings.

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