Enhancing Adherence and Satisfaction with Insulin Therapy in Type 1 Diabetes Mellitus Patients Through Pharmacist-Led Interventions: Interventional study

Marwa Salman Abd Alrahman, BSc* Ali Lateef Jasim, PhD** Muqdad A. Alhilal, FIBMS***

ABSTRACT

Pharmacist plays an essential role in treating DM. Pharmacist enrollment and patient education may improve adherence and satisfaction. The present study aimed to evaluate the influence of pharmacist-led educational intervention on insulin adherence and satisfaction in patients with type 1 diabetes mellitus. This study was conducted on patients with type 1 diabetes mellitus who were receiving insulin and attended Specialized Center for Endocrinology and Diabetes in Baghdad/Al-Russafa. It was a prospective, comparative pre-post, interventional, randomized clinical study. At the beginning of the study the Arabic version of the treatment satisfaction questionnaire for medication (TSQM-14item), The Iraqi Anti-Diabetic Medication Adherence Scale IADMAS and Insulin Self-Administration Assessment Checking Form were filled out at baseline for each patient in both groups (interventional and control). Each patient in the interventional group underwent a face-to-face educational session lasting for 30 minutes and was provided with a formal Arabic booklet. This booklet contains medical information about disease and treatment. Subsequently, after the following three months, the patient in both groups completed the identical questionnaires once again. The satisfaction scores significantly increased in the intervention group compared to the control group (4.0 vs. 0.0%, respectively), The medication adherence scores significantly increased in the intervention group compared to the control group (9.1 vs. 0.0%, respectively), The insulin knowledge level significantly increased in the intervention group compared to the control group (25.0 vs. 0.0%, respectively). The implementation of an educational intervention led by a clinical pharmacist can enhance the adherence and satisfaction of patients with type 1 DM.

Keywords: insulin, type 1 diabetes mellitus, Clinical Pharmacist Led-Intervention, treatment satisfaction and adherence.

INTRODUCTION

Diabetes Mellitus (DM) is a prevalent metabolic disease, particularly in developing countries like Iraq, it is marked by either complete or partial insulin insufficiency [1,2]. Pharmacists may assist patients in adhering to their pharmacotherapeutic regimens and monitoring plans by providing information and counseling to prepare and motivate them [3-6]. Medication non-adherence is a prevalent issue among individuals with diabetes [7]. The World Health Organization (WHO) found that long-term adherence to treatment among patients with chronic illnesses in industrialized nations is about 50%, resulting in worse health outcomes and greater total healthcare expenditures due to non-adherence [8]. Medication satisfaction is a crucial determinant of effective medication adherence. It is one of numerous patient-reported outcomes that are crucial for healthcare practitioners to understand patient perspectives on their current medication; these can be utilized to assess the effects of disease and medication on patient well-being, functioning, and daily life routine [9]. Key factors contributing to treatment satisfaction in T1DM patients include diabetes-related complications, educational levels, difficulty taking insulin, and compliance with lifestyle modifications [10]. Rightful treatment adherence, lifestyle counseling, and diabetes management flexibility and convenience increase patient satisfaction, thereby improving the quality of care and treatment outcomes. However, patient satisfaction is low, particularly in developing countries, affecting glycaemic control and treatment outcomes [11]. Pharmacists' responsibilities extend beyond conventional filling and dispensing functions. Pharmacists are essential in diabetes treatment, being among the most accessible healthcare specialists in primary care [12]. Patients counseling promotes patient adherence with prescribed medications and educates them about potential interactions with other medications. The objective is to foster knowledge and assist patients in comprehending the purpose of prescribed medications and their associated effects [13]. Numerous studies in Iraq shown pharmacist engagement and intervention via auditing, teaching, and interprofessional cooperation (a physician-pharmacist partnership) across diverse medical problems was beneficial and significant [14-18]. Individual Planned Teaching (IPT) is an efficient educational strategy that enhances diabetes patients' understanding and proficiency in self-administering insulin [19].

There had been no previous study in Iraq to explore the impact of a pharmacist-led intervention (PLI) on medication satisfaction and adherence among adult patients with type 1 DM.

Accordingly, this study aims to evaluate the efficacy of PLI on medication satisfaction and adherence of adult patients with type 1 DM who are taking insulin therapy.

METHOD

* Higher Diploma in Clinical Pharmacy
Baghdad Al-Karkh Health Directorate, Iraqi Ministry of Health, Baghdad, Iraq.
Email: marwa.abd2200m@copharm.uobaghdad.edu.iq
** Clinical Pharmacy Department, College of Pharmacy
University of Baghdad, Baghdad, Iraq.
*** Baghdad Al-Russafa Health Directorate, Iraqi Ministry of Health, Baghdad, Iraq.

Study Design and Study Population

This was a prospective, comparative pre-post, interventional, randomized clinical study conducted at the Specialized Center for Endocrinology and Diabetes in Baghdad/Al-Russafa from 1st February 2024 to 31st July 2024.

Inclusion Criteria

1- patients age ≥ 18 years who had the ability to communicate and read Arabic.
2- Patients were diagnosed with type 1 DM by a specialist physician for at least six months prior to enrollment.
3- Patients with uncontrolled hyperglycemia (glycosylated hemoglobin A1C ≥7% and/or fasting blood glucose >130 mg/dl).
4- Patients had been on the same therapeutic regimen for type 1 DM at least three months before the enrollment.
5- Acceptance of patients to participate in the study.

Exclusion Criteria

1- Patients were excluded from participation in the study if they had hearing, speech, or cognitive impairments that might hinder their acquisition of the queries and the educational material.
2- Patients who had co-morbid illnesses that may compromise the study, including asthma, thyroid problems, adrenal gland disorders, celiac disease, or substantial renal impairment.
3- Patients were taking chronic systemic corticosteroids of more than 7.5 mg per day of oral prednisolone or its equivalent [20].
4- Patients necessitating alterations to their insulin regimen, namely an increase above 20% of the prior dosage [21].
5- Patients with diseases influencing red blood cell turnover, including hemolytic and other anemias, G-6-PD deficiency, recent blood transfusions, administration of erythropoiesis-stimulating medications, end-stage renal illness, and pregnancy.
6- Patients refused to participate.

Data Collection and Pharmaceutical Counseling Sessions

The data related to the study were collected using a data collection sheet designed for the study's purpose. For each patient involved in the research, the following information was recorded:
1-Demographic characteristics: Age, gender, height, weight, socioeconomic situation, educational attainment, place of residence.
2-Variables associated with diabetes: Duration, familial history, current insulin regimen and dosage, and medication history for additional conditions if applicable.

Study Groups

Group 1: The interventional (active) group, involved 44 type 1 diabetic patients fit the inclusion criteria and received the educational intervention about the disease, symptoms & treatment that designed and delivered by the researchers.

Group 2: Active Comparator group (Control), involved 43 type 1 diabetic patients who fit the inclusion criteria and received the ordinary care by their health care providers.

We prepared a reference Arabic booklet for each patient in the interventional group. Five PhD-holding faculty members in the Department of Clinical Pharmacy, College of Pharmacy, University of Baghdad's scientific committee examined and evaluated the booklet.

The booklet contained the following medical information:
Details about diabetes and its manifestations. Details about the insulin used by the patient (function, method of administration, side effects, and strategies for mitigation or prevention). Instructions for measuring blood glucose levels and using a glucometer, information on hypoglycemia and hyperglycemia management, dietary guidance, exercise education, and foot care education.

After determining the baseline levels of adherence and satisfaction with insulin self-administration knowledge for each patient in both groups, participating patients in the interventional group received an educational aid (an educational booklet).

Firstly, the researcher independently completed the structured questionnaire for each patient in both groups to establish the baseline level of adherence and satisfaction, also the insulin self-administration level was determined. (a convenience sampling method was used to recruit the patients). After that, the patients in the interventional group received face-to-face pharmaceutical counseling.

Each patient in the interventional group received one counseling session at baseline, the session lasted for approximately 20-30 minutes. In addition, the researcher kept contact with these patients via mobile phone (if the author needed any information regarding the study or any patient needed an inquiry or questions regarding the booklet or the instructions that were conducted in the session), and patients could chat with the clinical pharmacists during all the study period.

Then, after three months, the researcher refilled the same questionnaires and the checking list for each patient in both groups to determine the degree of improvement in satisfaction, adherence and insulin self-administration knowledge.

The counselling session included the following information:
(1) Information about DM and its symptoms.
(2) Information about the insulin that the patient used (importance, administration, adverse effects, and how to reduce/ prevent them)
(3) Counseling about adherence and how to prevent intentional nonadherence.
The study timeline is presented in the figure 1.
The instructional material used the Dubai Health Authority's educational program for Type 1 Diabetes in Arabic [22] and Diabetes self-management education and support program for Iraqi patients with type 2 diabetes mellitus [23] after validating its contents for type 1 diabetic patients by face validation of group of clinical experts in College of Pharmacy – University of Baghdad.
The study timeline is presented in the figure 1.

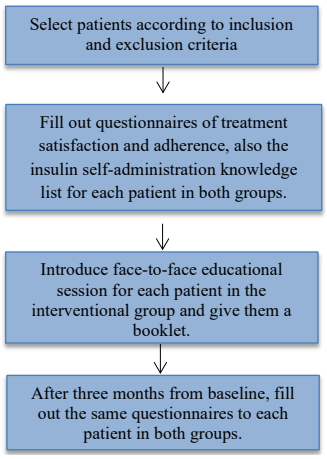

Figure1: The study timeline.

Study instruments

The demographics and clinical characteristics data were collected using a datasheet. After that, the following study instruments will be used:

The face validation Arabic version of the Treatment Satisfaction Questionnaire for Medication (TSQM version 1.4).

A face-validated (by a panel of experts of five PhD-holding faculty members in the Department of Clinical Pharmacy, College of Pharmacy, University of Baghdad scientific committee) Arabic version of the Questionnaire about TSQM was created. (The face validation led to acceptance and approval of the translation process after some suggestions to change some terms to be more understandable by Iraqi patients) [24].

The TSQM Version 1.4 is a 14-item, verified, and psychometrically sound instrument with four scales. The four scales of the TSQM are the effectiveness scale (questions 1 through 3), the side effects scale (questions 4 through 8), the convenience scale (questions 9 through 11), and the global satisfaction scale (questions 12 through 14) [24].

A Likert-type scale of 5 or 7 points was used to measure the responses, except item 4 on the side effects subscale, which inquired if there were any side effects. If the participant does not report any side effects, items 5 through 8 in the side effects subscale were not asked, and the total score for this subscale will automatically be tallied as a maximum of 100. Each of the subscales receives a score between 0 and 100, with higher scores indicating more patient satisfaction with medication [24,25].

Calculation of the scores in each scale: The sum of the scores of each subscale minus the number of questions in that subscale is divided by the maximum score minus the minimum score of that subscale multiplied by 100 [26].

The Iraqi Anti-Diabetic Medication Adherence Scale IADMAS

The Iraqi Anti-Diabetic Medication Adherence Scale IADMAS, validated by Mikhael et al.,2019 [27] Consists of eight questions; three items directly measure medication-taking behavior through collecting five responses: always (daily), often, sometimes, rarely, and never. The following five questions assess non-adherence by offering a dichotomous "Yes" or "No" answer. The first item measures inadvertent medication dosage missing; the subsequent items measure purposeful medication non-adherence. Non-adherence to medication time was assessed using two items (1 and 3). The level of purposeful medicine dosage non-adherence was assessed using four questions (2, 6, 7, and 8). Only one item (5) measures purposeful non-adherence by stopping DM treatment. Non-adherent answers were scored 0 and overall adherence 1 for all questions. All elements except 4 are inversely computed. The first three items employ a 5-point Likert scale with values of 1, 0.75, 0.5, 0.25, or 0. The entire IADMAS score was 0–8. Three degrees of medication adherence were identified in the IADMAS: high (total score=8), medium (6-8) and low (<6) [27].

Insulin self-administration assessment checking form

The insulin self-administration assessment checking form follows the current insulin injection method best practices from experts [28] Assessment areas cover three parameters: insulin preparation, insulin injection method and insulin storage and stability. Six questions (1-6) cover insulin preparation aspect, nine questions (1-9) cover insulin injection method, and two questions (1-2) cover insulin storage and stability. The answer for all questions by yes or no. Yes, indicate the right answer while no indicate the wrong answer [28].

Statistical analysis

The Anderson-Darlin test was used to assess the adherence of continuous variables to normality; variables that adhered to the normal distribution presented as mean ± standard deviation (SD), while those that did not adhere to the normal distribution presented as median (50th percentile) and interquartile range (25th to 75th percentile). A chi-square (X2) was used to compare the proportion of categorical variables; an independent t-test was used to compare treatment and intervention (if data is not normally distributed, Mann-Whitney U test was used), while a Wilcoxon signed-rank test was used to compare the difference between baseline and end of therapy in each group (data is not normally distributed). Linear regression analysis assessed the relationship between various parameters, and the regression coefficient was presented in a matrix plot. Multiple linear regression analysis with dummy variables was used to assess if variables in univariate analysis are independent predictors (the choice of parameters to enter the multivariate analysis based on the condition if correlation coefficients ≥0.25).

RESULTS

As illustrated in Table 1, there was no significant difference in mean age (28.56± 8.31 vs. 25.57± 7.99 years), sex (with a higher female-to-male ratio, 74.4/ 25.6% vs. 63.6/ 36.4%), marital status (married: 55.8% vs. 43.2%), education levels, median duration of DM (12 vs. 9 years), positive family history (18.6% vs. 9.1%), and number of injections between both groups.

Table 1. Sociodemographic characteristics of patients

Variable	Intervention group	Control group	p-value
Number	44	43	-
Age (year), mean ± SD	25.57± 7.99	28.56± 8.31	0.091#
BMI (kg/m^2), mean ± SD	23.76± 3.78	26.57± 3.97	0.001#
Sex, n (%)			0.277¥
Female	28 (63.6%)	32 (74.4%)	
Male	16 (36.4%)	11 (25.6%)	
Marital status, n (%)			0.239¥
Single	25 (56.8%)	19 (44.2%)	
Married	19 (43.2%)	24 (55.8%)	
Education level, n (%)			0.936¥
Primary	15 (34.1%)	16 (37.2%)	
Secondary	19 (43.2%)	17 (39.5%)	
College	10 (22.7%)	10 (23.3%)	
Duration of DM, median (IQR)	9 (5.25-15.75)	12 (9-18)	0.069*
Family history, n (%)	4 (9.1%)	8 (18.6%)	0.198¥
Number of injections, n (%)			0.218¥
Two	20 (45.5%)	14 (32.6%)	
Three	24 (54.5%)	29 (67.4%)	

#: Independent t-test, ¥ :Chi-square test, * : Mann-Whitney U test
SD: Standard deviation, IQR: Interquartile range, BMI: Body mass index, n: number, DM: Diabetic mellitus

Assessment of Change in Patients Scores, Medication Adherence and Medication Satisfaction.

The satisfaction scores significantly increased in the intervention group compared to the control group (4.0% vs. 0.0%, respectively), as illustrated in Table 2 and Figure 2.The effect size (Cohen's d) for

satisfaction score improvement was 0.147, indicating a small but positive impact of the pharmacist-led intervention.

The medication adherence scores significantly increased in the intervention group compared to the control group (9.1% vs. 0.0%, respectively), as illustrated in Table 2 and Figure 3. The effect size (rank-biserial correlation) for adherence improvement was 0.061, showing a slight improvement in adherence behavior among the intervention group.

At baseline, there were no significant differences between the intervention and control groups in satisfaction scores (Cohen's d = -0.077) or medication adherence (rank-biserial correlation = 0.043), confirming that both groups started at similar levels.

Table 2. Assessment of medication adherence and medication satisfaction Scores

Variable	Intervention	Control	P- value[#]
Number of Patients	44	43	-
Satisfaction score, median (IQR)			
Baseline	60.95 (55.2-78.85)	62.5 (48.7-79.1)	0.838
Three months	65.35 (58.2-78.4)	62.5 (48.7-79.7)	0.533
p-value	<0.001 †	0.745 †	
% Change, median (IQR)	4.0 (0.35 to 7.35)	0.0 (-1.8 to 2.9)	0.003
Medication adherence score			
Baseline	6.0 (5.5- 6.69)	5.5 (5.0- 6.75)	0.080
Three months	6.5 (6.0- 8.0)	5.75 (5.0- 6.5)	<0.001
P-value	<0.001 †	0.129 †	
% Change, median (IQR)	9.1 (5.53 to 16.28)	0.0 (0.0 to 4.2)	<0.001

[#]Mann-Whitney U test, Wilcoxon signed-rank test
IQR: interquartile range, N: number

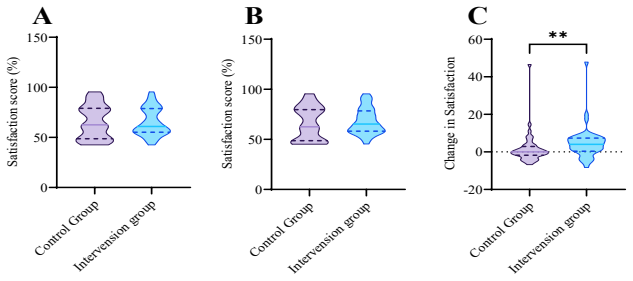

Figure 2. Violin Plot of Satisfaction Score, A) Satisfaction Score at Baseline, B) Satisfaction Score at The End of The Study, C) Change in Satisfaction from Baseline.

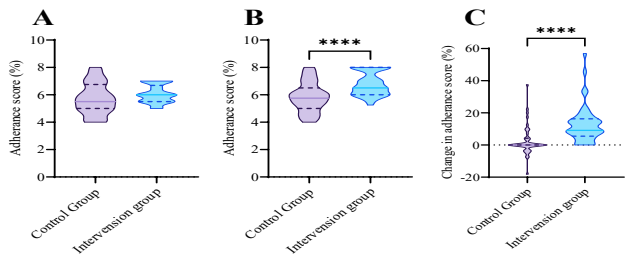

Figure 3. Violin Plot of Medication Adherence Score, A) Medication Adherence Score at Baseline Visit, B) Medication Adherence Score after 3 Months, C) Change in Medication Adherence from Baseline.

Assessment of Change in Patients Insulin Knowledge Level.

At baseline, both groups had similar levels of insulin knowledge, with no significant differences in most aspects of insulin preparation, injection technique, and storage.

The most significant improvements were seen in hand hygiene, injection timing, and proper storage—critical factors for insulin effectiveness and safety.

After 3 months patients in the intervention group showed a 25.0% improvement were observed across all insulin knowledge parameters, whereas no improvement was observed in the control group (0.0%), reinforcing the effectiveness of pharmacist-led education.

Table 3. Insulin Knowledge Level Among Patients at Baseline Visit

Variable	Intervention	Control
Number of Patients	44	43
Preparation		
Insulin vial inspection (yes) *	44 (100%)	43 (100%)
Cleaning hands (yes)	22 (50.0%)	22 (51.2%)
Mixing insulin (yes)	44 (100%)	43 (100%)
Resuspension (yes)	44 (100%)	43 (100%)
Injection mealtime gap (yes)	24 (54.5%)	12 (27.9%)
Insulin should be kept at room temp before (yes)	21 (47.7%)	16 (37.2%)
Technique		
Choice of a suitable site for injecting insulin (yes)	36 (81.8%)	37 (86.0%)
Inspection injection site for absence of wounds (yes)	43 (97.7%)	43 (100.0%)
Fold the skin (yes)	27 (61.4%)	35 (81.4%)
Insert the needle at 90 angles (yes)	37 (84.1%)	35 (81.4%)
Hold the needle under the skin for at least 10 seconds (yes)	30 (68.2%)	38 (88.4%)
Withdraw syringe (yes)	16 (36.4%)	27 (62.8%)
Dispose of used needles safely (yes)	15 (34.1%)	16 (37.2%)
Rotate the site of the injection (yes)	37 (84.1%)	43 (100.0%)
Single-use of a syringe (yes)	18 (40.9%)	21 (48.8%)
Storage and stability		
Storage of unopened vials in the fridge (yes)	44 (100%)	43 (100%)
All insulin vials should be discarded 1 month after opening (yes)	18 (40.9%)	14 (32.6%)

*: Correct answer

Table 4. Insulin Knowledge Level Among Patients after 3 Months

Variable	Intervention	Control
Number of Patients	44	43
Preparation		
Insulin vial inspection (yes) *	44 (100%)	43 (100%)
Cleaning hands (yes)	42 (95.5%)	21 (48.8%)
Mixing insulin (yes)	44 (100%)	43 (100%)
Resuspension (yes)	44 (100%)	43 (100%)
Injection mealtime gap (yes)	41 (93.2%)	12 (27.9%)
Insulin should be kept at room temp before (yes)	40 (90.9%)	16 (37.2%)

Technique		
Choice of a suitable site for injecting insulin (yes)	44 (100.0%)	37 (86.0%)
Inspection injection site for absence of wounds (yes)	43 (97.7%)	43 (100%)
Fold the skin (yes)	35 (79.5%)	35 (81.4%)
Insert the needle at 90 angle (yes)	43 (97.7%)	35 (81.4%)
Hold the needle under the skin for at least 10 sec (yes)	42 (95.5%)	38 (88.4%)
Withdraw syringe (yes)	31 (70.5%)	27 (62.8%)
Dispose of used needles safely (yes)	25 (56.8%)	16 (37.2%)
Rotate the site of the injection (yes)	44 (100%)	43 (100%)
Single-use of a syringe (yes)	23 (52.3%)	21 (48.8%)
Storage and stability		
Storage of unopened vials in the fridge (yes)	44 (100%)	43 (100%)
All insulin vials should be discarded 1 month after opening (yes)	29 (65.9%)	14 (32.6%)

*: Correct answer

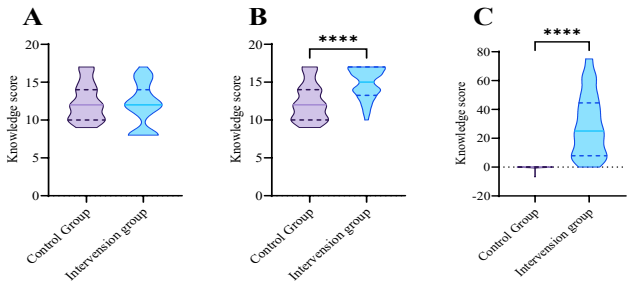

Figure 4. Violin plot of insulin knowledge score, A) insulin knowledge score at baseline, B) insulin knowledge score at the end of the study, C) change in insulin knowledge adherence from baseline.

DISCUSSION

The results of this research revealed that pharmacists' actively participating in delivering diabetes educational initiatives, supplemented by printed resources for home use, could enhance patients' understanding of diabetes and its drugs adhering to treatment, and satisfaction among type 1 DM outpatient care in Iraq. The attendees exhibited an improvement in knowledge, adherence, and satisfaction after the instructional program compared to prior assessments.

Lower education levels were observed in both groups, with most participants having only primary or secondary education. Previous studies indicate that low health literacy is associated with poorer diabetes self-management and adherence to insulin therapy. Since both groups had a similar educational distribution, this suggests that health literacy did not disproportionately impact one group over the other.

The study was conducted at the Specialized Center for Endocrinology and Diabetes in Baghdad/Al-Russafa, a government-run institution. This setting may provide better access to insulin, diabetes specialists, and pharmacist support compared to rural or lower-resource settings.

The interaction between health professionals and patients is one factor that is known to affect medication adherence. Successful communication between healthcare providers and patients promotes greater satisfaction with medical care and strengthening medication adherence [29]. In this study the medication adherence scores significantly increased in the intervention group compared to the control group. This corresponds to previously published outcomes, stated that pharmacists contributed to enhancing adherence to antidiabetic prescriptions and decreasing hospitalization rates after three- and six-month continued therapy [30]. In Jordan a study by Jarab *et al*. in 2012 for patients with type 2 DM who received pharmacist-led pharmaceutical care (A phone call and educational booklet) in an outpatient diabetes clinic experienced improvement in self-reported medication adherence after 6 months compared with essentially no change in the usual care group [31]. Similar result was found by Jahangard et al. in 2015 in an Iranian study which reported that community pharmacist intervention improved self-care activity and medication adherence in type 2 diabetic patients receiving specialty medical care by pharmacist intervention as Combined (pamphlet plus phone call) [32]. The main barriers to adherence to treatment were understanding of the disease, complications related to non-adherence to treatment, and lack of family support, as the lack of knowledge about medication and disease processes is linked to non-adherence [29]. A study in Pakistan by Malik M, *et al*. in 2022 approved that [33]. Another Chinese study by Zhuo Y *et al* in 2022 resulted in significant more women with high medication adherence assessed by the 5-item Medication Adherence Report Scale in the intervention group after a clinical pharmacist-led smartphone application intervention on 58 pregnant women with diabetes, who received a four-times-daily basal-bolus insulin regimen, were followed up till 12 weeks postpartum [34].

Satisfaction among patients regarding their therapy strongly affects the management of their illness. The current study indicated no statistically significant difference in the baseline treatment-related satisfaction scores comparing the intervention group and the controls; nevertheless, a significant difference was seen at the end of the study. Rothman *et al*. observed that intervention patients had greater improvements in diabetes knowledge and satisfaction than did control patients. The alteration in the mean satisfaction level of the study group was four times greater compared to that of the control group [35].

As the PLI improved understanding of insulin role, purpose and benefit of its prescription by doctor, declaring its adverse effect and how to overcome these effects. All of this will reduce patients' misconception and fears about insulin, leading to increase their satisfaction.

As patient education offers a comprehensive elucidation of the mechanisms of target medication, the rationale for the initiation or cessation of specific medications based on patient history, management of adverse effects, and responses to additional patient inquiries [36].

This study shows that the insulin administration knowledge level significantly improved in the intervention group relative to the control group. Selvadurai S *et al.* in 2021, conducted a study in in Malaysia to assess the impact of pharmacist-led patient education on insulin injection found that education is beneficial in enhancing injection technique and increasing patients' perceptions of insulin treatment [37]. The utilization of insulin in the self-management of diabetes necessitates counseling for individuals with both type 1 and type 2 diabetes. Given the numerous advancements in insulin delivery systems throughout the years, it is essential that patients possess comprehensive knowledge of proper insulin injection techniques to improve self-management. Therefore, instructing patients on injection procedures will significantly enhance self-management in individuals with diabetes. It should also instruct on how to identify and prevent indicators of hypoglycemia and thereafter treat it independently [38]. This was approved by Malik M *et al* in 2022 [33]. Similar findings were reported in a study conducted in France by Delage C *et al*. in 2021where the knowledge regarding

diabetes (type 2 DM) and hypertension improved after counseling by community pharmacists [39].

The pharmacist's intervention involves educating patients, correcting misconceptions, and assuring proper administration practices which in turn ensure absorption and effectiveness, so empowering patients and enhancing their confidence in treating their illness.

A study from China by Zuho Y *et al*. in 2022 stated that a clinical pharmacist-led smartphone application improved the insulin injecting technique in women with gestational diabetes mellitus, who received a four-times-daily basal-bolus insulin regimen, the following up period was 12 weeks postpartum [34].

Presently, there are limited educational programs available in diabetes clinics in Iraq for individuals with diabetes; however, our research introduced a new strategy by teaching patients via pharmacists on numerous aspects of diabetics-related self-care alongside illness information. Therefore, there was encouragement in such a study in Iraq to teach and educate patients with DM to improve their disease and to increase the role of the pharmacist in educating and treating those patients.

But despite improved adherence and satisfaction, longer follow-up studies were still required to educate the DM patients more and also for other chronic diseases. Furthermore, specialists who read the booklet stated that it would minimize their burden while increasing patients' knowledge of their ailment and treatment, resulting in higher adherence. This has helped DM patients improve their medication satisfaction and quality of life by teaching them how to self-inject and manage their therapy at home. In addition, any non-pharmacological instructions concerning disease and treatment were also mentioned in the sessions and booklet. As a result, this study's findings will help policymakers, Ministry of Health planners, doctors, health care providers, and others design effective plans and interventions to increase patient adherence and satisfaction with their medication.

LIMITATIONS

The main limitations where the study was performed in a single center with a small sample size may limit the generalizability of the findings. The study focused on adult patients with Type 1 Diabetes Mellitus (T1DM), so the results may not directly apply to pediatric patients. Short follow up period may reduce the ability to evaluate the continuity of the improvement in the outcomes. Medication adherence and treatment satisfaction were assessed using self-reported questionnaires, which may be subject to recall bias or social desirability bias (patients may overreport adherence to appear more compliant).

CONCLUSION

A pharmacist-led educational program enhances patients' understanding of diabetes and related medications, adherence to treatment, and glycemic control. This research advocates for the integration of clinical pharmacists into multidisciplinary healthcare teams within hospital and outpatient settings, as well as the adoption of such interventions into diabetes management programs to achieve optimum patient outcomes.

Authorship Contribution: All authors share equal effort contribution towards (1) substantial contributions to conception and design, acquisition, analysis and interpretation of data; (2) drafting the article and revising it critically for important intellectual content; and (3) final approval of the manuscript version to be published. Yes.

Potential Conflict of Interest: None

Competing Interest: None

Acceptance Date: 12-03-2025

REFERENCES

1. Mikhael EM, Hassali M, Hussain S, et al. Assessment of pharmacist's role in counselling and educating diabetic patients about insulin therapy. Int Res J Pharm 2018;9:65-8.
2. Shehab FA, Jasim AL, Mohammed AG. Impact of Gliclazide Modified Release or Glimepiride as Add-on Therapy to Metformin on Glycemic and Oxidative Stress Parameters in Type 2 Diabetic Patients. Iraqi J Pharm Sci 2024;33(2):20-30.
3. Munaf ZA, Mohammed SI. Quality of life, adherence and knowledge of epileptic patients and the impact of a pharmacist-led educational intervention: A review. Med Adv 2024;2(1):29-42.
4. Abbas JK, Al-Metwali BZ. The impact of pharmacist behavioral intervention on antibiotics prescribing in pediatric wards. F1000Res 2023;12:458.
5. Al-Hamdani FY. Evaluation of community pharmacist's role in Iraqi private pharmacies,Iraq. J Pharm Biomed Sci 2013;30(30):S76-S82.
6. Falah MJ, Jasim AL. The Impact of Implementing a Pharmacist-led Deprescribing Program on Medication Adherence among Hemodialysis Patients. Al-Rafidain J Med Sci 2023;5(1S):S29-S36.
7. Chaudhari H, Ganguly B, Mirza N. Association Between Quality of Life and Drug Adherence Among Patients With Diabetes in India. Cureus 2024;16(10):e71300.
8. Abdul-Jabbar MA, Kadhim DJ. Adherence to different treatment modalities among patients on maintenance hemodialysis. Iraqi J Pharm Sci 2022;31(1):95-101.
9. Perwitasari DA, Urbayatun S. Treatment adherence and quality of life in diabetes mellitus patients in Indonesia. Sage Open 2016;6(2):2158244016643748.
10. Sendekie AK, Belachew EA, Dagnew EM. Determinants of treatment satisfaction among patients with diabetes: multicentre cross-sectional study in Northwest Ethiopia. BMJ open 2023;13(9):e074731.
11. Al-Arifi MN. Patients' perception, views and satisfaction with pharmacists' role as health care provider in community pharmacy setting at Riyadh, Saudi Arabia. Saudi Pharm J 2012;20(4):323-30.
12. Hussain A, Bowen AM. Exploring Pharmacist Roles in Telepharmacy for Chronic Disease Management in New York State: A Qualitative Inquiry into Improving Implementation, Patient Communication, and Healthcare Technology Support. Cureus 2024;16(6):e62982.
13. Pourhabibi N, Mohebbi B, Sadeghi R, et al. Factors associated with treatment adherence to treatment among in patients with type 2 diabetes in Iran: a cross-sectional study. Front public health 2022;10:976888.
14. Ali MM, Al-Jumaili AA. Appraising the role of pharmacists in medication reconciliation at hospital discharge: A field-based study. Al-Rafidain J Med Sci 2023;5(1S):S57-S63.
15. Jabri AM, Assad HC, Al-Jumaili AA. Pharmacist role to enhance the prescribing of hospital discharge medications for patients after heart attack. Saudi Pharm J 2020;28(4):473-9.
16. Abbood SK, Assad HC, Al-Jumaili AA. Pharmacist intervention to enhance postoperative fluid prescribing practice in an Iraqi hospital through implementation of NICE guideline. Pharm Pract (Granada) 2019;17(3):1552.

17. Al-Jumaili AA, Al-Rekabi MD, Doucette W, et al. Factors influencing the degree of physician–pharmacist collaboration within Iraqi public healthcare settings. Int J Pharm Pract 2017;25(6):411-7.
18. Alkashaf KH, Mohammed SI. Impact of Clinical Pharmacist Intervention on Chemotherapy Knowledge, Attitude, and Practice among Breast Cancer Women. J Fac Med Baghdad 2024;66(1):103-9.
19. Al-Banna K, Khuder SA. Effectiveness of the Education Program on Diabetic Patients' Knowledge and Practice Regarding Self-Administration of Insulin in Erbil City. Kufa J Nurs Sci 2015;5(3):33-42.
20. Limbachia V, Nunney I, Page DJ, et al. The effect of different types of oral or intravenous corticosteroids on capillary blood glucose levels in hospitalized inpatients with and without diabetes. Clin Ther 2024;46(2):e59-e63.
21. Kovil R, Chawla M, Rajput R, et al. Consensus on insulin dose and titration algorithms in ambulatory care of type 2 diabetes in India. J Assoc Physicians India 2017;65(2):17-30.
22. Obaid HAM, Ali WMOA, Alolama AS, et al. Effectiveness of Diabetic Retinopathy Screening Program in Primary Health Care Centres, Dubai Health Authority 2015 – 2017. Clin Med J 2018;4(4):44-51
23. Mikhael EM, Hassali MA, Hussain SA. Validation of newly developed culturally specific diabetes self-management education and support program for Iraqi type 2 diabetes mellitus patients. J Educ Health Promot 2021;10:357.
24. Atkinson MJ, Sinha A, Hass SL, et al. Validation of a general measure of treatment satisfaction, the Treatment Satisfaction Questionnaire for Medication (TSQM), using a national panel study of chronic disease. Health Qual Life Outcomes 2004;2:12.
25. Liberato ACS, São João TM, Jannuzzi FF, et al. Treatment satisfaction questionnaire for medication (TSQM version 1.4): Ceiling and floor effects, reliability, and known-group validity in brazilian outpatients with hypertension. Value Health Reg Issues 2020;23:150-6.
26. Shahrbabaki ME, Ahmadipour H, Yousefi N, et al. Treatment Satisfaction Questionnaire for Medication (TSQM Version II): A Psychometric Properties Analysis. Int J High Risk Behav Addict 2022;11(4):e126406.
27. Mikhael EM, Hussain SA, Shawky N, et al. Validity and reliability of anti-diabetic medication adherence scale among patients with diabetes in Baghdad, Iraq: a pilot study. BMJ Open Diabetes Res Care 2019;7(1):e000658.
28. Tandon N, Kalra S, Balhara YPS, et al. Forum for injection technique and therapy expert recommendations, India: the Indian recommendations for best practice in insulin injection technique, 2017. Indian J Endocrinol Metab 2017;21(4):600-17.
29. Gow K, Rashidi A, Whithead L. Factors influencing medication adherence among adults living with diabetes and comorbidities: a qualitative systematic review. Curr Diab Rep 2024;24(2):19-25
30. Erku DA, Ayele AA, Mekuria AB, et al. The impact of pharmacist-led medication therapy management on medication adherence in patients with type 2 diabetes mellitus: a randomized controlled study. Pharm Pract (Granada) 2017;15(3):1026.
31. Jarab AS, Alqudah SG, Mukattash TL, et al. Randomized controlled trial of clinical pharmacy management of patients with type 2 diabetes in an outpatient diabetes clinic in Jordan. J Manag Care Pharm 2012;18(7):516-26.
32. Jahangard-Rafsanjani Z, Sarayani A, Nosrati M, et al. Effect of a community pharmacist–delivered diabetes support program for patients receiving specialty medical care: a randomized controlled trial. Diabetes Educ 2015;41(1):127-35.
33. Malik M, Hussain A, Aslam U, et al. Effectiveness of community pharmacy diabetes and hypertension care program: an unexplored opportunity for community pharmacists in Pakistan. Front Pharmacol 2022;13:710617.
34. Zhuo Y, Pan Y, Lin K, et al. Effectiveness of clinical pharmacist-led smartphone application on medication adherence, insulin injection technique and glycemic control for women with gestational diabetes receiving multiple daily insulin injection: A randomized clinical trial. Prim Care Diabetes 2022;16(2):264-270.
35. Rothman RL, Malone R, Bryant B, et al. A randomized trial of a primary care-based disease management program to improve cardiovascular risk factors and glycated hemoglobin levels in patients with diabetes. Am J Med 2005;118(3):276-84.
36. Stanton-Robinson C, Al-Jumaili AA, Jackson A, et al. Evaluation of community pharmacist–provided telephone interventions to improve adherence to hypertension and diabetes medications. J Am Pharm Assoc 2018;58(4):S120-S124.
37. Selvadurai S, Cheah KY, Ching MW, et al. Impact of pharmacist insulin injection re-education on glycemic control among type II diabetic patients in primary health clinics. Saudi Pharm J 2021;29(7):670-6.
38. Emeka PM, AlMunjem MF, Rasool ST, et al. Evaluation of counseling practices and patient's satisfaction offered by pharmacists for diabetics attending outpatient pharmacies in Al Ahsa. J Patient Exp 2020;7(3):338-45.
39. Delage C, Lelong H, Brion F, et al. Effect of a pharmacist-led educational intervention on clinical outcomes: a randomised controlled study in patients with hypertension, type 2 diabetes and hypercholesterolaemia. Eur J Hosp Pharm 2021;28(e1):e197-e202.