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The role of pharmacist counseling for patient with type 2 diabetes mellitus and its impact on blood glucose control and quality of life at RSUD Pasar Minggu

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ABSTRACT: Quality of life is an important aspect for patients with type 2 diabetes mellitus (T2DM). Pharmacist counseling is a non-pharmacological effort that can be provided to improve quality of life and control blood glucose levels. This study aimed to determine the effect of pharmacist-led therapeutic counseling for T2DM patients on improving their quality of life and reducing blood glucose levels. The study used a quasi-experimental nonequivalent control group design, with pretest and posttest assessments conducted before and after the intervention at RSUD Pasar Minggu, South Jakarta. A total of 194 T2DM patients participated in the study, with 97 patients in both the intervention and control groups. Quality of life was measured using the EQ-5D-5L and EQ-VAS questionnaires, along with fasting blood glucose levels. Measurements were taken three times: before the intervention, and one month and two months after the intervention. Paired data were analyzed using the Wilcoxon test, while unpaired data were analyzed using the Mann-Whitney test at a significance level of 0.05. Counseling significantly improved EQ-5D-5L scores (Δ=0.06; $p<0.001$) and EQ-VAS scores (Δ=6.40; $p<0.001$), as well as reduced fasting blood glucose levels (Δ=-12.10 mg/dL; $p<0.001$) in the intervention group after the intervention. The impact of counseling was particularly significant in the pain/discomfort and anxiety/depression domains. However, no significant correlation was found between quality of life and fasting blood glucose levels in this study ($p>0.05$). Pharmacist counseling conducted at RSUD Pasar Minggu had a positive and significant impact on improving the quality of life and treatment outcomes related to blood glucose reduction.

KEYWORDS: Diabetes melitus, fasting blood glucose, quality of life.

INTRODUCTION

About 80% of diabetes mellitus (DM) cases involve type 2 diabetes mellitus (T2DM), which occurs due to insulin resistance and impaired insulin secretion. The number of DM cases worldwide is expected to increase to 693 million by 2045 [1]. Riset Kesehatan Dasar (RISKESDAS) by the Ministry of Health of Indonesia reported a significant increase in diabetes prevalence, from 6.9% in 2013 to 8.5% in 2018. More than 16 million people suffer from diabetes mellitus, particularly T2DM, in Indonesia. Eighty percent of diabetes-related deaths occur in low- and middle-income countries, including Indonesia [2].

Quality of life is an important aspect of diabetes management, as poor quality of life leads to reduced self-care, making blood glucose levels difficult to control and increasing the risk of both short- and long-term diabetes complications. This indicates that quality-of-life issues can predict how well individuals manage the disease and maintain their health and well-being over the long term [3]. Quality of life measurement is multidimensional, encompassing physical, psychological, social, and environmental functions. According to the 2008 report from the Institute of Health Economics (IHE), quality of life (QoL) is a health status measured based on the patient's or individual's subjective perception. QoL assessments can determine compatibility among groups or individuals at a single point in time, measure changes in individuals or groups over a certain period, and predict future situations [4].

Pharmacological and non-pharmacological therapies play a role in improving the QoL of DM patients. Non-pharmacological therapeutic efforts, such as education and self-management support, are essential to prevent acute complications and reduce the risk of long-term complications [5]. One of the pharmacist's effective roles in improving the QoL of DM patients is providing counseling. [6] Counseling is an activity aimed at providing verbal or written information to T2DM patients about the correct use of medications,

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explaining the side effects of medications, how to store them, and recommending dietary and lifestyle modifications [6].

A systematic review shows that pharmacist counseling has the potential to improve medication adherence in T2DM patients in various settings, such as face-to-face meetings, group activities, and phone consultations [6]. This aligns with previous research by Nugraha, which stated that pharmaceutical interventions effectively achieve better glycemic control and quality of life in patients with T2DM [7]. Research by Septiar and Utami also concluded that pharmacist counseling improves the overall quality of life in diabetes patients [8]. Research by Pratiwi and Widayati states that pharmacist counseling can significantly enhance the quality of life of T2DM patients, particularly in the self-care dimension. This is attributed to educational materials on symptom self-management, treatment, and lifestyle changes [9].

Diabetes mellitus is the second most common reason for visits at the Outpatient Clinic of RSUD Pasar Minggu in 2019. In 2022, counseling services at RSUD Pasar Minggu were only provided to patients using specific medication, such as insulin, while general counseling for diabetes patients had not been conducted. Drug counseling, which is part of clinical pharmacy services, aims to optimize therapeutic outcomes, minimize the risk of adverse drug reactions (ADRs), and improve cost-effectiveness, ultimately contributing to patient safety [6].

Based on the above, it is necessary to conduct research on the role of pharmacist counseling at the Pharmacy Department of Pasar Minggu Regional General Hospital (RSUD Pasar Minggu). RSUD Pasar Minggu was selected because it is the only type B regional general hospital in South Jakarta. Based on data on the prevalence of Diabetes Mellitus at RSUD Pasar Minggu from July to September 2022, the number of visits by diabetes mellitus patients reached 4,625, with diabetes mellitus being the third most common diagnosis after atherosclerotic cardiovascular disease and hypertension. This research aims to provide an overview of the role of pharmacist counseling in improving the QoL of patients, particularly those with diabetes mellitus.

▪ MATERIALS AND METHODS

Materials

Subjects

This study was conducted at RSUD Pasar Minggu, South Jakarta, during the period of July to September 2023. Ethical approval was obtained from the Ethics Committee of RSUD Pasar Minggu with letter number 06/KOMETHUK/I/2023. The study subjects included all T2DM patients receiving outpatient care at RSUD Pasar Minggu between May 2023 and September 2023. Sampling was carried out using the purposive sampling method.

The inclusion criteria included patients who had undergone pharmacological therapy for at least 2 months, were aged ≥20 years, were treated under the BPJS health insurance program, and were willing to participate as respondents, as proven by signing an informed consent form. Exclusion criteria included pregnant or breastfeeding women, those using contraceptives, those with other endocrine diseases unrelated to diabetes mellitus, those diagnosed with mental illness, those who had experienced blood loss or undergone transfusion in the past 3 months, those undergoing hemodialysis, and those with fasting blood glucose (FBG) levels <126 mg/dL.

During the study period, the total number of diabetes mellitus patients who visited was 2,155. Respondents were then divided into two groups: 105 individuals in the intervention group and 105 in the control group. A total of 194 patients returned for post-test data collection, consisting of 97 patients in the intervention group and 97 in the control group, while 16 individuals who did not attend were declared dropouts.

Instrument

The instrument used in this study was the EQ-5D-5L questionnaire in the Indonesian version to assess the QoL of DM patients. The Indonesian version of EQ-5D-5L questionnaire had been validated and shown to be reliable for assessing health-related quality (Pearson's r ≥ 0.60 and Cronbach's Alpha of 0.799) [10]. This questionnaire consisted of five dimensions: mobility, self-care, usual activities, pain/discomfort, and

anxiety/depression. Each dimension had five levels: No problem, Slight problem, Moderate problem, Severe problem, and Extreme problem/Unable to perform. Each level selected by the patients was assigned a single-digit number representing their specific health status in each dimension. For example, the status '11111' indicated no problems in all five dimensions, while the status '54321' indicated an inability to walk, serious problems with washing or dressing, moderate problems performing daily activities, slight pain or discomfort, and no anxiety or depression. The scores were then transformed and standardized for EQ-5D Index calculation. The quality of life based on the EQ-5D Index ranged from a maximum score of 1.000 to a minimum score of -0.865. The description of EQ-5D was further complemented by the visual analogue scale (EQ-VAS), which ranged from 0 (the worst possible health condition) to 100 (the best possible health condition).

Study design

This study was a quasi-experimental research aimed at comparing the quality of life of patients between the intervention group and the control group. In the intervention group, patients received leaflets along with counseling, while in the control group, patients were only given leaflets without counseling. The allocation of participants was conducted using a non-randomized method. Patients attended the clinic in the morning were assigned to the intervention group, while those attended the clinic in the afternoon were assigned to the control group. The methodology used in this study followed a quasi-experimental nonequivalent control group design, which included a pretest before the intervention and a posttest after the intervention for each group.

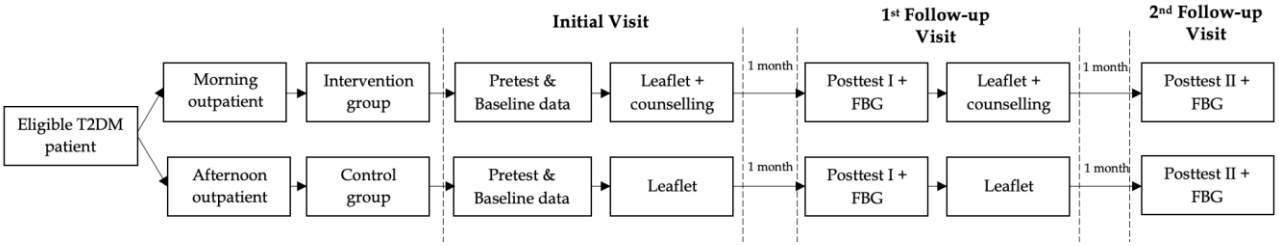

Figure 1. Experimental model of pretest posttest control group design.

Procedure

The research procedure began with selecting patients based on medical record data that met the inclusion criteria. Patients were then divided into two groups: the intervention group, consisting of patients from the morning outpatient clinic, and the control group, consisting of patients from the afternoon outpatient clinic. Each patient received information regarding the background, objectives, and benefits of the study. Patients who agreed to participate were asked to sign an informed consent form after receiving further explanation. During initial visit, baseline data collection, which included fasting blood glucose levels from patients' medical records within one month prior to the study, and pretest assessments were conducted. Following this, interventions were carried out according to group allocation. In the intervention group, patients received both a leaflet and counseling, whereas in the control group, patients were given only a leaflet. One month after the initial visit, the first follow-up visit was conducted. Counseling was delivered through face-to-face group educational sessions. Counseling session lasted approximately 45 minutes. The counseling material covered information about diabetes mellitus itself, lifestyle modifications to prevent and control blood glucose levels — including regular physical activity and dietary management — as well as guidance on the proper use of antidiabetic medications. Patients underwent the first posttest and fasting blood glucose testing during this visit. Subsequently, interventions were administered according to the previous group allocation. The educational material provided was the same as in the initial intervention. In the final visit, one month after first follow-up visit, the second posttest was completed and fasting blood glucose levels were rechecked, to assess the clinical outcomes of the patients.

Data analysis

The data analysis began with the Kolmogorov-Smirnov test to assess data distribution. Next, the Levene's test for homogeneity of variances was conducted to examine the equality of variances between groups. Paired data were analyzed using the Wilcoxon test, while unpaired data were analyzed using the Mann-Whitney test at a significance level of 0.05. Finally, the Spearman correlation test was employed to measure the linear relationship between two continuous variables. The data analysis was performed using IBM SPSS version 29.0.

RESULTS

Characteristics

Patient characteristics can influence the interaction between pharmacists and patients, which, in turn, may affect the outcomes achieved. These characteristics include age, gender, education, occupation, and physical activity. The majority of diabetes mellitus (DM) patients at RSUD Pasar Minggu were aged 41–60 years (53%), female (60%), high school graduates (52%), employed (51%), and regularly exercised (55%). Bivariate analysis showed no differences in the proportions of age, gender, education level, occupation, or physical activity between the treatment groups in this study (p > 0.05) (Table 1).

Table 1. Subject characteristics.

Variable		Control		Intervention		p-value
		N = 97	Proportion (%)	N = 97	Proportion (%)	
Age	20-40 years	11	11.34	8	8.25	0.112
	41-60 years	57	58.76	46	47.42	
	> 60 years	29	29.90	43	44.33	
Sex	Male	37	38.14	39	40.21	0.883
	Female	60	61.86	58	59.79	
Education	No formal education	1	1.03	0	0.00	0.072
	Elementary school	8	8.25	22	22.68	
	Junior high school	0	0.00	2	2.06	
	Senior high school	57	58.76	44	45.36	
	College	31	31.96	29	29.90	
Occupation	Yes	52	53.61	46	47.42	0.389
	No.	45	46.39	51	52.58	
Routine physical activity	Yes	38	39.18	50	51.55	0.08
	No	59	60.82	47	48.45	

Quality of life

The comparison of EQ-5D-5L scores between the control and intervention groups revealed that the control group initially had higher scores before the treatment. By posttest I and posttest II, no significant differences were observed between the groups, indicating that counseling had effectively improved the EQ-5D-5L scores in the intervention group, bringing them to a similar level as those in the control group despite their lower baseline scores. Additionally, there were no significant differences in EQ-VAS scores during the pretest and posttest I, but by posttest II, the intervention group had demonstrated significantly higher EQ-VAS scores compared to the control group (p <0.05), highlighting the impact of the intervention (Table 2).

Table 2. Comparison of quality of life between the control and intervention group.

Questionnaire	Observation	Difference (Intervention – control)	Group		p-value
			Control	Intervention	
EQ-5D-5L	Pretest	-0.10	0.64±0.32	0.54±0.34	0.014*
	Posttest I	-0.07	0.67±0.30	0.60±0.31	0.061
	Posttest II	-0.02	0.66±0.30	0.64±0.31	0.657
EQ-VAS	Pretest	-2.5	67.5±13.2	65.0±11.4	0.121
	Posttest I	1.1	70.3±11.0	71.4±8.6	0.794
	Posttest II	5.1	69.9±11.4	75.0±7.7	0.005*

Notes: * significant at 0.05 level

The findings demonstrated a significant improvement in patients' quality of life (EQ-5D-5L scores) in both the control and intervention groups during the pretest and posttest I following the initial counseling session. The intervention group showed a greater improvement compared to the control group, despite starting with lower baseline EQ-5D-5L scores. After the second counseling session, the EQ-5D-5L index in the intervention group increased further in the posttest II, while the control group, which did not receive counseling, experienced a decline in EQ-5D-5L scores during the same period (Table 3).

The results revealed no significant changes in the mobility and self-care domains in either the control or intervention groups before and after the first or second interventions (p >0.05). The self-care domain showed no significant improvements in either group following the first or second interventions (p >0.05), indicating

that counseling did not impact the quality of life in this domain for diabetes mellitus patients in both groups. However, significant improvements were observed in the usual activities domain within the intervention group after the first and second counseling sessions conducted by the pharmacist, compared to scores before counseling ($p < 0.05$). No significant improvements were noted in the usual activities domain within the control group ($p > 0.05$) (Table 3).

Table 3. Comparison of pretest and posttest quality of life.

Questionnaire	Group		Difference (After – Before)	Statistics		p-value**
				After	Before	
EQ-5D-5L	Control	$\Delta 2-1$	0.03	0.67±0.30	0.64±0.32	0.004*
		$\Delta 3-1$	0.02	0.66±0.30	0.64±0.32	0.087
		$\Delta 3-2$	-0.01	0.66±0.30	0.67±0.30	0.048*
	Intervention	$\Delta 2-1$	0.06	0.60±0.31	0.54±0.34	<0.001*
		$\Delta 3-1$	0.10	0.64±0.31	0.54±0.34	<0.001*
		$\Delta 3-2$	0.05	0.64±0.31	0.60±0.31	<0.001*
Domain 1 EQ-5D-5L: Mobility	Control	$\Delta 2-1$	0.0	1.6±0.9	1.6±0.9	1.000
		$\Delta 3-1$	0.0	1.6±0.8	1.6±0.9	0.317
		$\Delta 3-2$	0.0	1.6±0.8	1.6±0.9	0.317
	Intervention	$\Delta 2-1$	0.0	2.0±1.0	2.0±1.0	0.317
		$\Delta 3-1$	0.0	2.0±1.0	2.0±1.0	0.317
		$\Delta 3-2$	0.0	2.0±1.0	2.0±1.0	1.000
Domain 2 EQ-5D-5L: Selfcare	Control	$\Delta 2-1$	0.0	1.7±0.9	1.7±0.9	0.655
		$\Delta 3-1$	0.0	1.7±0.9	1.7±0.9	0.655
		$\Delta 3-2$	0.0	1.7±0.9	1.7±0.9	1.000
	Intervention	$\Delta 2-1$	0.0	1.8±1.0	1.8±1.0	0.317
		$\Delta 3-1$	0.0	1.8±1.0	1.8±1.0	0.317
		$\Delta 3-2$	0.0	1.8±1.0	1.8±1.0	1.000
Domain 3 EQ-5D-5L: Usual activities	Control	$\Delta 2-1$	0.0	1.7±0.9	1.7±1.0	0.180
		$\Delta 3-1$	0.0	1.7±0.9	1.7±1.0	0.180
		$\Delta 3-2$	0.0	1.7±0.9	1.7±0.9	1.000
	Intervention	$\Delta 2-1$	0.0	1.9±1.0	2.0±1.0	0.050*
		$\Delta 3-1$	-0.1	1.9±1.0	2.0±1.0	0.020*
		$\Delta 3-2$	0.0	1.9±1.0	1.9±1.0	0.180
Domain 4 EQ-5D-5L: Pain/discomfort	Control	$\Delta 2-1$	-0.1	2.3±1.0	2.4±1.0	0.018*
		$\Delta 3-1$	-0.1	2.3±0.9	2.4±1.0	0.131
		$\Delta 3-2$	0.0	2.3±0.9	2.3±1.0	0.655
	Intervention	$\Delta 2-1$	-0.5	2.3±0.7	2.8±0.9	<0.001*
		$\Delta 3-1$	-0.9	1.9±0.5	2.8±0.9	<0.001*
		$\Delta 3-2$	-0.3	1.9±0.5	2.3±0.7	<0.001*
Domain 5 EQ-5D-5L : Anxiety/depression	Control	$\Delta 2-1$	-0.2	2.0±0.8	2.3±0.9	0.002*
		$\Delta 3-1$	-0.1	2.1±0.8	2.3±0.9	0.031*
		$\Delta 3-2$	0.0	2.1±0.8	2.0±0.8	0.271
	Intervention	$\Delta 2-1$	-0.5	1.8±0.6	2.3±0.8	<0.001*
		$\Delta 3-1$	-0.9	1.4±0.5	2.3±0.8	<0.001*
		$\Delta 3-2$	-0.4	1.4±0.5	1.8±0.6	<0.001*
EQ-VAS	Control	$\Delta 2-1$	2.8	70.3±11.0	67.5±13.2	<0.001*
		$\Delta 3-1$	2.4	69.9±11.4	67.5±13.2	<0.001*
		$\Delta 3-2$	-0.4	69.9±11.4	70.3±11.0	0.242
	Intervention	$\Delta 2-1$	6.4	71.4±8.6	65.0±11.4	<0.001*
		$\Delta 3-1$	10.0	75.0±7.7	65.0±11.4	<0.001*
		$\Delta 3-2$	3.6	75.0±7.7	71.4±8.6	<0.001*

Notes: 1 showed pretest; 2 showed posttest I; 3 showed posttest II; * significant at 0.05 level, ** Wilcoxon' test.

In the pain/discomfort domain, improvements were reported in the intervention group ($p < 0.05$), while the control group demonstrated significant improvements only between the pretest and posttest I (after the first counseling session). The intervention group exhibited higher improvement scores in this domain compared to the control group, with the greatest improvement occurring in the posttest II (following the second counseling session) relative to the pretest. Additionally, both groups showed significant improvements

in the anxiety/depression domain before and after the first and second interventions (p <0.05), with the intervention group achieving greater improvements than the control group. These analyses were conducted using the Wilcoxon test (Table 3).

An increase in the average EQ-VAS scores was observed in both groups compared to baseline in the pretest. However, a larger increase in EQ-VAS scores was reported in the intervention group during the posttest I and posttest II compared to baseline. Notably, the rise in EQ-VAS scores from the posttest I to the posttest II occurred only in the intervention group. This highlighted sustained improvements in the quality of health-related life among patients who received counseling on diabetes medication use, which persisted until the posttest II (Table 3).

Fasting blood glucose

The differences in FBG categories before and after treatment were observed in both the control and intervention groups. The number of patients achieving glucose control (FBG < 126 mg/dL) was higher in the intervention group over time compared to the control group (Table 4).

No significant differences in FBG levels were found between the two groups before the intervention (pretest). However, significant differences in FBG levels were seen starting in posttest I and became more pronounced in posttest II (after the second counseling session), indicating that counseling had an effect on FBG control in diabetes mellitus patients (Table 5).

FBG control was only reported in the intervention group. Significant differences in FBG levels within the control group observed only when comparing posttest II to pretest. These findings highlighted the role of counseling in FBG management for diabetes patients. Counseling had a greater and more significant impact on FBG control, enhancing patients' knowledge of proper medication consumption and correct dosages, which made it easier to achieve glucose control targets. Furthermore, patients' awareness of the benefits and side effects of medication gained through counseling improved adherence to antidiabetic medication (Table 6).

Table 4. Fasting blood glucose categories in the intervention and control groups.

FBG Level	Control			p-value	Intervention			p-value
	Pretest	Posttest I	Posttest II		Pretest	Posttest I	Posttest II	
High	97	85	82	<0.001*	97	54	42	<0.001*
Normal	0	12	15		0	43	55	

Notes : High FBG>126 mg/dL; normal FBG ≤126 mg/dL; * significant at 0.05 level

Table 5. Comparison of fasting blood glucose in the control and intervention groups.

FBG	Difference (Intervention – Control)	Group		p-value
		Control	Intervention	
Pretest	-14.8	208.2±80.4	193.3±47.9	0.787
Posttest I	-48.2	191.9±64.3	143.7±43.3	<0.001*
Posttest II	-56.3	187.8±65.7	131.5±37.2	<0.001*

Notes: * significant at 0.05 level

Table 6. Comparison of pretest and posttest fasting blood glucose.

Group	FBG	Difference (After – Before)	Statistics		p-value
			After	Before	
Control	$\Delta 2-1$	-16.2	191.9±64.3	208.2±80.4	0.136
	$\Delta 3-1$	-20.3	187.8±65.7	2082±80.4	0.031*
	$\Delta 3-2$	-4.1	187.8±65.7	191.9±64.3	0.440
Intervention	$\Delta 2-1$	-49.6	143.7±43.3	193.3±47.9	<0.001*
	$\Delta 3-1$	-61.8	131.5±37.2	193.3±47.9	<0.001*
	$\Delta 3-2$	-12.2	131.5±37.2	143.7±43.3	<0.001*

Notes: 1 showed

DISCUSSION

This study found an improvement in the quality of life (EQ-5D-5L) among T2DM patients who received medication counseling. Counseling can enhance patients' ability to manage their disease and make informed decisions regarding appropriate management and treatment. Meanwhile, patients who did not receive counseling lacked sufficient knowledge to manage their condition, making their quality of life difficult to predict. Increased patient knowledge about the disease is expected to improve the success of both pharmacological and non-pharmacological therapies, thereby enhancing patients' quality of life. Successful diabetes management requires close and integrated collaboration among patients, their families, and healthcare providers, including doctors, pharmacists, and nutritionists. The critical role of pharmacists in providing counseling is particularly meaningful in managing diabetes. Counseling is a form of pharmaceutical care implementation. Pharmacists must interact with patients and other healthcare providers to enhance patients' understanding of their disease [11].

The quality of life of patients with type 2 diabetes mellitus significantly improves through pharmacist interventions. Similar studies have been conducted by researchers in various countries. Furthermore, it has been demonstrated that clinical pharmacist interventions in therapy, disease management, diet, exercise, lifestyle modification, and self-care practices can significantly improve the quality of life of patients with type 2 diabetes mellitus [12]. A study conducted on T2DM patients in a military hospital in Myanmar showed that pharmacist interventions significantly increased the average quality of life compared to those who did not receive interventions ($p<0.001$). In addition, the researchers observed significant improvements in body circumference, body mass index, and blood glucose concentration ($p<0.05$) [13]. The fact that the quality-of-life scores in the intervention group were higher than in the control group demonstrates the significant benefits of counseling for prolanis T2DM patients [8].

Various studies in Indonesia also show consistent results. Research at the Puskesmas Gedong Tengen found a strong relationship between pharmaceutical counseling and improved quality of life among patients with type 2 diabetes mellitus, supported by consistent findings from other studies [8]. These results align with research conducted in the Kebak Kramat Subdistrict, which showed significant differences in patients' quality of life before and after counseling [14]. Research conducted at the Kramat Jati Community Health Center in East Jakarta also showed significant differences before and after pharmaceutical interventions, both in medication adherence and improved quality of life among T2DM patients [9].

In this study, the researchers used leaflets as an educational tool. Providing leaflets as an aid for education proved highly effective in increasing patient knowledge. Interventions using leaflets had positive impacts on knowledge, short-term medication adherence, and communication between patients and healthcare providers, fostering better discussions. Caetano et al. mentioned that providing leaflets is especially beneficial for individuals with lower education levels. The use of written materials can enhance health literacy and behavior. However, the use of leaflets alone in patient education has limitations. The lack of individualized adjustments in the leaflets and limited contact time between the educator and the patient (as leaflets are read at home) may reduce the intervention's effectiveness. Therefore, providing leaflets should be accompanied by counseling to achieve better outcomes, as seen in this study. Educational interventions are more effective when repeated frequently over a short period [15].

Caetano et al., who studied 702 diabetes patients in Brazil, concluded that interventions involving written information through leaflets at primary healthcare facilities for individuals with type 2 diabetes could benefit medication adherence [15]. This was further confirmed in a study in Indonesia by Sagala et al., where providing booklets and pharmacist education improved the knowledge and self-management behaviors of T2DM patients in each group [16].

Based on a more detailed analysis, the impact of counseling on the quality of life of diabetes mellitus patients was most evident in certain domains, namely "pain/discomfort" and "anxiety/depression." These results align with previous research. Pharmacist interventions have been proven to significantly reduce the signs and symptoms of neuropathic pain in diabetes mellitus patients. Improvements in diabetic neuropathy are attributed to reduced HbA1c levels in DM patients. According to various studies, better HbA1c levels in diabetes patients can lead to improvements in complications, including chronic pain. Greater glycemic control was observed in the intervention group, which involved dietary and lifestyle modifications facilitated by

pharmacist interventions. In contrast, the improvement in symptoms in the control group was lower due to poorer glycemic control among these patients [17].

Pharmacist counseling has also been reported to reduce anxiety and depression levels. A study conducted in the Arab region found a significant positive impact on anxiety and depression levels in diabetes patients who received counseling from pharmacists [18]. A study showed improvements in anxiety measurements and QoL among diabetes patients managed by pharmacists [19]. The role of pharmacists in healthcare has recently expanded far beyond dispensing medications, encompassing clinical trials, health economics, patient education, and other areas. The specific skills of clinical pharmacists have been proven to improve treatment outcomes across various healthcare settings. With expertise in identifying drug interactions, their strategic position for direct patient interaction, and the trust patients place in them, pharmacists can help patients overcome therapy adherence barriers and integrate interventions into their care plans. A good social approach also provides patients with a sense of security in managing their conditions [20].

Nevertheless, it is important to consider potential confounding factors that might have influenced the study outcomes. Variables such as concomitant therapies, patients' baseline education levels, and levels of physical activity could have affected knowledge acquisition, medication adherence, and overall patient engagement. The insignificant results observed in this study may stem from the lack of control over these confounding factors. Future studies should account for these variables to better isolate the effects of educational interventions.

In addition to improving quality of life, pharmacist counseling in this study also impacted fasting blood glucose control. Knowledge about the disease condition serves as the foundation for diabetes care and glycemic control. Effective education has been shown to improve attitudes and daily practices, particularly in lifestyle modification and dietary management, contributing to better glycemic control and slowing the progression and complications of diabetes. Many interventions, especially those led by pharmacists, have been developed to enhance patient knowledge about disease management in individuals with type 2 diabetes. A study conducted in India found that pharmacist counseling on diabetes improved patient knowledge about the disease [21]. A systematic review of pharmacist-led interventions demonstrated positive impacts on diabetes mellitus treatment outcomes, particularly in disease knowledge, self-care, and glycemic control, as well as long-term complications [22],[23].

This study's findings also align with prevoius research conducted in Indonesia where blood glucose levels became more controlled with pharmacist counseling [24]. A research assessed the role of pharmacists in pharmaceutical services for diabetes mellitus (DM) patients and found that they could contribute to blood glucose control, reduce risk factors, improve medication adherence, and enhance quality of life for DM patients [25]. A study in Vietnam showed consistent results. At the 1-month follow-up, pharmacist interventions increased the percentage of patients achieving target FBG levels compared to the control group (OR = 1.979; 95% CI: 1.029 – 3.806; p = 0.041) [23]. Counseling provided to diabetes mellitus patients taking antidiabetic drugs was proven to help maintain their health. A study in Malaysia even reported that glycemic control improved significantly and persisted for up to a year in patients who received pharmacist interventions [26]. Counseling by pharmacists can enhance the health of diabetes mellitus patients and provide positive clinical outcomes, as evidenced by stable blood glucose levels in the tested DM patients [23].

The first limitation of this study was the use of a non-randomized sampling method, which introduces the possibility of selection bias. This approach may have resulted in differences between the groups that were not controlled for. The second limitation was the lack of control for several factors that could influence the relationship under study, such as concomitant therapies, education levels, and physical activity level. Addressing these limitations in future research would enhance the validity of the findings and provide a clearer understanding of the effects of the interventions.

▪ CONCLUSION

The pharmacist counseling at RSUD Pasar Minggu has a positive and significant impact on improving the quality of life of diabetes mellitus patients, particularly in the aspects of pain/discomfort and anxiety/depression, as well as contributing to achieving favorable clinical outcomes by maintaining controlled blood glucose levels in T2DM patients.

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