

# The Effect of Pharmacist Counseling on the Clinical Outcomes of Type 2 Diabetes Mellitus Outpatients admitted to Asahan Regional General Hospital

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## Abstract

*Type 2 Diabetes mellitus (T2DM) remains a global health problem due to its poor clinical outcomes, high morbidity, and mortality caused by many complicated problems, one of which is the ineffective role of pharmacists in providing counseling to DM patients. This pre and post prospective cohort study evaluated the effect of pharmacist counseling on the blood glucose level (BGL) and glycosylated hemoglobin (HbA1C) of T2DM out-patients (n=88) admitted to Asahan General Hospital period June to December 2022. Blood glucose levels and HbA1C of the patients were recruited from their medical records before and after interventions. Characteristics of the patients were analyzed by applying descriptive statistics. The significance of the pharmacist intervention on these outcomes was analyzed using Wilcoxon test ( $p < 0.05$  was considered significant). The mean age of the patients was  $57.89 \pm 9.75$  (years). Most (57.95%) of them were female. The present study showed significant differences in BGLs and HbA1C before and after interventions,  $p = 0$ . Pharmacist counseling plays an important role to improve BGLs and HbA1C in T2DM patients.*

**Keywords:** BGL, HbA1C, T2DM patients

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## I. INTRODUCTION

Diabetes Mellitus is one of the most prevalent diseases that affects a large number of people worldwide and a global health emergency. A study conducted in 2021 found that number of people with DM living in urban and rural areas were 360.0 million and 176.6 million, with estimated prevalences of 12.1% and 8.3%, respectively. It was estimated that the number of people with DM living in urban areas will increase to 596.5 million in 2045. Due to their low social acceptance, people with DM tend to develop other diseases, such as psychological disorders, blood vessel issues in the brain, gangrene, heart disease, and kidney failure [1].

In Indonesia, with a population of 179.72 million, the prevalence of diabetes was 10–60%. Diabetes Mellitus is a disease that can kill 6.7 million people, or it can be said that 1 sufferer is killed every 5 seconds. Indonesia was ranked as the fifth highest country with DM patients [2].

Controlling hypertension, cholesterol, and blood lipid levels is crucial in preventing cardiac issues since patients with diabetes have a high risk of developing heart disease. Patients are therefore required to adopt deliberate lifestyle changes, such as attempting to have an ideal body weight, engaging in regular physical activity, eating a balanced diet, quitting smoking, and managing stress [3]. It is hoped that the management of type II diabetes necessitates intervention targeted at managing glycemia and risk factors for the heart and blood vessels because there are so many chronic problems caused by T2DM that fatally harm many important organs [4].

The increasing number of DM sufferers in Indonesia cannot be separated from the roles of the patients themselves and healthcare providers. For a patient with DM, maintenance of a stable BGL is the most important thing for the patient to do to avoid from further complications. Actions taken to help improve the effectiveness of diabetes mellitus treatment require the role of healthcare providers, including pharmacists. Efforts to improve the quality of life of patients with DM can be pursued by providing guidance or counseling. Counseling also helps patients monitor their BGLs. Pharmacist consultation at the hospital is

an influential factor in increasing fasting blood glucose (FBG) and glycosylated hemoglobin A1 (HbA1c) levels for individuals with T2DM.

The goal of counseling is to increase the efficacy of therapy so that people with diabetes mellitus may use medications safely and effectively, patients can adhere to their medication regimens, and therapeutic goals can be readily attained [5]. The advantage of counseling is that by having face-to-face encounters with patients, healthcare providers (pharmacists) can share detailed information about the patient's condition, the medications provided to them, and how to cope with the disease suffered by the patient [6].

Clinical outcomes are the results of interventions provided by healthcare providers to those who are the target of the intervention. Rational therapy in controlling DM can improve the achievement of expected clinical outcomes, namely controlled BGLs. Other factors, such as lifestyle and patient education, have an impact on the clinical outcome in patients with DM, which is the achievement of controlled BGLs. Lifestyle is significantly related to the clinical outcome of DM patients. A well-controlled DM occurs when BGLs, lipid levels, HbA1c, and blood pressure reach the expected levels. The clinical outcome is a picture of the patient's clinical response related to the success of anti-diabetic therapy, which can be in the form of a fasting blood glucose level (FBGL) [6]. This study aimed to find out how pharmacist counseling improved the clinical outcomes (which consisted of BGL and HbA1C) of patients with T2DM admitted to Asahan Regional General Hospital, Province of Sumatera Utara, Indonesia.

## II. METHODS

Pre and post cohort design was applied to perform the study. In this study, all outpatients with T2DM admitted to Asahan General Hospital, Province of Sumatera Utara, Indonesia period June to December 2022 and met the inclusion criteria were included study sample (n=88). The inclusion criteria were T2DM patients with and without complications and comorbidities, age of 18 years or older, had no mental disorders, received at least one antidiabetic drug, and agreed to sign the informed consent. Characteristics of the patients including gender, age, education, occupation, the disease duration, comorbidities, complications, and diagnosis were collected using a predetermined questionnaire. BGLs and HbA1C were collected before, during (follow up I and II), and after the pharmacist counseling. Counseling provided to the T2DM patients focused on the importance of adherence to the prescribed medications and non-pharmacological efforts to improve their clinical outcomes. Characteristics of the T2DM patients were analyzed by applying descriptive statistics. The significance of counseling on the BGL and HbA1C improvement was statistically analyzed by applying Wilcoxon test ( $p > 0.05$  was considered significant).

## III. RESULT AND DISCUSSION

### 3.1 Patient Characteristics

The target population in this study was all T2DM out-patients (n=113) admitted to the Asahan Regional General Hospital period June to December 2022. Only 88 patients met the inclusion criteria. These patients were then recruited as the study sample. Characteristics of the T2DM patients in this study included gender, age, education, occupation, duration of T2DM disease, comorbidities, complications, and disease diagnosis are presented in Table 1.

**Table 1.** Characteristics of the T2DM Patients (n=88)

Patient Characteristics		Total	(%)
Gender	Male	37	42.05
	Female	51	57.95
Age (Year)	≤ 30	1	1.14
	31 - 40	4	4.54
	41 - 50	15	17.04
	51 - 60	31	35.23
	> 60	37	42.05
	Mean	57.89 ± 9.75	
Education	Primary school	28	31.82
	Junior high school	16	18.18

	Senior high school	37	42.05
	University	7	7.95
Occupation	Housewife	37	42.05
	Civil Servant	10	11.36
	Self – employed	19	21.59
	Employee	11	12.50
	Others	11	12.50
Duration of suffer from DM (in years)	0 - 1	12	13.64
	1 - 5	32	36.36
	5 - 10	26	29.54
	10 - 20	15	17.05
	20 -30	3	3.41
	Mean	7 ± 6.08	
Comorbidities	With co-morbidities	86	97.73
	Without co-morbidities	2	2.27
Complications	With complications	88	100
	Neurological complications	66	75
	Ketoacidosis	22	25
	No Complications	0	0
Diagnosis	Insulin-dependent DM with neurological complications	18	20.45
	Insulin dependent DM with Ketoacidosis	12	13.64
	Non-Insulin dependent DM with neurological complications	48	54.55
	Non-Insulin dependent DM with Ketoacidosis	10	11.36

As shown in Table 1, the majority (57.95%) of the T2DM patients were female. More than one third (35.23%) of them was at the age range of 51–60 years. Most (42.05%) of them graduated from high school. Subsequently, as much as 42.05% of the patients were housewives. Most (36.36%) of them and have suffered from T2DM for 1–5 years. In addition, most (97.73%) of the patients had comorbidities. Most (54.55%) of them were diagnosed as non-insulin dependent DM with neurological complications.

### 3.2 Blood Glucose Level of The Patients

The term “blood glucose level” (BGL) refers to the blood's tightly controlled glucose levels. The BGL is tightly regulated in the body. Glucose flowing through the blood is the main source of energy for the body's cells [7]. Differences of BGLs of the T2DM patients before, during, and after the intervention can be seen in Table 2.

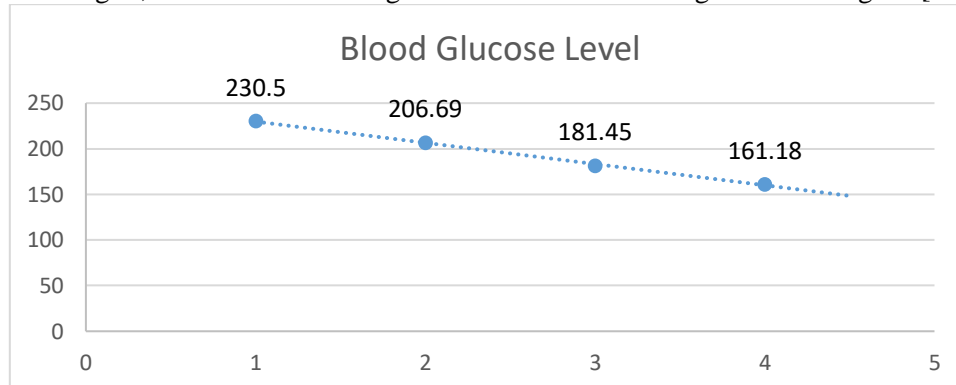
**Table 2.** Differences in BGLs in patients with type 2 DM (n=88) before, during, and after intervention

Category of BGL	Frequency	BGL (mg/dL)							
		Pretest	Mean	Follow Up I	Mean	Follow Up II	Mean	Posttest	Mean
Controlled	F	24	165.29 ±	39	165.69 ±	72	165.31 ±	79	152.80 ±
	%	27.27	8.05	44.32	9.58	81.8	13.06	89.8	10.34
Not Controlled	F	64	254.95 ±	49	239.33 ±	16	254.13 ±	9	234.78 ±
	%	72.73	50.21	55.68	40.90	18.2	47.47	10.2	27.44

As shown in Table 2, less than one-third (27.27%) of the patients had controlled BGL. In the follow-up I, as many as 39 (44.32%) of the patients had controlled BGLs and more than half (55.68%) of the patients were uncontrolled. In follow-up II, as many as 72 (81.8%) of them had controlled BGLs and as many as 16 (18.2%) were not controlled. In general, only 24 (27.27%) of the patients had controlled BGLs before the intervention with a mean value of 165.29 ± 8.05 mg/dL. Most (72.73%) of them had uncontrolled BGLs with a mean value of 254.95 ± 50.21. In contrast, the present study proved that the number of patients with T2DM outpatients with controlled BGLs increased up to 79 (89.8%) after the intervention.

Suyono, in *The Management of Integrated DM* (2013), argued that DM patients showed that the reduced amount of insulin is not of good quality. So, even though there are insulin and receptors, due to abnormal cells occurring, glucose cannot enter because all the cell doors are closed, so glucose cannot be metabolized within the cells. This is what makes BGL in the blood rise, which is the cause of hyperglycemia. [8].

Monitoring of BGLs is of important to diagnose diabetes mellitus [9]. Blood glucose levels can be evaluated when the patient is in a fasting state or when the patient comes to be checked, with the results of BGLs when  $> 200$  mg/dl, while the results of glucose levels when fasting are  $> 126$  mg/dL [10].



**Fig 1.** The average BGL of T2DM patients

As presented in Figure 1, the mean BGL was 230.5 at the pretest, dropped to 206.69 in follow-up I, dropped to 181.45 in follow-up II, and dropped to 161.18 in the post-test. It showed that the average BGL decreased after the intervention. These findings proved that pharmacist role in counseling is crucial to improve the patients' clinical outcomes.

### 3.3 Glycosylated Hemoglobin (HbA1C)

HbA1C is an accurate and precise examination for measuring chronic BGLs and positively correlated with the risk of diabetes complications. HbA1c has several advantages over plasma glucose. The diagnosis is established if the HbA1c value is  $\geq 6.5\%$  [11]. This is a laboratory examination that can be used in all types of diabetes mellitus, especially to determine long-term glycemic status, because the results are very accurate [12]. The HbA1C values of T2DM patients can be seen in Table 3.

**Table 3.** HbA1C of type 2 diabetes mellitus outpatients before and after interventions

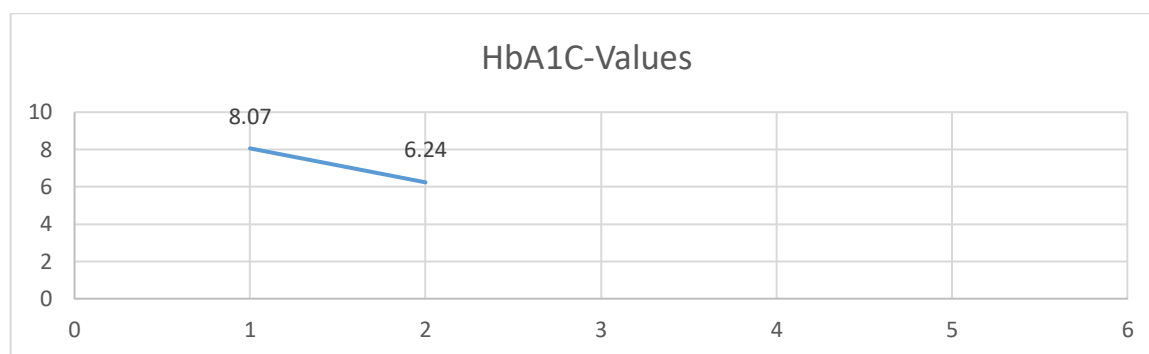
Category	HbA1C before intervention			HbA1C after the intervention		
	( n = 88)	( % )	Mean	( n = 88)	( % )	Mean
Controlled	24	27.3	$6.06 \pm 0.34$	79	89.8	$5.94 \pm 0.33$
Not Controlled	64	72.7	$8.52 \pm 1.19$	9	10.2	$8.81 \pm 1.10$

Before intervention, as listed in Table 3, it was known that patients with controlled HbA1C were 24 (27.3%) with an average of  $6.06 \pm 0.34$  and uncontrolled as much as 64 (72.7%) with an average of  $8.52 \pm 1.19$ . After intervention, most (89.8%) the patients with T2DM had controlled HbA1C with an average and standard deviation of  $5.94 \pm 0.33$ . whereas patients with uncontrolled HbA1C were only 9 or 10.2% with a mean and standard deviation of  $8.81 \pm 1.10$ . the average value of HbA1C values can be seen in Table 4 below.

**Table 4.** The mean of HbA1C in T2DM patients (n=88)

Average HbA1C per Patient		Average	Wilcoxon ( Asymp.Sig )
Pretest	Posttest		
$8.07 \pm 1.61$	$6.24 \pm 0.98$	$1.82 \pm 0.62$	0.000

Table 4 shows that the average pretest HbA1C value was 8.07, and in the post test it decreased to 6.24. Wilcoxon test conducted indicated that the p-value was  $0.000 < 0.05$ . From these results, it can be concluded that there was a significant difference in the average pretest and posttest of HbA1C values. These results can also be seen from the controlled and uncontrolled HbA1C frequency graphs, as follows:



**Fig 2.** The average HbA1C value of T2DM patients before and after intervention

From Figure 2, it is known that the average value of HbA1C before the intervention was 8.07 and after the intervention was reduced to 6.24. This implied that there was a significant decrease in HbA1C after providing of pharmacist counseling.

This present study supported several similar studies conducted elsewhere. Hening et al conducted a quasi-experimental study entitled “Effect of Hospital Pharmacist Counseling on Clinical Outcomes of Type 2 Diabetes Mellitus Outpatients” in a secondary hospital in Indonesia period April to October 2018. They found that BGL and HbA1C improved significantly in the intervention group compared to those without intervention ( $p < 0.001$ ) [13]. A more recent pre and post cohort study undertaken on T2DM patients in Sakaka, Saudi Arabia period April to October 2021 also argued that pharmacist-based intervention significantly improved HbA1C of the T2DM patients ( $p < 0.05$ ) [14].

#### IV. CONCLUSION

The present study indicated that most of the T2DM patients were female. There were significant differences in terms of BGLs and HbA1C before and after interventions. Pharmacist counselling plays an important role to improve BGLs and HbA1C in T2DM patients which can finally improve their quality of life. Counseling should always be routinely practiced in the management of patients with T2DM.

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