INTERNATIONAL JOURNAL OF SOCIAL HEALTH
https://ijsh.ph/index.php/rp
Volume 4 Number 1 January 2025 E-ISSN: 2963-3036

The Relationship Between Adherence to Oral Antidiabetic Medication and Fasting Blood Glucose Control in Type 2 Diabetes Mellitus Patients at Palmerah District Health Center in 2024

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KEYWORDS
medication adherence, type 2 diabetes mellitus, fasting blood glucose.

ABSTRACT
Type 2 diabetes mellitus is a metabolic disease characterized by hyperglycemia due to impaired insulin secretion or function. Data from the Indonesian Ministry of Health in 2021 reported 19.47 million Indonesians living with diabetes. This research evaluated the impact of adherence to oral antidiabetic medication on fasting blood glucose control in type 2 diabetes patients at Palmerah Subdistrict Health Center. A cross-sectional analytic design was used with 52 respondents selected via consecutive sampling. Data were obtained through medical records and the MARS-5 questionnaire. Of the respondents, 55.8% (n=29) were female, and 44.2% (n=23) were male. Adherence to medication regimens was evenly distributed, with 25 patients (50%) adhering and 25 (50%) not adhering. Analysis showed significant differences in fasting blood glucose control. In the adherent group, 92.6% (n=25) achieved controlled blood glucose levels, while all non-adherent patients (100%) had high fasting blood glucose levels. Fisher's Exact test results (p=0.000) confirmed a significant relationship between adherence and blood glucose control. These findings highlight that medication adherence is crucial in managing type 2 diabetes. Practical implications include the need for targeted strategies to enhance adherence, such as patient education, reminders, and personalized support. Factors such as demographics, comorbidities, memory decline, and BMI also influence adherence, requiring a comprehensive approach. Consistent adherence improves glycemic control, reduces complications, and is essential for effective diabetes management.

DOI: 10.58860/ijsh.v4i1.276

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INTRODUCTION

Type 2 diabetes mellitus (DM) is a group of metabolic disorders characterized by chronic hyperglycemia due to impaired insulin secretion, insulin action, or both, which disrupt carbohydrate, fat, and protein metabolism (Lima et al., 2022). Several factors contribute to diabetes mellitus, including obesity, aging, unhealthy lifestyles, hormonal imbalances, and genetic predispositions, leading to an increasing global prevalence of the disease. Based on its causes, diabetes mellitus is classified into four types: type 1 DM, type 2 DM, gestational DM, and other specific types of DM.

The International Diabetes Federation (IDF) reported in 2021 that 537 million adults (20–79 years old) worldwide are living with diabetes, with this number projected to rise to 643 million by 2030 and 784 million by 2045 (Lynch, 2022). Alarmingly, diabetes mellitus caused 6.7 million deaths in 2021, and nearly 44% of adults with diabetes (240 million people) remain undiagnosed. Additionally, 541 million adults globally, or 1 in 10, have impaired glucose tolerance, placing them at high risk of developing type 2 diabetes mellitus.

In Indonesia, the prevalence of diabetes has reached critical levels. The Ministry of Health of the Republic of Indonesia reported that in 2021, 19.47 million people were living with diabetes,

highlighting the pressing need for effective management and prevention strategies. With type 2 DM being a significant contributor to this burden, addressing the factors that impact disease management, particularly adherence to therapy, is of national importance (Reach et al., 2017).

Therapeutic adherence, defined as a patient's ability to follow medical instructions, such as maintaining a proper diet, engaging in physical activity, taking prescribed medications, and attending regular checkups, plays a vital role in achieving optimal glycemic control. However, non-adherence is a widespread issue, affecting 40–50% of patients with chronic conditions like diabetes (Kardas, 2024). Non-adherence in type 2 DM patients can lead to poor blood glucose control and life-threatening complications, including damage to critical organs such as the eyes, kidneys, nerves, heart, and blood vessels.

Despite the significant burden of type 2 DM in Indonesia, limited studies have specifically explored the relationship between adherence to oral antidiabetic therapy and blood glucose control at the community level. This research seeks to fill that gap by examining this relationship in type 2 DM patients at the Palmerah District Health Center in 2024 (Sumarni et al., 2024). By focusing on adherence patterns and their impact on glycemic control, this research aims to contribute novel insights into effective diabetes management in Indonesia, providing valuable evidence to inform local healthcare strategies and improve patient outcomes.

Based on the background above, the objective of this research is to analyze the relationship between adherence to oral antidiabetic therapy and blood glucose control in type 2 diabetes mellitus (DM) patients at the Palmerah District Health Center in 2024. This research aims to identify adherence patterns and evaluate their impact on glycemic control to provide a better understanding of the factors influencing effective diabetes management. The benefits of this research are expected to contribute to improving diabetes management strategies at the community level. By identifying the correlation between therapeutic adherence and blood glucose control, this research can serve as a basis for designing targeted interventions to enhance patient compliance with prescribed therapies. Additionally, the findings of this research can provide evidence-based recommendations for healthcare providers and policymakers to optimize treatment outcomes, reduce complications, and improve the quality of life for patients with type 2 DM in Indonesia.

METHOD

This research employs a cross-sectional analytical research design targeting type 2 DM patients at the Palmerah District Health Center. The aim is to evaluate the relationship between adherence to oral antidiabetic medication and fasting blood glucose control in type 2 DM patients, conducted in July 2024. The research sample consists of 52 patients selected based on predetermined inclusion and exclusion criteria. Adherence to oral antidiabetic medication serves as the independent variable, while fasting blood glucose levels are the dependent variable. The MARS-5 questionnaire, a validated tool for assessing medication adherence, and medical records were utilized as research instruments to ensure reliability and accuracy. To reduce potential bias, external factors influencing adherence and glucose levels, such as comorbid conditions and lifestyle factors, were controlled during data collection. Data were analyzed using the IBM SPSS software with univariate and bivariate analysis, employing Fisher's Exact test for statistical evaluation.

RESULT AND DISCUSSION

The majority of respondents were 29 women (55.8%), while 23 men (44.2%). Most patients had 75.0% comorbidities. The majority of patients underwent monotherapy, 76.9%, while 23.1% used a combination of two drugs.

Table 1. The majority of patients underwent monotherapy

	Sum	
Characteristic	**N**	**%**
Man	23	44.2%
Woman	29	55.8%
Exist	39	75.0%
Not	13	25.0%
Combination of 2 drugs	12	23.1%
Monotherapy	40	76.9%
<30 years	1	1.9
30-40 years old	3	5.8
41-50 years old	14	26.9
51-60 years old	32	61.5
>60 years	2	3.8
GDP Normal	25	48.1 %
High GDP	27	51.9 %
Obey Taking Medicine	26	50.0 %
Not Complying with Taking Medication	26	50.0 %

Most patients were in the age range of 51–60 years (61.5%), followed by 41–50 years old (26.9%), and the rest were in a smaller percentage. A total of 26 patients (50.0%) were included in the complaint category, and another 26 patients (50.0%) were non-compliant. Then, 25 people (48.1%) had normal blood glucose levels, while 27 people (51.9%) had high blood glucose levels.

Table 2. 27 people (51.9%) had high blood glucose levels

		Medication Compliance					
Characteristic Category		**Obedient**		**Non-Compliance**		**Total**	
		N	**%**	**N**	**%**	**N**	**%**
Education	Junior high school equivalent	4	80%	1	20%	5	100%
	High school equivalent	8	40%	12	60%	20	100%
	Diploma	4	50%	4	50%	8	100%
	Sarjana	11	57.9%	8	42.1%	19	100%
Categories IMT	Normal	10	50%	10	50%	20	100%
	Overweight	8	57.1%	6	42.9%	14	100%
	Obesity	9	50%	9	50%	18	100%
Therapy	Monotherapy	21	52.5%	19	47.5%	40	100%
	Combination of 2 drugs	6	50%	6	50%	12	100%
Comorbid	Exist	19	48.7%	20	51.3%	39	100%
	None	8	61.5%	5	38.5%	13	100%

Junior high school education at the same level showed the highest level of compliance, which was 80%, with the other 20% not complying. In contrast, the lowest level of compliance was found in high school education equivalent, which was 40% compliant, while 60% were non-compliant. Diploma and undergraduate education have compliance in the range of 50– 57.9%. Normal weight and obese patients showed an adherence rate of 50%, while another 50% did not comply. The compliance category level is 57.1%, slightly higher than other categories. Based on the type of therapy, 21 people (52.5%) from the monotherapy group adhered to it, while 19 people (47.5%) did not comply. In the group that used the combination of two drugs, the compliance rate was 50%, with the same amount. Respondents without comorbidities showed a higher level of compliance, namely 8 people (61.5%) compared to 5

people (38.5%) who did not comply. In contrast, in the group with comorbidities, only 19 people (48.7%) were compliant, while 20 people (51.3%) were not compliant.

Table 3. 20 people (51.3%) were not compliant

		GDP Rate					
Characteristic	**Category**	**Usually**		**Tall**		**Total**	
		%	**N**	**%**	**N**	**%**	**N**
Categories IMT	Usual	9	45%	11	55%	20	100%
	Overweight	7	50%	7	50%	14	100%
	Obesity	9	50%	9	50%	28	100%
Comorbid	Exist	18	46.2%	21	53.8%	39	100%
	None	7	53.8%	6	46.2%	13	100%

A total of 9 people (45%) have normal GDP levels, while 11 people (55%) have high GDP levels. In the overweight group, the proportion of normal and high GDP levels was balanced, with as many as 7 people (50%) each. Meanwhile, in the obesity category, the distribution is also the same, namely 9 people (50%) with normal GDP levels and 9 people (50%) with high GDP levels. In terms of the characteristics of comorbidities, respondents who had comorbidities showed a higher skewed distribution of GDP levels. A total of 18 people (46.2%) have normal GDP levels, while 21 people (53.8%) have high GDP levels. In contrast, respondents without comorbidities showed a different proportion, where more respondents had normal GDP levels (7 people or 53.8%) than high GDP levels (6 people or 46.2%). Of the 27 patients who adhered to oral antidiabetic drugs, as many as 25 people (92.6%) had normal fasting blood glucose levels, while only 2 people (7.4%) had high blood glucose levels. In contrast, of the 25 non-compliant patients, all (100%) had high blood glucose levels.

Table 4. all (100%) had high blood glucose levels

		Control of Fasting Blood Glucose Levels						
		Usual		**Tall**		**Total**		**Fisher's Exact (-sided)**
		N	**%**	**N**	**%**	**N**	**%**	
Medication Compliance	Obedient Non-compliant	25	92.6 %	2	7.4%	27	100%	P-Value 0.000
		0	0.0%	25	25%	25	100%	
Total		25	48.1 %	27	51.9 %	52	100%	

Based on the Fisher's Exact test table above, the analysis results show a significance value (p-value) of 0.000. This indicates a significant relationship between the level of adherence to taking oral antidiabetic drugs and the control of fasting blood glucose levels in patients with type 2 diabetes mellitus. In addition, the Pearson Chi-Square results also showed a significance value of 0.000, assuming the expected frequency was met because there were no cells with a value of less than 5. Thus, both Fisher's Exact Test and Chi-Square support the conclusion that there is a significant relationship between the two variables tested.

PRR was calculated by dividing the risk of high blood glucose levels in the non-compliant group by the risk of high blood glucose levels in the compliant group. Of the 27 patients who obeyed, as many as 25 patients (92.6%) had normal fasting blood glucose levels. A total of 2 patients (7.4% or 0.074) were at risk of high blood glucose levels. Of the 25 non-compliant patients, all (100%) had high blood glucose levels. The risk of having high blood glucose levels in this group is 100% or 1.0.

PRR = Non-compliant group risk: Compliance group risk

$$PRR = \frac{Rrisk\ of\ non-compliant\ groups}{Compliant\ group\ risk}$$

$$PRR = = 13.51\frac{1.0}{0.074}$$

Non-compliant patients had a 13.51 times greater risk of having high blood glucose levels compared to compliant patients. This shows a very strong relationship between adherence to oral antidiabetic medication and control of fasting blood glucose levels.

Based on gender, the majority of respondents were women, as many as 29 people (55.8%), while male respondents amounted to 23 people (44.2%). This finding is comparable to the results of a research conducted, which shows that the number of female respondents is more than men. There are factors that increase the risk of diabetes mellitus, including obesity, high-stress levels, pregnancy history, and the use of oral contraceptives. 8 However, several studies, including those conducted, show that there is no relationship between gender and the level of adherence to taking anti-diabetic drugs in type 2 DM patients. Nevertheless, the results of previous studies still support this research, which suggests that female patients tend to be more obedient than male patients.10 reviews (Lawrence et al., 2016).

Patients with a junior high school education or equivalent tend to have the highest levels of adherence to treatment, followed by individuals with a bachelor's education (Paschal et al., 2014). In contrast, the lowest levels of compliance were found in groups with equivalent high school education. This is very important because the right knowledge will increase the success of treatment. Patients with higher education typically have a more comprehensive understanding of their illness and available treatment options. Diabetes therapy, which requires perseverance and deep understanding, requires patients to have higher cognitive abilities in order to be able to consistently follow medication recommendations and achieve blood sugar control targets.

The results of the findings of patient comorbidities showed that most of the patients had comorbidities, namely 39 people (75.0%), while those who did not have comorbidities were 13 people (25.0%). Research shows that the more complex a treatment regimen is, the more difficult it is for patients to remember and follow all treatment instructions, potentially lowering adherence levels. These findings are comparable to research conducted by Moh Rasyid Kuna et al. (2023) that the complexity of a treatment regimen is often a barrier for patients to comply with all treatment instructions. As a result, patients tend to disobey the therapy given. This research found that 90 patients with type 2 diabetes who suffered from hypertension experienced problems related to DRPs. This showed a high prevalence of drug-related problems in the group of patients with these comorbidities.

Based on therapy, the results showed that monotherapy, namely the use of one type of drug, was the most dominant treatment approach, with a total of 40 people (76.9%), while the remaining 12 people (23.1%) used a combination of two drugs. Based on data, 52.5% of patients using monotherapy consistently consumed drugs according to the recommendations, while in the combination therapy group, the percentage of compliance only reached 50%. This suggests that the type of therapy can affect patient adherence, where more complex combination therapies may decrease patient consistency in following prescribed medications. According to the research of Rasdianah et al. (2022), there is a significant difference in the level of treatment adherence in type 2 DM patients. Patients who underwent monotherapy 48.1% were recorded to have a higher level of adherence compared to those who received combination therapy 40.6%. 17 reviews

According to WHO guidelines, obesity is a condition characterized by a significant increase in body fat mass due to an imbalance between energy intake and energy expenditure (2018). Based on the BMI category in 52 research respondents, it was shown that respondents with normal BMI had an

adherence rate of 50% (10 people) for each category of compliant and non-compliant. In the overweight category, the majority of respondents (57.1% or 8 people) were compliant, while the rest (42.9% or 6 people) were not compliant. Meanwhile, in the obesity category, the level of compliance is also balanced, namely 50% (9 people) for obedience and non-compliance. Determination of obesity status cannot be done subjectively based on physical assessment alone. Accurate and standardized measurements, such as BMI, are essential tools for classifying individuals into appropriate weight categories (De Lorenzo et al., 2016). BMI, which is calculated based on height and weight, provides a more objective picture of a person's nutritional status 17 The findings in the normal BMI category as many as 45% of respondents have normal GDP levels, while 55% have high GDP levels, this data shows a greater tendency towards higher GDP levels. Meanwhile, in the overweight and obesity groups, the distribution of normal and high GDP levels is balanced, each by 50%.

Quoted by Andriana et al. (2021), leptin, as a hormone produced by adipose tissue, has a central role in weight regulation and energy metabolism. Increased leptin levels in obese individuals are often associated with leptin resistance, a condition characterized by decreased cellular sensitivity to the hormone leptin, thereby contributing to the development and worsening of obesity and increasing the risk of various metabolic complications, including hyperglycemia. These findings are in line with research conducted by Lindayati et al. (2018), showing a significant correlation between BMI and blood glucose levels. A total of 46.4% of participants were categorized as obese based on BMI values, while 67.9% had high blood glucose levels. These findings indicate that obesity is a strong risk factor for the occurrence of type 2 diabetes.21 reviews

The results showed a significant relationship in the level of adherence to oral antidiabetic treatment between groups with normal and abnormal fasting glucose levels. All respondents with normal fasting blood glucose levels complied with treatment, while only 7.14% of respondents with abnormal fasting blood glucose levels complied. Based on the results of the interview research, information was obtained that some respondents' non-compliance was caused by leisure factors, such as busyness daily activities that can increase the risk of forgetfulness in respondents, some respondents also admitted that they should not consume oral antidiabetics because they felt that they did not experience symptoms of the disease or felt bored with continuous treatment. This can be a barrier for patients to maintain long-term compliance.

The results of the research by Nanda et al. (2018) showed a positive correlation between treatment compliance and a decrease in blood glucose levels. The research also revealed that non-compliance is caused by a variety of factors. As many as 62.9% of respondents reported forgetting to take medication due to memory loss. In addition, a number of respondents, as many as 38.5%, deliberately did not take medication because they felt healthy or were worried about side effects. The boredom factor with the treatment routine is also an obstacle for respondents. These results are consistent with a research conducted which found that type 2 DM patients with high levels of adherence to oral antidiabetic consumption tended to have controlled fasting blood glucose levels because patients had a sense of responsibility for medication so they were more obedient in undergoing therapy.

The results of this research are in line with research conducted by Deby A. Mpila et al. (2024), which showed a significant relationship between the level of medication adherence and the achievement of blood sugar level targets in type 2 DM patients with ($p<0.05$). The results of statistical analysis prove that patients who are very compliant with treatment more often reach the target blood sugar level. These findings indicate that medication adherence is a key factor in the success of diabetes therapy.23 Although adherence to oral antidiabetic drug therapy is an important pillar in the management of type 2 DM, the success of this therapy can be hampered by a variety of factors. Beta cell dysfunction, which is characterized by decreased insulin production, as well as insulin resistance, refers to the inability of

the body's cells to respond to insulin effectively. There are two main mechanisms that contribute to therapy failure, as a result of which patients who have been on treatment consistently have blood glucose levels that are difficult to control (Kenny & Abel, 2019). These findings are in line with research conducted which showed that there was a strong correlation between insulin resistance and failure of oral antidiabetic drug therapy in type 2 DM patients. The therapy failure rate reached 64.83%, indicating that insulin resistance significantly inhibited the effectiveness of pharmacological therapy in achieving glycemic targets.

Behind the existence of obedient patients, there are patients who do not comply with carrying out treatment steps according to the doctor's or clinical recommendations. According to the World Health Organization (WHO), non-compliance refers to a condition in which a patient does not or only partially follows the treatment guidelines that have previously been agreed upon with the doctor. According to the International Diabetes Federation (IDF), the common understanding is that diabetes mellitus is a chronic disease that requires long-term management, and the associated psychological burden can be a barrier to patient adherence to treatment. According to Sari (2021), medication adherence in patients with diabetes mellitus is very important to achieve treatment effectiveness, prevent complications, and support recovery. Good therapy provides significant health benefits, especially for patients who have to take medication for a long time or even a lifetime to manage diabetes mellitus.

Researchers assume that adherence to the treatment regimen is a crucial factor in achieving the main goal of type 2 DM therapy, which is to optimize fasting blood glucose control. Thus, the risk of long-term complications such as cardiovascular disease, nephropathy, and neuropathy can be minimized (Arnold et al., 2016). In addition, good compliance also contributes to improved patients' quality of life and reduced long-term treatment costs. Adherence to the treatment regimen is the main determinant factor, according to statistical analysis using the chi-square and Fisher Exact tests conducted at the Palmerah District Health Center, which shows a statistically significant relationship between the independent variable (medication adherence) and the dependent variable (GDP level). The obtained p-value ($p < 0.001$) reinforces the hypothesis that adherence to the treatment regimen has a strong influence on glucose control.

CONCLUSION

A research of 52 respondents with type 2 diabetes mellitus at the Palmerah District Health Center revealed that adherence to oral antidiabetic treatment significantly contributes to the control of blood glucose levels. The majority of respondents, predominantly women aged 51–60 years, demonstrated that 92.6% of those adhering to their medication regimen achieved optimal blood glucose control. The Fisher's Exact test analysis yielded a significant value ($p = 0.000$), indicating a strong relationship between medication adherence and fasting blood glucose control. Various factors, including individual characteristics such as gender, education level, memory, comorbidities, and body mass index (BMI), as well as treatment factors like the number of medications, frequency, and regimen complexity, influence patient adherence.

These findings underscore the critical role of adherence to oral antidiabetic treatment in managing type 2 diabetes mellitus. To enhance adherence, education-based interventions should focus on patient-centered approaches, such as providing clear, accessible information about diabetes management, using visual aids to simplify complex regimens, and incorporating reminders or digital tools to improve memory and consistency. From a public health policy perspective, efforts should include integrating diabetes management programs into primary healthcare services, prioritizing health literacy campaigns, and advocating for policies that promote the availability of affordable medications and support streamlined treatment regimens. Strengthening collaboration between healthcare providers and

communities can further ensure sustainable adherence and improved outcomes for diabetes management.

REFERENCES

Arnold, R., Issar, T., Krishnan, A. V, & Pussell, B. A. (2016). Neurological complications in chronic kidney disease. *JRSM Cardiovascular Disease*, *5*, 2048004016677687.

Banat, H., Ambrus, R., & Csóka, I. (2023). Drug combinations for inhalation: Current products and future development addressing disease control and patient compliance. *International Journal of Pharmaceutics*, *643*, 123070. https://doi.org/10.1016/j.ijpharm.2023.123070

De Lorenzo, A., Soldati, L., Sarlo, F., Calvani, M., Di Lorenzo, N., & Di Renzo, L. (2016). New obesity classification criteria as a tool for bariatric surgery indication. *World Journal of Gastroenterology*, *22*(2), 681.

Fonseca, D. C., Sala, P., de Azevedo Muner Ferreira, B., Reis, J., Torrinhas, R. S., Bendavid, I., & Linetzky Waitzberg, D. (2018). Body weight control and energy expenditure. *Clinical Nutrition Experimental*, *20*, 55–59. https://doi.org/10.1016/j.yclnex.2018.04.001

Kardas, P. (2024). From non-adherence to adherence: Can innovative solutions resolve a longstanding problem? *European Journal of Internal Medicine*, *119*, 6–12. https://doi.org/10.1016/j.ejim.2023.10.012

Kenny, H. C., & Abel, E. D. (2019). Heart failure in type 2 diabetes mellitus: impact of glucose-lowering agents, heart failure therapies, and novel therapeutic strategies. *Circulation Research*, *124*(1), 121–141.

Lawrence, R. E., Oquendo, M. A., & Stanley, B. (2016). Religion and suicide risk: a systematic review. *Archives of Suicide Research*, *20*(1), 1–21.

Lima, J. E. B. F., Moreira, N. C. S., & Sakamoto-Hojo, E. T. (2022). Mechanisms underlying the pathophysiology of type 2 diabetes: From risk factors to oxidative stress, metabolic dysfunction, and hyperglycemia. *Mutation Research/Genetic Toxicology and Environmental Mutagenesis*, *874–875*, 503437. https://doi.org/10.1016/j.mrgentox.2021.503437

Lynch, P. (2022). Type 2 diabetes mellitus. *Type 2 Diabetes Mellitus-Medical Independent*.

Mishra, S., & Kishore, S. (2018). Effect of physical activity during pregnancy on gestational diabetes mellitus. *Indian Journal of Endocrinology and Metabolism*, *22*(5), 661–671.

Paschal, A. M., Rush, S. E., & Sadler, T. (2014). Factors associated with medication adherence in patients with epilepsy and recommendations for improvement. *Epilepsy & Behavior*, *31*, 346–350. https://doi.org/10.1016/j.yebeh.2013.10.002

Pratiwi, N., Samodra, G., Nawangsari, D., & Melani, R. (2024). Formulation and iritaso test of ethanol extract gel of kersen bark (muntingia calabura l.). *Proceeding ICHBS*, *1*(1), 232–246.

Reach, G., Pechtner, V., Gentilella, R., Corcos, A., & Ceriello, A. (2017). Clinical inertia and its impact on treatment intensification in people with type 2 diabetes mellitus. *Diabetes & Metabolism*, *43*(6), 501–511. https://doi.org/10.1016/j.diabet.2017.06.003

Rimadania, D., Sari, E. A., & Sari, C. W. M. (2021). Motivation and compliance to type 2 diabetes mellitus diet in the work area of Puskesmas Padalarang. *Journal of Community Empowerment for Health*, *4*(2), 16–21.

Rusminingsih, E., & Purnomo, R. T. (2022). Relationship of Patient Characteristics with Medication Adherence in Type 2 DM. *Indonesian Journal of Global Health Research*, *4*(3), 603–610.

Sitar-Tăut, A.-V., Cozma, A., Fodor, A., Coste, S.-C., Orasan, O. H., Negrean, V., Pop, D., & Sitar-Tăut, D.-A. (2021). New insights on the relationship between leptin, ghrelin, and leptin/ghrelin ratio enforced by body mass index in obesity and diabetes. *Biomedicines*, *9*(11), 1657.

Sumarni, I., Baskara, I., & Fadli, J. A. (2024). The Effect Of Service Quality And Destination Image On Return Visit Intention Through Tourist Satisfaction. *Jurnal Ilmiah Manajemen Kesatuan*, *12*(6), 2309–2336.

van der Eng, P., & Sohn, K. (2018). *Center for Economic Institutions*.