Description of Adherence Level of Antidiabetic Medication in Type 2 Diabetes Mellitus Patients in Dr. Soediran Mangun Sumarso Wonogiri Hospital

Monita Dwi Oktaviya[1], Lusia Murtisiwi[2*]

[1,2]Sekolah Tinggi Ilmu Kesehatan Nasional, Indonesia

*Corresponding Author: Lusia Murtisiwi, email: lusia.murtisiwi@stikesnas.ac.id

Abstract. Medication adherence in diabetes mellitus patients is very important and is one of the keys of the success of diabetes mellitus therapy. The purpose of this study was to determine the characteristics and level of antidiabetics medication adherence to in patients with type 2 diabetes mellitus at Dr. Soediran Mangun Sumarso Hospital. Sampling technique used by total sampling technique, because the average number of patients with type 2 diabetes mellitus per month is 66 patients, relatively small (less than 100), so the entire population is used as sample. The number of samples in this study were 91 patients. Research data collection was carried out by distributing questionnaires to patients at the internist policlinic at Dr. Soediran Mangun Sumarso Hospital. Respondent's characteristics data were analyzed descriptively, consist of gender, age, education, duration of diabetes mellitus, number of antidiabetic drugs, comorditities, insurance owned and occupation. The results showed that the characteristics of type 2 diabetes mellitus patients at Dr.Soediran Mangun Sumarso was dominated by 56 female respondents (62%). Most of the respondents were in the 55-65 years category with 32 respondents (35%), with the last formal education in senior high school or higher of 55 respondents (60.5%). The majority of respondents have worked as many as 62 respondents (88%) and antidiabetic therapy which in most widely used as many as 29 respondents (31,9%) as a single oral therapy, and combination oral therapy with 2 drugs as many as 29 respondents (31,9%). The level of antidiabetic medication adherence in outpatients at the internist polyclinic at Dr. Soediran Mangun Sumarso Wonogiri Hospital was classified as low adherence level category as many as 49 respondents (54%) and 42 respondents (46%) are in the high adherence level category.

Key words: [antidiabetic drug, level of adherence, type 2 diabetes mellitus.**]**

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder (Dipiro, et al., 2020). Diabetes mellitus is still health global problem. According to the International Diabetes Federation (IDF), it is estimated that in Indonesia data related to the number of DM sufferers will increase, which in 2021 is only 19.5 million, then it is estimated that in 2045 it will increase to 28.6 million (IDF, 2021). Then more broadly, on a global scale, data obtained that around 14.3 million people, or around 73.7% of all people between the ages of 20-79 years, are accompanied by undiagnosed DM. Indonesia is estimated to be in third place in the world in terms of the number of people with this age group who have not been diagnosed after India and China (IDF, 2021).

Type 2 diabetes mellitus (DM) requires long term treatment such as oral antidiabetic drugs. The main goal of treating diabetic patients is to maintain glycemic control and prevent diabetes-related complications, as well as morbidity and mortality (Dipiro, et al., 2020). However, poor patient management causes treatment failure and leads to complications (Darkwa, 2011).

Adherence is a change in behavior made by patients according to instructions given by doctors, including in the form of diet, exercise therapy, medication, and control of diabetes mellitus (Nanda et al., 2018). Patient adherence in taking the drug is considered crucial to make the treatment process successful, while ensuring the normality of blood glucose levels or blood pressure (Mokolomban et al., 2018). Several studies have shown that adherence of diabetes mellitus patients to medication was low and associated with poor glycemic control (Sendekie, et al., 2022). A cross-sectional study that was carried out among patients with type 2 diabetes mellitus attending the Internal Medicine Department of a hospital in the United Arab Emirates shown that the self-reported adherence rate to anti-diabetic medications was 84%, and forgetfulness was the most common reason for non-adherence (Arifulla, et al., 2014). A cross-sectional study that included 2,070 patients with type 2 diabetes who presented at five health facilities in the Chittagong Division, southern Bangladesh between November 2018 and June 2019 shown that the overall prevalence of low medication adherence was 46.3% of the study population (Mannan, et al., 2021).

Also in Indonesia, non-adherence to medication was still a problem for patients undergoing diabetes

mellitus treatment (Pertiwi, et al., 2022). A study in patients with type 2 DM at the Enemawira Health Center, North Tabukan District, Sangihe Islands Regency, North Sulawesi Province in February-March 2021 classified as low adherence (Bidulang, et al., 2021). Poor treatment adherence in patients with type 2 diabetes mellitus is associated with inadequate glycemic control; increased morbidity and mortality; and increased costs of outpatient care, emergency room visits, hospitalization, and management of diabetes complications (Polonsky, et al., 2016). There Therefore, this study aims to describe the level of adherence to the use of antidiabetics for patients with type 2 diabetes mellitus who are at dr. Soediran Mangun Sumarso Wonogiri Hospital.

METHODS

This research is observational through the application of descriptive methods based on data taken prospectively. This research was conducted at the internal medicine polyclinic at dr. Soediran Mangun Sumarso Wonogiri Hospital in December 2022-March 2023 for 30 days of data collection. The average population of type 2 diabetes mellitus patients is identified in the hospital pillar sheet at the dr. Soediran Mangun Sumarso Wonogiri. The number found in 2022, with an average monthly in the last 6 months of 66 patients. The total population in this study were 66 patients.

The sample for this study was taken using the total sampling technique because the average number of patients with type 2 diabetes mellitus during the last 6 months was 66 patients, where the number was still below 100, so that the entire population in this study was included as a sample with a minimum number of 66 patients. Until this research ended, this research involved 91 respondents. The instrument used in this study was a Medication Adherence Rating Scale-5 (MARS-5) questionnaire sheet which aims to measure the level of adherence of diabetes mellitus patients. This instrument has been widely used to measure the level of compliance in taking oral antidiabetics for diabetes mellitus patients in Indonesia and has been tested for validity and reliability by Alfian and Putra (2017). Due to differences in language during translation, validity and reliability tests are needed to ensure the same understanding of the questions on the questionnaire. This questionnaire contains five statements that evaluate the level of adherence to drug use (forgetting, changing doses, stopping, using smaller doses, and using medication less than the actual instructions).

The type of validity test conducted in Alfian and Putra's research (2017) is content validity, which is carried out based on the correlation between the score of each statement and the total score of all questions based on Pearson Product Moment calculations. The results of the validity test conducted by Alfian and Putra (2017) show that the correlation value of each statement's score with the total score shows a correlation value of more than 0.396. This indicates that each statement contained in the questionnaire used is valid, and will be useful in measuring the level of adherence to the use of oral antidiabetics in DM patients. The reliability test of the questionnaire was also carried out by Alfian and Putra (2017), with the result that the MARS questionnaire used in the Indonesian version had good reliability with a Cronbach Alpha value $0.803 \geq 0.70$ (Alfian and Putra, 2017). The data obtained in this study were analyzed and presented descriptively.

RESULTS AND DISCUSSION

Characteristics of Type 2 Diabetes Mellitus Patients at Dr. Soediran Mangun Sumarso Wonogiri Hospital based on age, gender, education, occupation, co-morbidities, and duration of type 2 diabetes mellitus can be seen in table 1.

Table 1. Characteristics of Type 2 Diabetes Mellitus Patients at Dr. Soediran Mangun Sumarso Wonogiri Hospital.

Characteristics		f	%
Gender	Male	35	38.5
	Female	56	61.5
Age	25-34 years	0	0
	35-44 years	0	0
	45-54 years	13	14.3
	55-64 years	43	47.3
	65-74 years	21	23.1
	>75years	14	15.4

Last formal education	Junior high school or lower	36	39.6
	Senior high school or higher	55	60.5
Occupation	Working	62	68.1
	Not working	29	31.9
Comorbidities	None	23	25.3
	Hypertension	50	54.9
	Cholesterol disorders	3	3.3
	Hyperthyroid	2	2.2
	Dyspepsia	3	3.3
	Pulmonary TB	2	2.2
	Diabetic neuropathy	2	2.2
	CKD neuropathy	1	1.1
	CKD, Hypertension	1	1.1
	Gout	1	1.1
	Heart problems	3	3.3
Duration of diabetes mellitus	≤ 5 years	50	54.9
	> 5 years	41	45.1
	TOTAL	91	100

Table 2. Description of Adherence Level of Type 2 Antidiabetic Use Based on Respondent's Gender.

Characteristic		**Level of adherence (f)**		**Level of adherence (%)**	
		High	**Low**	**High**	**Low**
Gender	Male	22	13	24	14
	Female	34	22	37	24
TOTAL		91		100	

The data in table 1 shows that most of the patients were women, 56 respondents (61.5%), the remaining 35 respondents (38.5%) were men. Like the results of the Riskedas study (2018), that based on a doctor's diagnosis and symptoms, women are more likely to find it related to the prevalence of diabetes mellitus symptoms. In line with Putri's research whose research found that women tend to experience hyperkalemia more easily than men, with 20 respondents (66.7%) women who have blood sugar (Putri et al., 2015). In this case, the high prevalence of diabetes mellitus in the elderly, especially women, is indicated by a decrease in the estrogen hormone due to menopause. This estrogen hormone along with the progesterone hormone is a hormone that is very influential in various cells in responding to insulin. After menopause, these hormone levels will change and cause blood sugar levels to become unstable (Desi et al., 2014). The results showed that the level of adherence to the use of antidiabetics in female type 2 DM patients (37%) was higher than that of males (24%) (table 2). As in a study conducted by Akrom (2019), showed consistent results that patients with type 2 DM, female patients (71.6%) tend to be more obedient than men (28.4%) (Akrom et al., 2019). This is closely related to the habits of men who are quite ignorant in terms of health, because they are busier and intense in doing their work so they forget to take anti-diabetic drugs (Malfirani et al., 2019).

Table 3. Description of Adherence Level of Type 2 Antidiabetic Use Based on Respondent's Age.

Characteristic		**Level of adherence (f)**		**Level of adherence (%)**	
		High	**Low**	**High**	**Low**
Age	25-34 years	0	0	0	0
	35-44 years	0	0	0	0
	45-54 years	10	3	11	3
	55-64 years	27	16	30	18
	65-74 years	9	12	10	13
	>75years	9	5	10	5
TOTAL		91		100	

The results of this study show that most patients with type 2 diabetes mellitus are in the age category of 55-64 years, with a total of 43 respondents (47.3%), so that the majority of respondents are in the late elderly category (table 1). The increased risk of suffering from type 2 diabetes mellitus continues to

occur when the age is over 45 years (Mihardja, et al., 2014). Thus, age or age has quite an effect on the possible risk of diabetes mellitus, because it has a strong influence on changes in blood glucose levels. This is because the insulin secreted by the pancreas will also decrease, which will then increase the prevalence of diabetes mellitus along with impaired glucose tolerance (Anggraini and Puspasari, 2019). productive age of more than 45 years is included as a risk factor for the occurrence of type 2 diabetes mellitus (Octaviani, 2017). The results of this study showed that respondents in the 55-64 years age category had a high level of adherence to treatment as much as 30%, while only 11% of patients in the 45-54 years age category (table 3). The results were also corroborated by Kirkman et al (2015) who in their study found that the level of adherence obtained was lower in patients aged 20-44 years (4.7%) than patients aged 45-64 years (40 .2%) (Kirkman et al., 2015). So that treatment adherence will tend to increase with increasing age, because patients aged >45 years will be more aware than patients aged ≥18-45 years, and also have a greater desire to recover. Patients aged >45 years will also have greater family support, so that they will be even more motivated to take drugs (Malfirani et al., 2019).

Table 4. Description of Adherence Level of Type 2 Antidiabetic Use Based on Respondent's Last Formal Education.

Characteristic		Level of adherence (f)		Level of adherence (%)	
		High	Low	High	Low
Last formal education	Junior high school or lower	16	20	16	21
	Senior high school or higher	40	15	53	16
TOTAL		91		100	

This study showed that the majority of patients with high school education or higher, about 55 respondents (60.5%), while it was stated in other studies that the majority of patients had low educational levels, about 40 (87.0%) respondents. It is suspected that this is closely related to the level of awareness based on access to education, which in this case is represented by the level of education. So that with a higher level of education, a person's awareness and knowledge will also increase in carrying out treatment to health services (Ramadhan and Marissa, 2015). The results of the study showed that the number of respondents who had a high level of adherence was more with a high school education background or higher (53%) than the number of respondents with a junior high school education background or lower (16%). Respondents with a high school education level or higher with a low adherence category were 16%, while respondents with a junior high school educational background or lower had a lower level of compliance with a higher percentage of 21% (table 4). The results of this study are in line with Ningrum's opinion (2020) that 82.9% of respondents with higher education were compliant with taking medication, while for low education levels 85.9% were not compliant with taking medication. The level of education will also influence the level of knowledge and ability of a person to be able to live a healthier life. With higher education, of course wider access to knowledge will also be more easily achieved, the greater the level of awareness to be able to adjust to a healthy lifestyle. Nevertheless, experience in participating in the treatment process can also improve or increase the behaviour of respondents whose education tends to be lower (Ningrum, 2020).

Table 5. Description of Adherence Level of Type 2 Antidiabetic Use Based on Respondent's Occupation.

Characteristic		Level of adherence (f)		Level of adherence (%)	
		High	Low	High	Low
Occupation	Working	39	23	30	26
	Not working	17	12	31	13
TOTAL		91		100	

The results showed that 62 respondents (68.1%) worked while those who did not work were 29 respondents (31.9%) (table 1). The same thing was shown by Arania (2021) in his research that there were 47 respondents (37.2%) who did not work, while those who worked found 79 respondents (62.7%). Occupational factors can affect the risk of diabetes mellitus because jobs that require little physical activity result in only a little energy being burned by the body, so that excess energy in the body can be stored as fat which encourages obesity and is included as a risk for diabetes mellitus (Arania et al., 2021). Based on occupation data, respondents who do not work (31%) are more compliant in using

antidiabetic therapy compared to respondents who work (30%), so that respondents who are already working have a lower adherence rate (23%) than respondents who do not work (12%) (table 5). As found by Diantari (2019) in his research at the Tabanan Health Center, that based on bivariate results, the level of adherence to taking medication was found to be higher among respondents who did not work (76.67%) compared to those who worked (74.36%) (Diantari and Sutarga, 2019). Patients who work generally have more limited time in visiting or accessing health facilities, so their level of compliance with treatment is also lower (Diantari and Sutarga, 2019). On the contrary, patients who do not work will have more free time and are not too busy, so they tend to be more compliant in terms of treatment such as taking medication, and so on (Diantari and Sutarga, 2019; Mokolomban et al., 2018).

Table 6. Description of Adherence Level of Type 2 Antidiabetic Use Based on Respondent's Co-morbidities.

Characteristic		Level of adherence (f)		Level of adherence (%)	
		High	Low	High	Low
Co-morbidities	None	23	0	25	0
	Hypertension	23	27	25	29
	Cholesterol disorders	2	1	2	1
	Hyperthyroid	1	1	1	1
	Dyspepsia	2	1	2	1
	Pulmonary TB	1	1	1	1
	Diabetic neuropathy	1	1	1	1
	CKD neuropathy	0	1	0	1
	CKD, Hypertension	0	1	0	1
	Gout	1	0	1	0
	Heart problems	2	1	2	1
TOTAL		91		100	

Majority of respondents were accompanied by hypertension comorbidities as many as 50 respondents (54.9%) (table 1). These results are in line with research conducted by Wijaya (2015) that the majority of diabetes mellitus patients suffer from other health problems. The results in the study showed that the most number of disturbances was with 2 or 3 disorders (36.23%) (Wijaya et al., 2015). Siwi et al (2022) in her research showed that patients had found complications of diabetes mellitus with other diseases, such as hypertension, kidney disorders, or cardiovascular. The results of this study state that hypertension is a major risk factor for DM, and the relationship between hypertension and type 2 DM is quite complex, because hypertension can encourage cell resistance to insulin (Siwi et al., 2022). Respondents with hypertension comorbidities had a low adherence rate (29%). The results of a study conducted by Yulianti (2020) showed that patients with complications were usually less compliant in taking medication (47.1%). There are more patients with this complication, because most of them have had type 2 DM for a long time (Yulianti and Anggraini, 2020). Almira et al., (2019) also stated that patients with complications will use more drugs, and they are more complex too, so that their adherence to treatment also decreases. Type 2 diabetes mellitus also applies like other chronic diseases, if left unchecked it can cause other diseases especially when you cannot control blood glucose levels (Almira et al., 2019).

Table 7. Description of Adherence Level of Type 2 Antidiabetic Use Based on Respondent's Duration of Diabetes Mellitus.

Characteristic		Level of adherence (f)		Level of adherence (%)	
		High	Low	High	Low
Duration of diabetes mellitus	≤ 5 years	31	19	34	20
	> 5 years	25	16	27	17
TOTAL		91		100	

Majority of respondents in this study suffered from type 2 diabetes mellitus for ≤ 5 years as many as 50 respondents (54.9%) (table 1). A research at the Enemawira Health Center related to the length of time patients had type 2 diabetes mellitus the majority were <5 years, namely 48 respondents (75%) (Bidulang, et al., 2021). The quality of life and self-efficacy based on patients with a duration of disease of < 5 years is still not good, so there is a higher tendency for distress to arise, while for patients with a duration of disease of ≥ 5 years, the quality of life and self-efficacy will be better, so that there is less

possibility of distress. because someone has been suffering from related diseases for longer (Laili, 2019). The longer the opportunity to learn about the disease he is suffering from, the more experience he will have with the problems caused by the disease (Setiyorini and Wulandari, 2017). As reported by Katadi et al., (2019), that the longer a person has diabetes mellitus, the higher the risk of complications. Respondents with diabetes mellitus ≤ 5 years years had a high adherence level of 34% while those with a low adherence level of 19% (table 7). The results are in line with Ningrum's research (2020) that respondents who have had diabetes for a long time ≤ 5 years, (42.4%) can comply with treatment, while the remaining (57.6%) do the opposite. In general, the level of adherence is high for patients who have just been diagnosed with type 2 DM, because patients still adhere to recommendations, even though the duration of diabetes does not actually affect adherence (Jilao, 2017). As for the level of compliance with the duration of the disease usually found a negative relationship. The longer a person is a patient with diabetes, the less likely he is to comply with the treatment he is currently taking (Aliyana and Rosmiati, 2021).

Table 8 shows the characteristics of type 2 diabetes patients at Dr. Soediran Mangun Sumarso Wonogiri Hospital based on the type of antidiabetic drug therapy. Description of Adherence Level of Type 2 Antidiabetic Use Based on Respondent's Antidiabetic Drug Therapy showed in table 9.

Table 8. Characteristics of Type 2 Diabetes Mellitus Patients Based on the Type of Antidiabetic Drug Therapy.

Type of Antidiabetic Drug Therapy		f	%
Single oral	Glimepiride 1mg	20	22
	Metformin	2	2
	Gliquidone	7	8
Single insulin	Novorapid	5	5
	Ezelin	1	1
	Levemir	2	2
	Novomix	2	2
	Humalog	1	1
	Apidra	1	1
	Lantus	1	1
Combination oral	Metformin + Gliquidone	3	3
	Glimepiride + Metformin	19	21
	Glicazid + Metformin	1	1
	Glimepiride + Acarbose	3	3
	Glucodex + Metformin	1	1
	Glimepiride + Metformin + Acarbose	2	2
Combination insulin	Lantus + Novorapid	5	5
	Novorapid + Ezelin	3	3
	Apidra + Lantus	3	3
	Humalog + Lantus	2	2
Combination of oral and insulin	Glimepiride + Metformin + Humalog + Lantus	1	1
	Metformin + Lantus	3	3
	Glimepiride + Lantus	2	2
	Glimepiride +Metformin + Novorapid + Lantus	1	1
	TOTAL	91	100

Table 9. Description of Adherence Level of Type 2 Antidiabetic Use Based on Respondent's Antidiabetic Drug Therapy.

Characteristic		Level of adherence (f)		Level of adherence (%)	
		High	Low	High	Low
Antidiabetic Drug Therapy	Single oral	14	16	15	18
	Single insulin	8	4	9	4
	Combination oral	10	19	11	21
	Combination insulin	6	7	7	8
	Combination of oral and insulin	4	3	4	3
TOTAL		91		100	

Type 2 DM patients with oral antidiabetic monotherapy in this study were 29 respondents (31.9%), the same as patients with combined oral antidiabetic therapy as many as 29 respondents (31.9%), the rest received single insulin therapy (14.3%), combined insulin (14.3%) and oral combination therapy

and insulin (7.7%) (table 8). These results differ from Akrom et al, (2019), that there are more patients with monotherapy (60.7%) than patients with combination therapy (39.3%) (Akrom et al., 2019). Antidiabetic drug monotherapy which is often used in the internal medicine polyclinic at Dr. Soediran Mangun Sumarso Wonogiri hospital is a glimepiride (sulfonylurea group). As PERKENI revealed that the first line of treatment given to type 2 DM patients included metformin, alpha glucosidase inhibitors, glinids/ sulfonylurea, thiazolidinediones, SGLT-2 inhibitors, DPP-IV inhibitors, and GLP-1 agonists. Then it is also recommended to combine several antidiabetics compared to increasing one type of antidiabetic dose which will increase the risk of toxicity and its side effects. It is suspected that this will provide better benefits for controlling blood glucose levels (PERKENI, 2021). The adherence level of patients who received single oral therapy who were included in the high adherence category was 15%, more than patients who received combined oral drug therapy who had a high adherence level (11%) or single insulin (9%), combination insulin (7%) and patients receiving combination oral therapy and insulin (4%) (table 9). This is in line with Diantari's study (2019) based on the type of drug used, patients who received 1 type of antidiabetic therapy were more adherent (76.09%) compared to patients who received 2 types of antidiabetic therapy tended to be non-adherent 26.09%). The type of antidiabetic drug used can also affect the level of patient adherence to antidiabetic drugs. This decrease in the level of adherence is possible due to an increase in the daily dose consumed. Therefore, reducing the intensity of the dose has the potential to promote increased adherence. Type 2 diabetes sufferers who are accompanied by other diseases indirectly are certainly more complex and will consume more drugs. Followed by the amount, dosage form along with dosage instructions, and the frequency of administration has the potential to cause non-compliance (Diantari and Sutarga, 2019).

Table 10. Description of Adherence Level of Type 2 Antidiabetic Patients at Dr. Soediran Mangun Sumarso Wonogiri Hospital.

Category	Score	Level of Adherence	
		n=91	%
High	1	42	46
Low	2	49	54

The level of antidiabetic medication adherence in type 2 diabetes patients at Dr. Soediran Mangun Sumarso Wonogiri hospital who was identified using the MARS-5 questionnaire showed that 49 respondents (54%) were in the low adherence level category and 42 respondents (46%) were in the high adherence level category (<50%) (table 10). The low level of antidiabetic medication adherence showed that efforts to increase the success of therapy for patients with type 2 diabetes mellitus are still a challenge. There are several ways that pharmacists and other health workers can take in dealing with non-adherence problems, including providing medical information along with patient counseling, home visits, especially for the elderly who suffer from complexes, making booklets and leaflets as a dissemination of the importance of medication adherence for type 2 diabetes mellitus patients (Kemenkes RI, 2015).

CONCLUSION

The level of antidiabetic medication adherence in outpatients at the internist polyclinic at Dr. Soediran Mangun Sumarso Wonogiri hospital was classified as low adherence level category as many as 49 respondents (54%) and 42 respondents (46%) are in the high adherence level category.

ACKNOWLEDGEMENT

The authors would like to thank Dr. Soediran Mangun Sumarso Wonogiri Hospital for their support in this study.

REFERENCES

Akrom, A., Sari, O.M., Urbayatun, S., Saputri, Z., 2019. Analisis Determinan Faktor-Faktor yang Berhubungan dengan Kepatuhan Minum Obat Pasien Diabetes Tipe 2 di Pelayanan Kesehatan Primer. *J Sains Farm Klin* 6, 54. https://doi.org/10.25077/jsfk.6.1.54-62.2019

Alfian, R., Putra, A.M.P., 2017. Uji Validitas dan Reliabilitas Kuesioner Medication Adherence Report

Scale (MARS) terhadap Pasien Diabetes Mellitus. *Jurnal Ilmiah Ibnu Sina* 2, 176–183.

Aliyana, A., Rosmiati, M., 2021. Tingkat Kepatuhan Pengobatan pada Pasien Prolanis Diabetes Melitus Tipe 2 di Klinik Jatisari Karawang Periode bulan Januari-Maret 2021. *JHS* 2, 1555–1573. https://doi.org/10.46799/jhs.v2i12.370

Almira, N., Arifin, S., Rosida, L., 2019. Faktor-faktor yang Berhubungan dengan Perilaku Kepatuhan Minum Obat Anti Diabetes pada Penderita Diabetes Mellitus Tipe 2 di Puskesmas Teluk Dalam Banjarmasin. *Homeostasis* 2, 1–12.

Anggraini, T.D., Puspasari, N., 2019. Tingkat Kepatuhan Penggunaan Obat Antidiabetik Pada Pasien Diabetes Melitus Tipe 2 Di Apotek Sehat Kabupaten Boyolali. *Indonesian Journal On Medical Science* 6, 1–8.

Arania, R., Triwahyuni, T., Prasetya, T., Cahyani, S.D., 2021. Hubungan Antara Pekerjaan dan Aktivitas Fisik dengan Kejadian Diabetes Mellitus di Klinik Mardi Wal;uyo Kabupaten Lampung Tengah. *Jur.Alumni* 5, 163–169. https://doi.org/10.33024/jmm.v5i3.4110

Arifulla M, John LJ, Sreedharan J, Muttappallymyalil J, Basha SA. Patients' Adherence to Anti-Diabetic Medications in a Hospital at Ajman, UAE. *Malays J Med Sci*. 2014 Jan;21(1):44-9. PMID: 24639611; PMCID: PMC3952347.

Bidulang, CB, Wiyono, WI, Mpila, DA. 2021. Evaluasi Tingkat Kepatuhan Penggunaan Obat Antidiabetik pada Pasien Diabetes Mellitus Tipe 2 di Puskesmas Enemawira. PHARMACON Volume 10 Nomor 3 Agustus 2021. https://ejournal.unsrat.ac.id/v3/index.php/pharmacon/article/view/35611/33334

Darkwa S, editor *Prevalence of diabetes mellitus and resources available for its management in the Cape Coast Metropolis* 2011. https://academicjournals.org/journal/ISABB-JHE/article-full-text-pdf/05310B444872

Desi, T.U., Karim, D., Agrina, 2014. Faktor-faktor yang Mempengaruhi Kualitas Hidup Pasien Diabetes Melitus dengan Ulkus Diabetikum. *Jurnal Online Mahasiswa Program Studi Ilmu Keperawatan Universitas Riau* 1, 1–7.

Diantari, I.A.P.M., Sutarga, I.M., 2019. Kepatuhan Minum Obat pada Pasien Diabetes Mellitus Tipe 2 di Wilayah Kerja Puskesmas Tabanan II Tahun 2019. *ACH* 6, 40. https://doi.org/10.24843/ACH.2019.v06.i02.p04

DiPiro, JT, Yee, GC, Posey, LM, Haines, ST, Nolin, TD, Ellingrod, V. 2020. *Pharmacotherapy A Pathophysiologic Approach*, Elevent Edition. New York: McGraw-Hill Medical.

IDF, 2021. International Diabetes Federation (IDF) *Diabetes Atlas*, 10th ed. International Diabetes Federation.

Jilao, Mareeya (2017) Tingkat kepatuhan penggunaan obat antidiabetes oral pada pasien diabetes melitus di puskesmas Koh-Libong Thailand. *Undergraduate thesis*, Universitas Islam Negeri Maulana Malik Ibrahim

Katadi, S., Andayani, T.M., Endarti, D., 2019. The Correlation of Treatment Adherence with Clinical Outcome and Quality of Life in Patients with Type 2 Diabetes. *J. Manaj. dan Pelayanan Farm.* 9, 19. https://doi.org/10.22146/jmpf.42927

Kirkman, M.S., Rowan-Martin, M.T., Levin, R., Fonseca, V.A., Schmittdiel, J.A., Herman, W.H., Aubert, R.E., 2015. Determinants of Adherence to Diabetes Medications: Findings From a Large Pharmacy Claims Database. *Diabetes Care* 38, 604–609. https://doi.org/10.2337/dc14-2098

Laili, F., 2019. Hubungan Faktor Lama Menderita DM dan Tingkat Pengetahuan dengan Distres Diabetes pada Penderita Diabetes Mellitus Tipe 2 Tahun 2017 (Studi di Wilayah Kerja Puskesmas Rowosari, Kota Semarang). *MKMI* 18, 35–38. https://doi.org/10.14710/mkmi.18.2.35-38

Malfirani, L., Purwanti, N.U., Nawawi, J.H., (2019). Analisis Kepatuhan Pengobatan Pasien Diabetes Mellitus Tipe 2 Rawat Jalan di Puskesmas Kampung Bangka Pontianak Tenggara Periode Juli 2017-Desember 2018. *Jurnal Mahasiswa Farmasi Fakultas Kedokteran UNTAN* Vol 4, No 1 (2019).

Mannan A, Hasan MM, Akter F, Rana MM, Chowdhury NA, Rawal LB, Biswas T. Factors associated with low adherence to medication among patients with type 2 diabetes at different healthcare facilities in southern Bangladesh. *Glob Health Action*. 2021 Jan 1;14(1):1872895. doi: 10.1080/16549716.2021.1872895. PMID: 33475476; PMCID: PMC7833014.

Mihardja L, Soetrisno U, Soegondo S. Prevalence and clinical profile of diabetes mellitus in productive

aged urban Indonesians. *J Diabetes Investig*. 2014 Sep;5(5):507-12. doi: 10.1111/jdi.12177. Epub 2013 Dec 1. PMID: 25411617; PMCID: PMC4188107.

Mokolomban, C., Wiyono, W.I., Mpila, D.A., 2018. Kepatuhan Minum Obat pada Pasien Diabetes Melitus Tipe 2 Disertai Hipertensi dengan Menggunakan Metode MMAS-8. *PHARMACON : Jurnal Ilmiah Farmasi* 7, 10.

Nanda, O.D., Wiryanto, B., Triyono, E.A., 2018. Hubungan Kepatuhan Minum Obat Anti Diabetik dengan Regulasi Kadar Gula Darah pada Pasien Perempuan Diabetes Mellitus. *AMNT* 2, 340. https://doi.org/10.20473/amnt.v2i4.2018.340-348

Ningrum, D.K., 2020. Kepatuhan Minum Obat pada Penderita Diabetes Melitus Tipe II. *Higeia Journal Of Public Health Research And Development* 4, 492–505.

Octaviani, P., 2017. Pengaruh Pemberian Konseling Farmasis dengan Alat Bantu terhadap Kepatuhan Pasien Diabetes Mellitus Tipe 2 Anggota PROLANIS di Puskesmas Purwokerto Utara. *Viva Medika* 10.

Pertiwi, MV, Alfian, R, Nita, Y, Athiyah, U. 2022. Medication adherence of diabetes mellitus patients in Indonesia: A systematic review. *Pharmacy Education* 22 (2) 188-193, https://pharmacyeducation.fip.org/pharmacyeducation/article/view/1619/1297

Polonsky WH, Henry RR. Poor medication adherence in type 2 diabetes: recognizing the scope of the problem and its key contributors. *Patient Prefer Adherence*. 2016 Jul 22;10:1299-307. doi: 10.2147/PPA.S106821. PMID: 27524885; PMCID: PMC4966497.

Putri, A.F.Y., Decroli, E., Nasrul, E., 2015. Hubungan Derajat Obesitas dengan Kadar Gula Darah Puasa pada Masyarakat di Kelurahan Batung Taba dan Kelurahan Korong Gadang, Kota Padang. JKA 4, 707–711. https://doi.org/10.25077/jka.v4i3.351

Ramadhan, N., Marissa, N., 2015. Karakteristik Penderita Diabetes Mellitus Tipe 2 Berdasarkan Kadar HbA1C di Puskesmas Jayabaru Kota Banda Aceh. *Sel Jurnal Penelitian Kesehatan* 2, 49–56. https://doi.org/10.22435/sel.v2i2.4637.49-56

Sendekie AK, Netere AK, Kasahun AE, Belachew EA. Medication adherence and its impact on glycemic control in type 2 diabetes mellitus patients with comorbidity: A multicenter cross-sectional study in Northwest Ethiopia. *PLoS One*. 2022 Sep 21;17(9):e0274971. doi: 10.1371/journal.pone.0274971. PMID: 36130160; PMCID: PMC9491880.

Setiyorini, E., Wulandari, N.A., 2017. Hubungan Lama Menderita dan Kejadian Komplikasi dengan Kualitas Hidup Lansia Penderita Diabetes Mellitus Tipe 2. *Seminar Nasional dan Gelar Produk* UMM 2, 75–82. http://research-report.umm.ac.id/index.php/research-report/article/viewFile/1194/1413

Siwi, M.A.A., Ilmanita, D., Dias, M.S.C., 2022. Tingkat Kepatuhan Penggunaan Obat Antidiabetes Oral pada Pasien DM di Rumah Sakit Bantuan Rampal Malang. *PHARMADEMICA* 1, 47–57. https://doi.org/10.54445/pharmademica.v1i2.15

Wijaya, I.N., Faturrohmah, A., Agustin, W.W., Soesanto, T.G., Kartika, D., Prasasti, H., 2015. Profil Kepatuhan Pasien Diabetes Melitus Puskesmas Wilayah Surabaya Timur dalam Menggunakan Obat dengan Metode Pill Count. *Jurnal Farmasi Komunitas* 2, 18–22.

Yulianti, T., Anggraini, L., 2020. Faktor-Faktor yang Mempengaruhi Kepatuhan Pengobatan pada Pasien Diabetes Mellitus Rawat Jalan di RSUD Sukoharjo. Pharmacon 17, 110–120. https://doi.org/10.23917/pharmacon.v17i2.12261