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Research Article

The Relationship Between Therapy Compliance and the Incidence of Diabetic Retinopathy in Type 2 Diabetes Mellitus Patients

(A Study at the Primary Health Facility (FKTP) Pratama Clinic Tanjung Purwokerto)

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Abstract: Background: Diabetic retinopathy is a microvascular complication of diabetes resulting from blood vessel damage in the retina, which can lead to blindness. Several studies indicate low levels of therapy adherence in diabetes mellitus patients. At FKTP Tanjung Clinic Purwokerto, one-third of diabetic patients fail to perform routine glycemic control. Objective: To examine the relationship between therapy adherence and the incidence of diabetic retinopathy in type 2 diabetes mellitus patients at FKTP Tanjung Clinic Purwokerto. Method: This study employed an observational analytic design with a cross-sectional approach. A total of 35 patients from FKTP Tanjung Clinic Purwokerto were selected through consecutive sampling. Therapy adherence was measured using the MMAS-8 questionnaire, while the incidence of diabetic retinopathy was determined via posterior segment examination using an indirect ophthalmoscope by an ophthalmologist. Fisher's exact test was used for hypothesis testing. Results: Among the 35 respondents, 2.9% had high adherence, 42.9% had moderate adherence, and 54.3% had low adherence. The incidence of diabetic retinopathy was 28.6%, while 71.4% showed no signs of retinopathy. Fisher's test analysis revealed a p-value of 0.474, indicating no significant relationship between therapy adherence and the occurrence of diabetic retinopathy in type 2 diabetes mellitus patients. Conclusion: There is no significant relationship between therapy adherence and the incidence of diabetic retinopathy in type 2 diabetes mellitus patients at FKTP Tanjung Clinic Purwokerto.

Keywords: Adherence Treatment; Diabetes Mellitus; Diabetic Retinopathy; Impression Therapy; Ophthalmoscopy Examination.

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1. Introduction

Diabetes mellitus (DM) is one of the degenerative diseases that can reduce a person's quality of life. According to the International Diabetes Federation (2019), Indonesia is among the top 10 countries in the world with the highest number of people living with diabetes mellitus. Indonesia ranks seventh, with 10.7 million people affected, and this number is projected to increase to 13.7 million by 2035 (IDF, 2019). The global prevalence of diabetes in 2000 reached 2.8%, or approximately 171 million people, and this figure is estimated to rise to 4.4%, or 366 million people, by 2030 (Yusran, 2017).

Currently, diabetes mellitus is not only considered a degenerative disease but also a cause of mortality. According to data from Riset Kesehatan Dasar (2018), the prevalence of DM in Indonesia among all age groups was 1.5%, while among individuals aged ≥ 15 years it was 2%. Meanwhile, in Jawa Tengah, the prevalence of DM among all age groups was 1.8%, and among those aged ≥ 15 years it was 2% (Riskesdas, 2018). According to the Central Java Health Profile data, the number of DM cases in Kabupaten Banyumas in 2018 was 19,956 cases (Central Java Health Profile, 2018).

The increasing prevalence of DM will lead to complications. Diabetes mellitus can cause various types of complications. complications both in terms of macrovascular and microvascular (Nirmala et al., 2019). On macrovascular complications can become disease heart, hypertension, stroke or dysfunction kidney.

Meanwhile, microvascular complications that can occur include diabetic neuropathy and diabetic retinopathy (Sari and Made, 2013). Diabetic retinopathy is an eye disease caused by an inflammatory process that often occurs in people with diabetes. This causes progressive microangiopathy characterized by damage and blockage of small blood vessels, resulting in nutritional disorders in the eye (Ilyas and Sri, 2014). Diabetic retinopathy is the most common cause of blindness in adults aged 20-75 years. The risk of developing diabetic retinopathy increases with the duration of diabetes (IDF, 2019).

According to IDF (2019) the prevalence of diabetic retinopathy in various populations is reported as follows Asia (20.8%), Caucasians (55.7%), and African Americans (55.7%). Diabetic retinopathy is the leading cause of blindness in the United States, with a prevalence of 4.1 million people. The prevalence of diabetic retinopathy in patients with type 2 diabetes mellitus at the time of diagnosis is around 20%, meaning that retinopathy has already been detected in about one-fifth of patients. After 15 years, the prevalence increases to more than 60–85% (Manullang et al., 2016). According to a study conducted by DiabCare Asia in 2008 involving 1,785 patients with diabetes mellitus across 18 primary and secondary healthcare centers in Indonesia, it was reported that 42% of patients with DM developed retinopathy complications, and 6.4% of them had proliferative diabetic retinopathy (Pengan et al., 2014).

Previous research has shown that patient compliance with chronic disease treatment is generally low. Research involving outpatients showed that more than 70% of patients did not take their medications. drug in accordance with dose Which determined (Basuki, 2009). According to WHO report (2003) compliance patient on therapy term long against disease chronic in developed countries only 50% and in In developing countries, this number will be lower (Asti, 2006).

According to research by Rasdianah et al. (2016), 123 respondents showed that the overall level of compliance of type 2 diabetes mellitus patients was at a low level. No subjects had a high level of compliance. In addition, according to Paz et al. (2006), approximately 65% of type 2 diabetes mellitus patients also did not comply with the eye examination guidelines according to the American Diabetes Association (ADA). This was influenced by education. low, No existence insurance health, No existence inspection routine eye and uncontrolled type 2 diabetes mellitus.

This study was conducted at the FKTP (Primary Healthcare Facility) Tanjung Clinic in Purwokerto. FKTP Tanjung is located in South Purwokerto Subdistrict, Banyumas Regency, and provides services to communities in the areas of South Purwokerto, West Purwokerto, Patikraja, and Karanglewas, with a total of 10,004 registered participants, both BPJS and non-BPJS. BPJS (Badan Penyelenggara Jaminan Sosial) is Indonesia's national social security agency that administers public health insurance coverage for registered members. BPJS participant visit data in October 2017 showed 3,009 visits, consisting of 15 non-illness visits and 2,994 illness visits. In October 2019, diabetes mellitus (DM) was the third most common disease after acute respiratory tract infections (ISPA) and hypertension, with 332 DM patients at FKTP Klinik Pratama Tanjung Purwokerto. The PROLANIS (Chronic Disease Management Program) management system at FKTP Klinik Pratama Tanjung is considered good and systematic. Diabetes mellitus Prolanis patients at FKTP Klinik Pratama Tanjung generally comply well and routinely participate in Prolanis activities, as well as making monthly visits to the clinic to control and monitor their condition. However, not all patients undergo routine monitoring. Approximately one-third of diabetes mellitus patients at FKTP Tanjung Clinic do not have their condition checked, which may lead to complications in the future. The number of diabetes mellitus patients enrolled in Prolanis at FKTP Tanjung Clinic is 250, while the number of patients actively participating in Prolanis activities is 198. (Primary Data, FKTP Tanjung, 2020)

The problem identified at FKTP Tanjung Clinic is that approximately one-third of diabetes mellitus (DM) patients at the clinic do not attend regular follow-up visits. This may cause diabetes to become poorly controlled and increase the likelihood of complications. Based on the results of a preliminary study, diabetic retinopathy screening had never previously been conducted among DM patients at FKTP Tanjung Clinic. Therefore, the researcher is interested in conducting a study aimed at determining the relationship between therapy compliance and the incidence of diabetic retinopathy. (Primary Data of FKTP Tanjung, 2020).

2. Preliminaries or Related Work or Literature Review

Diabetes Mellitus

a. Definition

Diabetes mellitus is a chronic disease that occurs when the pancreas cannot produce enough insulin or the body cannot effectively use the insulin it produces (WHO, 2016). Meanwhile, according to Chris et al. (2014), diabetes mellitus is a metabolic disorder characterized by elevated blood glucose levels (hyperglycemia). Chronic hyperglycemia can lead to a range of complications affecting the eyes,

kidneys, nerves, and blood vessels. Therefore, it can be concluded that diabetes mellitus is a condition characterized by hyperglycemia. And caused by insulin resistance, mpaired insulin secretion, or a combination of both (Pratiwi, 2018).

b. Classification of Diabetes Mellitus

Based on etiology Diabetes mellitus can be classified into four categories, (Chris et al., 2014), namely:

1. DM type 1 results from autoimmune destruction of pancreatic β-cells, leading to absolute insulin deficiency.
2. DM type 2 caused by insulin resistance and impaired insulin secretion.
3. DM gestational is associated with pregnancy-related hormonal changes that can increase blood glucose levels during pregnancy.
4. Other types of DM are caused by various factors that can impair pancreatic function or insulin action, including genetic defects in β-cell function, genetic defects in insulin action, diseases of the exocrine pancreas, endocrinopathies, drug- or chemical-induced diabetes, infections, and other genetic syndromes associated with diabetes.

c. Pathogenesis of Type 2 Diabetes Mellitus

In type 2 diabetes mellitus, abnormalities in glucose metabolism arise from impaired insulin secretion due to pancreatic β-cell dysfunction and impaired insulin action resulting from insulin resistance. In the setting of insulin resistance, pancreatic β-cells undergo adaptive changes to increase insulin output in order to compensate for excessive and abnormal metabolic demands. Consequently, plasma insulin concentrations increase in both the fasting state and after meal stimulation. Insulin resistance associated with hyperinsulinemia may lead to impaired glucose tolerance (Baynest, 2015).

d. Complications

One of the most common microvascular complications is diabetic retinopathy. Diabetic retinopathy is the most common complication in patients with diabetes mellitus and a leading cause of blindness (Anugerah *et al* ., 2019). Retinopathy diabetic is disease eye Which caused by because of the process inflammation Which often happen on individuals with diabetes mellitus. It develops as a result of progressive microangiopathy which is characterized by damage and occlusion of small blood vessels, causing nutritional disorders in the eye (Ilyas and Sri, 2014).

Diabetic Retinopathy

a. Definition

Diabetic retinopathy is a progressive microangiopathy characterized by damage to the small vessels including precapillary arterioles. retina, capillary And veins. The exact cause of diabetic retinopathy remains unclear, however, prolonged exposure to hyperglycemia is believed to induce physiological and biochemical alterations that ultimately lead to vascular endothelial damage (Harlina *et al* ., 2018).

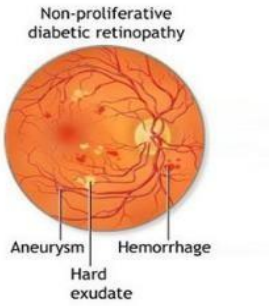
b. **Classification**

Diabetic retinopathy is divided into several stages, (Yusran, 2017) , namely:

1. Non Proliferative Diabetic Retinopathy (NPDR)

   Non-proliferative diabetic retinopathy (NPDR) represents the early stage of diabetic retinopathy. NPDR is characterized by microvascular abnormalities that do not extend beyond the internal limiting membrane, including microaneurysms, areas of capillary non-perfusion, nerve fiber layer damage, intraretinal microvascular abnormalities (IRMAs), dot–blot intraretinal hemorrhages, retinal edema, hard exudates (HE), and venous beading. NPDR is classified into three severity levels: mild, moderate, and severe. Severe NPDR is defined by the

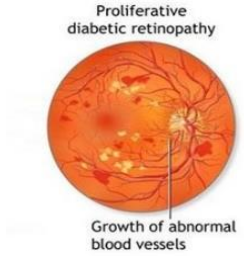
presence of at least one criterion of the 4–2–1 rule, namely: microaneurysms/hemorrhages in four quadrants, and/or venous beading in two quadrants, and/or IRMAs in one quadrant.



Picture 1. Non-Proliferative Diabetic Retinopathy (Ilery et al., (2014).

2. Proliferative Diabetic Retinopathy (PDR)

Proliferative Diabetic Retinopathy (PDR) is an advanced stage of diabetic retinopathy. PDR is characterized by neovascularization triggered by ischemia. Neovascularization of the Disc (NVD) and Neovascularization Elsewhere (NVE) are the main signs of PDR (Figure 2.3). Neovascularization can trigger vitreous hemorrhage and spontaneous hyphema. Neovascularization Which happen in in the anterior chamber angle can lead to secondary glaucoma.



Picture 2. Proliferative Diabetic Retinopathy (Ilery *et et al* ., 2014).

c. Risk Factors

The risk factors associated with the occurrence of diabetic retinopathy can be classified into three categories (Perdana, 2018)

1. Duration of Diabetes Mellitus

The duration of diabetes mellitus is a major factor in the development of diabetic retinopathy. The incidence of diabetic retinopathy in type 2 DM patients after 10 years is 18% and increases to 52.12% after 20 years. Bin bin He et al. in 2012 demonstrated that the severity of diabetic retinopathy increases with time. This is evidenced by the number of patients who do not experience diabetic retinopathy is highest in those with DM duration of less than 5 years, while those with NPDR and PDR are most are most frequently observed in those with DM duration of more than 10 years.

2. Dyslipidemia

Dyslipidemia is a risk factor for diabetic retinopathy, according to the Wisconsin Epidemiological Study . There is a significant association between increases in total and LDL cholesterol and the incidence of diabetic retinopathy. The use of fenofibrate in patients with type 2 diabetes is associated with a reduced rate of diabetic retinopathy progression and a decreased need for laser photocoagulation.

3. Hypertension

Hypertension is a risk factor for diabetic retinopathy. Research by Yau et al (2012) found that type 2 DM patients and blood pressure >140/90 mmHg had a diabetic retinopathy prevalence of 39.6%, whereas those with blood pressure <140/90 mmHg had a prevalence of 30.8%.

d. **Pathogenesis**

Diabetic retinopathy is an ocular microangiopathy resulting from metabolic disorders. Which influence three process biochemical Which related with hyperglycemia (Setiati et al*.,* 2017), namely the polyol pathway, non-enzymatic glycation and protein kinase C.

1. Clinical Manifestation

Diabetic retinopathy is usually asymptomatic for a long time. In proliferative diabetic retinopathy, clinical manifestations can be categorized into subjective symptoms and objective signs (Setiati et al., 2017).

1) Subjective symptom (Setiatiet al*.,* 2017), like :
   a. Blurred vision due to macular edema
   b. Diplopia (double vision)
   c. Difficulty reading
   d. Sudden decrease in vision in one eye
   e. Seeing dark spots (floaters) and flashing lights (photopsia)
2) Objective sign (Ilyas And Sri, 2014), such as :
   a. Microaneurysm is protrusion on wall capillary especially venous area in the form of small red spots located near the blood vessels blood. Microaneurysm in the form of point red round And small, initially observed in the temporal and foveal regions which are usually located near the posterior pole.
   b. Vascular changes, characterized by vessel dilatation with an irregular lumen and increased tortuosity.
   c. Hard exudate is a lipid infiltration into the retina. The characteristic appearance is irregular yellowish. Exudates may appear and resolve within a few weeks.
   d. Soft exudates (cotton wool patches) indicate retinal ischemia. On ophthalmoscopic examination, these appear as diffuse yellow-white patches. They are usually located at the margins of non-perfused areas and are associated with retinal ischemia..
   e. Retinal edema is often occur in the macula area (macular edema), which greatly impair visual acuity
   f. Retinal neovascularitation in which new vessels form on the surface of retinal tissue. These vessels appear tortuous, fine, clustered, and irregular. Initially confined within the retina, they may extend into the preretinal space and the vitreous body. Rupture of these neovessels can cause retinal hemorrhage, preretinal (subhyaloid) hemorrhage, and vitreous hemorrhage.

2. Diagnosis

The diagnosis of diabetic retinopathy and its staging are based on a stereoscopic fundus examination performed after pupillary dilation. Ophthalmoscopy and fundus photography are considered the gold standard for evaluating diabetic retinopathy.

Fluorescein angiography (FA) is used to determine whether laser treatment is indicated. FA is performed by intravenous injection of a fluorescein dye, which circulates through the bloodstream and reaches the fundus (Setiati et al*.,* 2017).

3. Therapy

Primary management of retinopathy diabetes is optimal glycemic control and management of hypercholesterolemia. Mild to moderate nonproliferative diabetic retinopathy does not require specific treatment, but annual observation and continued blood glucose control are recommended. In severe non-proliferative diabetic retinopathy, follow-up every six months is necessary to detect early signs of progression to the proliferative stage (Elvira and Ernes, 2019).

4. Therapy Compliance

a. Definition

Compliance is to the extent to which a patient's behavior follows prescribed instructions in the form of therapy, including diet, medication, and exercise, as determined and mutually agreed upon by both parties (Mokolomban et al., 2018). Whereas according to Hasbi (2017) Compliance with treatment is a behavior that indicates the extent to which an individual follows recommendations related to health or disease. Based on these definitions that compliance behavior towards treatment is an individual's as an individual's active engagement and willingness to follow advice or regulations provided by healthcare professionals in order to support recovery and improve health outcomes.

b. Compliance Classification

Patient compliance can be classified into two categories (Adikusuma and Nurul, 2017), namely:

1. Total compliance refers to patients who undergo regular follow-up examinations according to the prescribed schedule and who take medications consistently as instructed..
2. Non-compliance refers to patients who do not attend follow-up examinations routinely in accordance with the established recommendations.

c. Factors that influence compliance

Factors that influence patient compliance in using medication (Gede, 2015), as follows:

1. Socio Demographics

Socio-demographic factors that influence patient compliance in therapy include age, sex, ethnicity, and cultural background. Increasing ages generally associated with higher levels of compliance with medication. Compliance with medication is also influenced by the culture, economic and geographic conditions of the country.

2. Socio Economy

Socioeconomic factors can influence patient adherence to treatment, including income, culture, economic conditions, and geography. Low income and financial constraints are causes of non-adherence to treatment.

3. Psychosocial

   Psychosocial factor which influence compliance treatment include mental health conditions such as depression, low self-esteem, and pessimistic attitudes. Limited health literacy or insight and lack of motivation may also reduce compliance with treatment.

4. Patient characteristics

   Patient characteristics also influence treatment adherence, including health beliefs, discipline, and awareness. Patient involvement in treatment decisions will improve adherence to treatment.

5. Drug characteristics

   Drug characteristics that influence adherence include medication regimen, duration of therapy, type of medication, price, and side effects. Chronic illnesses, such as advanced stages of HIV, will decrease adherence, while prolonged pain will increase adherence.

6. Communication

   Better communication can lead to better compliance. A common language between patient and doctor significantly impacts treatment adherence. The frequency, duration, quality, and ability of doctors or healthcare professionals to provide accurate information will improve patient adherence to treatment.

d. How to measure compliance

There are five ways that can be used to measure patient compliance (Yuli, 2011), namely:

1. Asking clinical staff

   This method is generally regarded as a last-resort option because information provided by physicians is often inaccurate.

2. Asking the patient directly

   This method is considered more valid than the previous approach; however, it also has limitations. Patients may provide inaccurate responses to avoid disapproval from healthcare providers, and they may not accurately recognize or report the extent of their own adherence the extent of their own compliance.

3. Asking another individual who regularly monitors the patient

   This approach also has several limitations. First, continuous observation is often not feasible, particularly for behaviors such as dietary intake and alcohol consumption. Second, ongoing monitoring may create an artificial situation and often increases adherence levels (the observation effect), which conflicts with the purpose of measuring usual adherence and may compromise the accuracy of the assessment.

4. Count How many Lots pill or drug Which should consumed by patients according to medical advice given by the doctor

   This method is considered the most reliable, as there is minimal opportunity for error when calculating the remaining medication. However, it has limitations; patients may intentionally avoid certain medications or may not

adhere to prescribed instructions despite consuming all medication.

5. Checking biochemistry evidence

   This approach may address the limitations of previous methods by seeking biochemical evidence, such as through blood or urine analysis. Although it is generally more reliable than medication counting, it is significantly more costly.

3. Materials and Method

The research applied an observational analytical approach. Analytical research seeks to identify relationships between variables and to measure and define these variables. In observational analytical studies, phenomena are measured without intervention in the variables (Sastroasmoro and Sofyan, 2011).

A cross-sectional study design was applied to examine relationships between independent variables (risk factors) and dependent variables (effects) at a single point in time (Sastroasmoro and Sofyan, 2011). Data on therapy compliance and the occurance of diabetic retinopathy in patients with type 2 diabetes mellitus were collected concurrently.

4. Results and Discussion

Demographic and Clinical Characteristics of Respondents at the FKTP Pratama Clinic Tanjung Purwokerto

The majority of respondents were over 65 years of age, representing 54.3% of the sample. The age range was 50 to 74 years, with a mean age of 63 years.

Of the respondents, 21 were female (60%) and 14 were male (40%), indicating a higher proportion of female participants in the study.

Fasting blood sugar (FBS) levels were ≥126 mg/dL in 20 respondents (57.1%), while 15 respondents (42.9%) had FBS levels <126 mg/dL.

A total of 23 respondents (65.7%) had a duration of diabetes mellitus (DM) of at least 5 years, while 12 respondents (34.3%) had a duration of less than 5 years.

Twenty respondents (57.1%) had blood pressure readings greater than 130/85 mmHg, while 15 respondents (42.9%) had normal blood pressure, defined as ≤130/85 mmHg.

Total cholesterol levels were ≥200 mg/dL in 32 respondents (91.4%), while 3 respondents (8.6%) had total cholesterol levels <200 mg/dL.

Body mass index (BMI) was greater than 22.9 in 22 respondents (62.9%), while 13 respondents (37.1%) had a normal BMI.

Respondent Compliance Rates at the FKTP Pratama Clinic Tanjung Purwokerto

Table 1. Therapy Compliance Rates Based on the MMAS-8 Questionnaire.

Compliance Therapy	Frequency	Percentage (%)
High Compliance	1	2.9
Moderate Compliance	15	42.9
Low Compliance	19	54.3
Total	35	100

The table presents the study results, indicating that 19 respondents, representing 54.3%, exhibited a low level of therapy compliance. In contrast, only 2.9% of respondents demonstrated a high level of therapy compliance.

Incidence of Diabetic Retinopathy at the FKTP Tanjung Clinic Purwokerto

Table 2. Pravelence of Retinopathy Diabetics.

Retinopathy Diabetics Incidence	Frequency	Percentage (%)
Positive Retinopathy Diabetics	10	28.6
No Retinopathy Diabetics	25	71.4
Total	35	100

Table 3 indicates that 25 respondents, representing 71.4% of the total sample, were not diagnosed with diabetic retinopathy. In contrast, Table 4.3 reports that 10 respondents, or 28.6%, were diagnosed with diabetic retinopathy.

Table 3. Respondents Which diagnosed Retinopathy Diabetic.

Name	Age (year)	Type Sex	Long DM (year)	Hypertension (mmHg)	Cholesterol (mg/dL)	BMI
Mrs. T	70	P	2	146/75	304	29.25
Mrs. N	53	P	17	114/82	211	28.52
Mr. K	59	L	4	145/93	219	27.91
Mrs. W	72	P	16	126/64	261	21.92
Mrs. K	64	P	3	131/69	207	25.63
Mrs. S	63	P	2	130/78	314	24.52
Mrs. L	72	P	7	150/82	287	26.31
Mrs. W	65	P	9	122/73	259	20.55
Mr. S	66	L	5	180/116	287	26.69
Mrs. S	67	P	10	131/73	275	22.37

Relationship between Therapy Compliance Levels and Incidence of Diabetic Retinopathy at the FKTP Pratama Clinic Tanjung Purwokerto

Table 4. Relationship Compliance Level Therapy with the incident Diabetic Retinopathy.

Level Therapy Compliance	Incident Retinopathy Diabetic		Fisher's exact test
	(+)	(-)	
High-Medium	5	9	p value : 0.474
Low	5	16	

The relationships between variables in this study were analyzed using Fisher's exact test, as the data did not meet the requirements for the chi-square test due to one cell having an expected value less than 5. The Fisher's exact test yielded a p-value of 0.474, indicating no significant association between therapy compliance and the occurance of diabetic retinopathy ($p > 0.05$).

Discussion

Characteristics of Respondents at the FKTP Pratama Clinic Tanjung Purwokerto

a. **Age**

The majority of respondents in this study were in the >65 age group, comprising 19 individuals (54.3%). The mean age of type 2 diabetes mellitus (DM) patients among the respondents was 63 years, with ages ranging from 50 to 74 years. These findings are consistent with the profile of type 2 DM patients in Indonesia, where the prevalence in the 55-64 age group is 6.2% and in the 65-74 age group is 6.0% (Riskesdas, 2018).

Age is a significant factor contributing to the decline of physiological systems, particularly the endocrine system. Advancing age leads to increased insulin resistance, resulting in unstable blood glucose levels. Consequently, the high occurance of diabetes mellitus (DM) is partly attributable to the degenerative effects of aging, which impair overall bodily function (Isnaini and Ratnasari, 2018).

Perkeni (2015) identifies age greater than 45 years as a risk factor for diabetes mellitus. Theoretically, advancing age is closely associated with elevated blood glucose levels, resulting in an increased prevalence of diabetes as age rises (Smeltzer and Bare, 2008). This observation is consistent with the findings of Kurniawaty and Bella (2016), who reported that patients with type 2 DM aged 50 years or older are at higher risk due to reduced insulin sensitivity and impaired glucose metabolism associated with aging.

b. **Gender**

The study identified a higher proportion of female respondents, with 21 individuals (60%), compared to 14 male respondents (40%). This finding aligns with the results of Prasetyani and Sodikin (2017), who also reported a majority of female participants. The elevated occurance of diabetes mellitus (DM) among women may be attributed to differences in body composition and sex hormone levels.

Women possess a greater proportion of adipose tissue compared to men. In males, fat comprises approximately 15-20% of body weight, whereas in females it constitutes 20-25% (Ernawati et al., 2004). A reduction in oestrogen levels during menopause leads to increased body fat reserves, particularly in the abdominal region, which subsequently elevates fatty acid expenditure (Thorand et al., 2007).

c. **Fasting Blood Sugar Levels**

The study identified that 20 respondents (57.1%) exhibited fasting blood sugar levels of ⩾126 mg/dL, while the remaining 15 respondents had normal fasting blood sugar levels of <126 mg/dL. Fasting blood sugar levels (FBS) serve as a diagnostic reference for diabetes mellitus (DM) (Fahmiyah and Latra, 2016). Blood sugar levels are influenced by multiple factors, including hormones, age, stress, and dietary habits (Ugahari et al, 2016).

In individuals over 30 years of age, fasting blood sugar levels increase by 1–2 mg/dL per year, and by 5.6–13 mg/dL two hours postprandially (Lestari et al., 2013). Factors influencing blood sugar elevation include dietary fiber content, digestive processes, cooking methods, the presence of anti-nutritional substances that inhibit absorption, and food density (Waspadji et al., 2003).

These findings are consistent with those of Nurayati and Merryana (2017), who reported that the majority of respondents with type 2 DM at the Mulyorejo Community Health Centre had fasting blood sugar levels of ⩾126 mg/dL (36 individuals). Similarly, a study at the Kendal Kerep Health Centre found that 14 respondents (66.7%) exhibited high fasting blood sugar levels of ⩾126 mg/dL (Gayatri, 2019).

d. **Duration of DM**

The present study found that 23 respondents (65.7%) had experienced diabetes mellitus (DM) for five years or less, while 12 respondents had a duration of DM exceeding five years. These findings differ from those of Lathifah (2017), who reported that 27 respondents with type 2 DM at the Rangkah and Pacarkeling Community Health Centres in Surabaya had a DM duration of more than 6.5 years. The risk of complications in diabetes mellitus is strongly associated with the duration of the disease; a longer duration increases the likelihood of complications.

These findings are consistent with Harnita (2013), who observed that the prevalence of diabetic retinopathy increases with the duration of DM. Similarly, Tsalissavrina et al. (2018) reported that diabetic retinopathy typically develops after ten years, with occurance rates rising as the duration of diabetes mellitus increases. The Wisconsin Epidemiological Study of Diabetic Retinopathy (WESDR) reported prevalence rates of 8% at three years, 25% at five years, 60% at ten years, and 80% at fifteen years (Klein et al., 2008).

In summary, diabetic retinopathy is a chronic condition resulting from the formation of free radicals, such as reactive oxygen species (ROS), induced by hyperglycaemia. These free radicals contribute to circulatory disorders, hypoxia, and inflammation in the retina (Qisthina, 2017). Hypoxia leads to increased expression of angiogenic factors, which stimulate the development of new blood vessels with compromised basement membranes and deficient intercellular tight junctions. This process results in plasma protein leakage and bleeding within the retina and vitreous (Lathifah, 2017).

e. **Blood Pressure**

In this study, 20 respondents (57.1%) exhibited blood pressure greater than 130/85 mmHg, while the remaining 15 respondents had normal blood pressure, defined as less than or equal to 130/85 mmHg. These findings are consistent with Mahfudzoh et al. (2019), who reported that 47 respondents (58.8%) with type 2 diabetes also experienced hypertension. Hypertension is a significant risk factor for diabetes, as it can cause arterial thickening and narrowing, which impairs glucose transport from the blood and may result in hyperglycaemia..

f. **Cholesterol Total**

In this study, 32 respondents (91.4%) exhibited total cholesterol levels of 200 mg/dL or higher, while the remaining 3 respondents had normal levels below 200 mg/dL. These findings are consistent with those of Putriyani et al. (2019), who reported that 19 respondents (23.5%) had elevated cholesterol levels. Individuals who are overweight and engage in limited physical activity are at increased risk for high cholesterol. According to Perkeni (2015), in individuals with diabetes mellitus (DM),

impaired glucose uptake by cells leads to decreased cellular energy, prompting the body to metabolize fat as an alternative energy source. This process results in the release of large amounts of fatty acids into the bloodstream, which serve as precursors for cholesterol synthesis.

Multiple factors contribute to elevated total cholesterol levels, including age, dietary habits, physical inactivity, hypertension, and smoking. The risk of high cholesterol increases with advancing age, particularly in individuals over 45 years old. This increased risk is attributed to a decline in low-density lipoprotein (LDL) receptor activity with age. LDL receptors regulate cholesterol homeostasis in the bloodstream; when their function is impaired, cholesterol concentrations in the blood rise (Kapitan et al, 2014).

g. **Body Mass Index**

In this study, 22 respondents (62.9%) had a BMI greater than 22.9. These findings are consistent with Mahfudzoh et al. (2019), who reported that most individuals with type 2 diabetes mellitus had a BMI of 25 or higher, classified as obese. Luthansa and Pramono (2017) demonstrated that individuals with a BMI above 22.9 are three times more likely to develop type 2 diabetes mellitus compared to those with a normal or low body mass index. Overweight individuals have increased caloric intake, requiring pancreatic beta cells to work harder to compensate. Prolonged strain on beta cells can lead to decreased function and suboptimal insulin production.

Furthermore, an elevated body mass index is influenced by lifestyle factors, including physical activity. Individuals who engage in limited exercise are more likely to store excess nutrients as fat and sugar rather than metabolize them. Insufficient insulin to convert glucose into energy may result in hyperglycaemia, increasing the risk of diabetes mellitus (Trisnawati and Setyorogo, 2016).

Therapy Compliance Levels Among Respondents at the FKTP Pratama Clinic Tanjung Purwokerto

Research conducted at the FKTP Pratama Clinic Tanjung Purwokerto indicates that 54.3% of respondents exhibit low levels of compliance, whereas only 2.9% demonstrate high compliance. Various factors influence compliance, including psychological issues such as affective disorders, family conflicts, and stress (Mayberry and Chandra, 2012).

Nanda et al. (2018) reported similar findings, with 53.8% of patients exhibiting low compliance or non-compliance associated with unregulated blood sugar. Similarly, Alfian (2015) found that among outpatients with diabetes mellitus at Dr H. Moch. Ansari Saleh Banjarmasin Regional General Hospital, 42.7% demonstrated low compliance, while only 18.2% exhibited high compliance.

Patient compliance significantly influences treatment success. Optimal treatment outcomes require patient awareness and compliance. Among patients with diabetes mellitus, low medication compliance is primarily attributed to forgetting to take oral hypoglycaemic agents. Additionally, the inconvenience associated with long-term medication regimens contributes to reduced compliance (Alfian, 2015).

Nanda et al. (2018) identified several reasons for non-compliance among patients with uncontrolled blood sugar: forgetting to take medication (69.2%), forgetting to bring medication while traveling (46.2%), and deliberately not taking medication (38.5%).

Forgetfulness is often associated with age-related memory decline, while intentional non-adherence may result from patients perceiving themselves as healthy or wishing to avoid dependence on medication due to concerns about kidney function**.**

Incidence of Diabetic Retinopathy at the FKTP Pratama Clinic Tanjung Purwokerto

At the FKTP Pratama Clinic Tanjung Purwokerto, 25 respondents (71.4%) did not have diabetic retinopathy, while 10 respondents (28.6%) were diagnosed with the condition. Among those diagnosed, 8 were female and 2 were male, indicating a higher prevalence among female respondents.

This is consistent with a study by Pengan et al. (2014), which found that the prevalence of diabetic retinopathy is higher in women. In 2012, there were 22 people diagnosed with diabetic retinopathy, and in 2013, there was an increase of 31.81% or 29 people. Meanwhile, the number of male patients increased from 12 in 2012 to 15 in 2013, a 25% increase. Ridhani's (2018) study at Dr. Soetomo General Hospital, conducted from January 2016 to December 2017, showed that diabetic retinopathy was more common in women (58%) than in men (42%), with the highest occurance in the 52-60 age group (48.5%). The high occurance of diabetic retinopathy in women is associated with high obesity rates in women due to genetics and lifestyle, which are risk factors for DM. Oestrogen is a sex hormone in women. High hormone levels can reduce leptin, which helps suppress appetite, leading to uncontrolled food intake and fat accumulation, accompanied by high blood sugar levels (Noventi, 2018).

Furthermore, this study observed that all 10 respondents diagnosed with diabetic retinopathy had a body mass index (BMI) greater than 22.9. This finding contrasts with Rahmawati's (2017) study at the Wua-Wua Community Health Centre, where 46.2% of respondents had a normal BMI and only 8 respondents had a BMI above 22.9. Individuals with a BMI greater than 22.9 are three times more likely to develop type 2 diabetes mellitus. Increases in BMI are influenced by lifestyle factors, particularly physical activity. Low physical activity reduces insulin sensitivity, leading to elevated blood glucose levels, a condition known as hyperglycaemia (Nurayati and Merryana, 2017). Additionally, low physical activity increases free fatty acid (FFA) levels, which impairs glucose uptake into the plasma membrane and contributes to insulin resistance in muscle and adipose tissue (Isnaini and Ratnasari, 2018).

Relationship Between Therapy Compliance and Incidence of Diabetic Retinopathy at the FKTP Pratama Clinic Tanjung Purwokerto

Therapy adherence was designated as the independent variable, while the occurance of diabetic retinopathy served as the dependent variable. Fisher's exact test was employed to analyze the relationship between these variables. The statistical analysis indicated no significant association between therapy compliance and the occurance of diabetic retinopathy (p value = 0.474).

Medication adherence is important for people with diabetes mellitus to achieve good and proper treatment goals, especially for patients who are required to take medication for a long time and for life (Hannan, 2013). Several factors influence an individual's level of compliance, namely treatment and disease characteristics (duration of disease, complexity of therapy and care provision), intrapersonal factors (gender, age, stress, self-confidence,

and depression), interpersonal factors (patient relationships with health workers and social support), and environmental factors (Nanda et al., 2018).

The present study did not identify a significant association between therapy compliance and the occurance of diabetic retinopathy at the FKTP Pratama Clinic Tanjung Purwokerto. Several factors may have influenced these findings, including age distribution. The majority of respondents (54.3%) were over 65 years old and diagnosed with type 2 diabetes mellitus. Older adults with type 2 diabetes often experience declines in physical functions, such as mobility and activity, as well as cognitive impairments, including memory loss (Purwanti and Tetik, 2017). These impairments may result from central nervous system disorders, such as reduced cerebral oxygenation, neurodegeneration, Alzheimer's disease, and malnutrition. Such conditions can diminish patient motivation and subsequently lower compliance to treatment regimens (Ramli and Masyita, 2020). However, these findings contrast with those of Sulistyarini and Marrisca (2015), who reported that 22 respondents aged 66 or older demonstrated high levels of compliance. At this age, individuals may exhibit more rational decision-making and heightened awareness regarding their treatment.

Furthermore, another factor that can influence the study's results is the duration of the disease. In this study, the disease duration among respondents was mostly $\leqslant$ 5 years, accounting for 65.7%. This is in line with Hannan's (2013) study, which found a significant association between disease characteristics and treatment with medication compliance. The study found that 41.9% of respondents had had DM for 3 years, with a low compliance rate of 67.7%. Respondents' non-compliance in taking DM medication as recommended by doctors was partly due to the complexity of the treatment procedure. Treatment complexity refers to the frequency of treatment patients must undergo, such as the number of medications they must take per day (Niven, 2002). Patients are more compliant with once-daily doses than with more frequent doses, such as three times a day. This can affect a person's level of compliance; the more complex the treatment regimen, the less likely patients are to adhere to the therapy (Edi, 2015).

Age is another factor influencing the occurance of diabetic retinopathy at the FKTP Pratama Clinic Tanjung Purwokerto. Respondents over 65 years were more frequently diagnosed with diabetic retinopathy. Increased age is associated with greater glucose intolerance, and individuals with a prolonged history of diabetes mellitus in older age are at higher risk for diabetic retinopathy. This observation is supported by theories indicating that most type 2 DM patients aged 65 years or older experience declines in metabolic function and cellular structure due to degenerative processes (Lathifah, 2017).

Gender also influences research outcomes. In this study, female respondents outnumbered male respondents. Among the ten individuals diagnosed with diabetic retinopathy, eight were female, and two were male. The higher occurance of diabetic retinopathy in women is linked to increased obesity rates among women, attributed to genetic and lifestyle factors, which are established risk factors for DM (Anugrah, 2013). Elevated oestrogen levels can diminish leptin function, which normally suppresses appetite in the hypothalamus. This reduction leads to uncontrolled food intake, excess fat accumulation, and elevated blood glucose levels, due to decreased peripheral insulin sensitivity (Setyoputri et al., 2014).

Hypertension is another factor that may influence study outcomes. At the FKTP Pratama Clinic Tanjung Purwokerto, 15 respondents were identified with hypertension. Among these, 10 were diagnosed with diabetic retinopathy, and 6 had blood pressure readings of at least 130/85 mmHg. These findings are consistent with Nirmala et al. (2019), who reported that 102 respondents (62.9%) with diabetic retinopathy also had hypertension. Chronic hypertension in patients with diabetes mellitus (DM) can increase both the occurance and severity of diabetic retinopathy by 1 to 1.2 times. In DM patients, hypertension may cause endothelial damage to retinal blood vessels and elevate the expression of Vascular Endothelial Growth Factor (VEGF) receptors. VEGF binds to endothelial cells, increasing vascular permeability and promoting ischaemic neovascularisation in diabetic retinopathy (Al-Sarraf et al., 2010).

Beyond age, gender, and hypertension, the duration of diabetes mellitus (DM) is a significant factor influencing the occurance of diabetic retinopathy. Nirmala et al. (2019) found that at Dr. M. Djamil Padang General Hospital, 110 respondents (68%) with DM for more than five years were diagnosed with diabetic retinopathy. Patients with DM for at least five years have a twofold increased risk of developing diabetic retinopathy, which rises to threefold after twenty years. Prolonged duration of type 2 DM leads to progressive structural changes in the retina. In diabetic retinopathy, histopathological alterations in the capillaries include aneurysm formation, increased permeability, impaired blood vessel proliferation (neovascularisation), fibrotic tissue development, and contraction of both capillary and vitreous fibrotic tissue (Perdana et al., 2018).

Dyslipidaemia is another significant factor influencing the development of diabetic retinopathy. Widyasari (2017) reported that, in the Tanah Kalikedinding sub-district of Kanjeran district, Surabaya, 54% of diabetes mellitus (DM) patients exhibited dyslipidaemia, while 46% had normal lipid profiles. Patients with elevated dyslipidaemia levels demonstrated approximately twice the risk of developing diabetic retinopathy compared to those with normal levels. This increased risk is attributed to endothelial dysfunction in individuals with hyperlipidaemia, which can damage the retina and promote the formation of exudates by serum lipids and lipoproteins (Qisthina, 2017).

HbA1c levels also play a critical role in the development of diabetic retinopathy. Arisandi et al. (2018) found that, at the Kedaton Community Health Centre, 35.3% of type 2 DM patients with diabetic retinopathy had uncontrolled HbA1c levels, whereas none of the patients with controlled HbA1c levels developed the condition. HbA1c serves as an important indicator of diabetic retinopathy severity, as it reflects glucose metabolism control over a three-month period (Qisthina, 2017).

Uncontrolled HbA1c levels in patients indicate persistent hyperglycaemia over a period of 3 to 4 months. Chronic hyperglycaemia can damage retinal blood vessels, leading to nerve conduction disorders in both the retina and optic nerve. These changes impair the retina's capacity to capture light stimuli and inhibit the transmission of electrical impulses to the brain. Patients with diabetic retinopathy frequently report visual disturbances, including blurred vision (Refa and Nadia, 2005).).

5. Conclusion

1. The level of therapy compliance among patients with type 2 diabetes mellitus at the Primary Health Facility (FKTP) Pratama Clinic Tanjung Purwokerto was low, with 19 respondents (54.3%) demonstrating non-compliance.
2. The occurance of diabetic retinopathy among patients with type 2 diabetes mellitus at the Primary Health Facility (FKTP) Pratama Clinic Tanjung Purwokerto was 28.6%, with 10 respondents diagnosed with the condition.
3. No significant relationship was found between therapy compliance and the occurance of diabetic retinopathy at the Primary Health Facility (FKTP) Pratama Clinic Tanjung Purwokerto.

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