


# Titiek Ernawati

## 9. THE RELATIONSHIP OF THE DEGREE OF DRY EYE SYNDROME WITH THE DEGREE OF DIABETIC NEUROPATHY ...

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## THE RELATIONSHIP OF THE DEGREE OF DRY EYE SYNDROME WITH THE DEGREE OF DIABETIC NEUROPATHY AT GOTONG ROYONG HOSPITAL SURABAYA

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### ABSTRACT

**Introduction:** Dry eye syndrome is an uncomfortable condition in the eyesight caused by lubrication in the eyes and lack of moisture. The prevalence of dry eyes in Indonesia is 27.5% with an average age of more than 37 years. One of the risk factors for dry eye syndrome is diabetes mellitus. Dry eye syndrome is common in type 2 diabetes patients who experience polyneuropathy complications. Therefore, it is necessary to carry out further research regarding the relationship between dry eye syndrome and diabetic neuropathy. **Objective:** To determine the relationship between the degree of dry eye syndrome and the degree of diabetic neuropathy at the Gotong Royong Hospital Surabaya. **Method:** This research uses a correlation analytical research design with a cross-sectional method. Sampling was carried out using a purposive sampling technique by looking for respondents according to predetermined criteria. Primary data was obtained through the results of examinations carried out on DM sufferers (Schirmer test and MNSI and MDNS questionnaires), while secondary data was obtained officially through medical records (HbA1c) from the Gotong Royong Hospital from August to October 2023. Data in the study were analyzed using tests of Spearman's rho correlation. Results are significant if  $p < 0.05$ . **Results:** The total sample was 71 patients who met the inclusion and exclusion criteria. The average age of patients was 60.4 years. More males (54.9%) than females (45.1%). There were 58 patients with a diagnosis of dry eye syndrome with diabetic neuropathy (72%), 10 patients with a diagnosis of dry eye syndrome without diabetic neuropathy (14.1%), and 13 patients with a diagnosis of diabetic neuropathy without dry eye syndrome (18.3%). In the analysis of Spearman's rho correlation test, the value of  $p = 0.000$  ( $p < 0.05$ ) was obtained. **Conclusion:** There is a relationship between the degree of dry eye syndrome and the degree of diabetic neuropathy at the Gotong Royong Hospital Surabaya.

**Keywords:** Dry eye syndrome, diabetic neuropathy, diabetes mellitus

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## INTRODUCTION

The uncomfortable condition of vision caused by lubrication in the eye and lack of moisture is called dry eye syndrome. A multifactorial disease that occurs in tears and the surface of the eye which is characterized by loss of homeostasis of the tear film which can damage the surface of the eye as well as discomfort in the eye, instability of the tear film, and visual disturbances is the definition of dry eye syndrome.<sup>1</sup> Initial complaints that patients can experience are itchy, gritty eyes, photosensitivity, excessive mucus secretion, difficulty moving the eyelids, and blurred or blurred vision.<sup>2</sup>

Several population-based epidemiological studies state that the prevalence of dry eye syndrome in America and Australia is 5-16%, while in Asia the prevalence is higher, namely around 27 to 33%.<sup>2</sup> Reports of the prevalence of dry eye in Indonesia is 27.5% with an average of the average age is more than 37 years.<sup>3</sup>

According to the American Academy of Ophthalmology (2022), chronically high blood glucose can cause many eye complications, such as retinopathy, cataracts, and glaucoma. Diabetes affects the function of the lacrimal gland, which produces the watery part of the eye. Diabetes also affects the oil glands in the eyelids which prevent the watery part of the eyes from evaporating too quickly after

each blink. These glands are responsible for producing tears and maintaining healthy moisture levels in the eyes.<sup>4</sup>

Chronic complications of diabetes are traditionally classified as macrovascular or microvascular depending on the underlying pathophysiology. Peripheral neuropathy, nephropathy, and retinopathy are well-known microvascular complications of diabetes.<sup>5</sup> Microvascular complications cause damage throughout the body, especially in small blood vessels, such as those in the eyes. This condition can affect the function that produces tears, namely the tear glands which are needed to maintain moisture and eye health.<sup>6</sup>

Several research studies state that one of the causes of dry eye syndrome is DM. However, research discussing the relationship between dry eye syndrome and diabetic neuropathy, especially in Indonesia, is still rare. Therefore, it is necessary to carry out further research on this matter. Based on this background, researchers are interested in researching the relationship between the degree of dry eye syndrome and the degree of diabetic neuropathy at the Gotong Royong Hospital Surabaya.

## METHODS

This research uses a correlation analytical research design with a cross-

sectional method. The samples used were outpatients who had a history of type 2 diabetes mellitus aged 50-65 years in the Internal Medicine Outpatient Unit at Gotong Royong Hospital. The sample obtained was 71 people who met the inclusion and exclusion criteria. Data collection was carried out from August 2023 to October 2023 by collecting primary data from the Schirmer test and MNSI and MDNS questionnaires as well as secondary data (HbA1c) from patient medical records. The sample size in this study was 71 samples. Data will be analyzed using SPSS version 26. On both variables, the analysis will be carried out using Spearman's rho correlation test. The test results are significant if  $p < 0.05$ .

## RESULTS

**Table 1. Characteristics of Respondents Based on Age, Gender, Length of Suffering from T2DM, and HbA1c.**

Classification	Frequency (n)	Percentage (%)
<b>Age</b>		
50-59	30	42.3
60-69	41	57.7
Total	71	100.0
<b>Gender</b>		
Man	39	54.9
Woman	32	45.1
Total	71	100.0
<b>Length of DM2</b>		
1-10	52	73.2
11-20	14	19.7
21-30	3	4.2
31-40	2	2.8
Total	71	100.0
<b>Smoker</b>		
Yen	28	39.4
No	43	60.6

Total	71	100.0
<b>History of Concomitant Diseases</b>		
Nothing	20	28.2
HT	25	35.2
PJK	6	8.5
Stroke	5	7
CKD	0	0
Other Diseases	15	21.2
Total	71	100.0
<b>HbA1c</b>		
<7(Controlled)	23	32.4
≥7(Not Controlled)	48	67.6
Total	71	100.0

Based on Table 1, respondents aged 60-65 years are respondents with more frequency, namely 41 respondents (57.7%), 39 respondents (45.1%) are male and 32 respondents (45.1%) are female. Then the longest duration of suffering from DM2 was in the range of 1-10 years, namely 52 respondents (73.2%), for the frequency of not smoking there were 43 respondents (60.6%), and the highest history of disease in HT was 25 (35.2%) of all respondents, and the highest HbA1c was in the  $\geq 7$  range, namely 48 (67.6%) respondents.

**Figure 1. Distribution of Degrees of Dry Eye Syndrome in Research Samples**

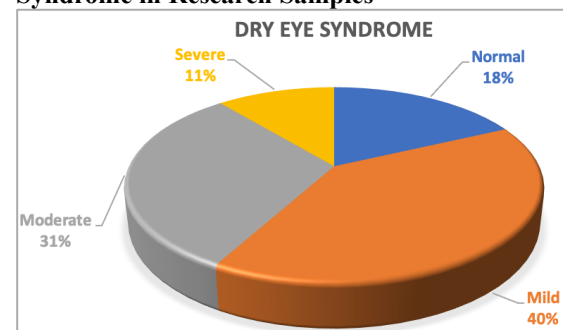


Figure 1 shows that this case was taken with SMK data on DM2 patients. The results of the study found that many DM2 patients had SMK with a mild degree, 28 patients (39.4%), while it was found that few DM2 patients had SMK with a severe degree, 8 patients (11.3%).

**Figure 2. Distribution of Degrees of Diabetic Neuropathy in Research Samples**

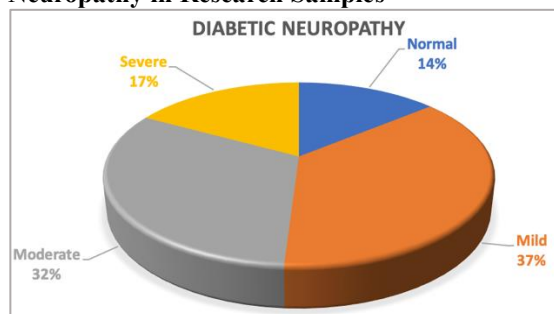
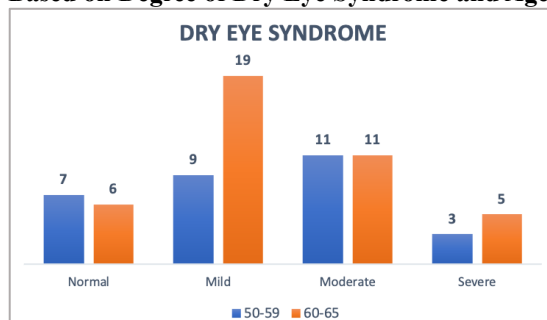


Figure 2 shows that this case is taken with data on diabetic neuropathy in DM2 patients. The results of the study found that many DM2 patients had mild degrees of diabetic neuropathy, 26 patients (36.6%), while a few found that DM2 patients had normal degrees of diabetic neuropathy, 10 patients (14.1%).

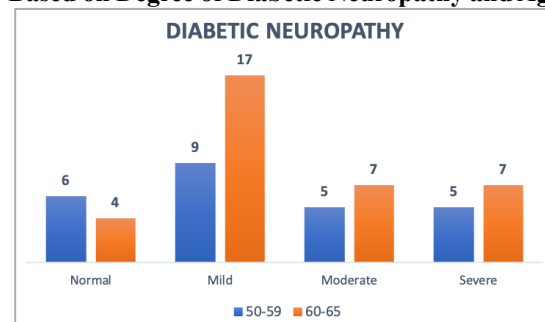
**Figure 3. Distribution of Research Samples Based on Degree of Dry Eye Syndrome and Age**



Based on Figure 3, DM sufferers at the Gotong Royong Hospital in Surabaya

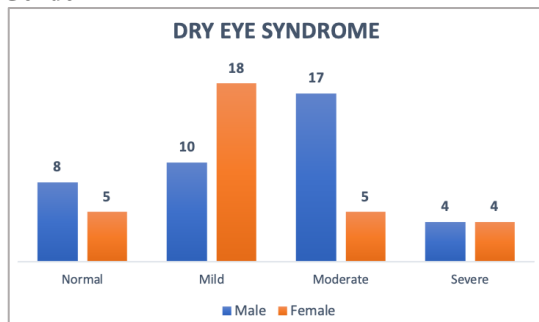
who have a normal SMK degree are found to be more at the age of 61-65 years, namely 7%, DM sufferers who have a mild SMK degree are found to be more at the age of 61-65 years, namely 21.1 %, DM sufferers who have a medium vocational school degree are found to be more common at the age of 50-55 years, namely 12.7%, and DM sufferers who have a vocational school degree.

**Figure 4. Distribution of Research Samples Based on Degree of Diabetic Neuropathy and Age**



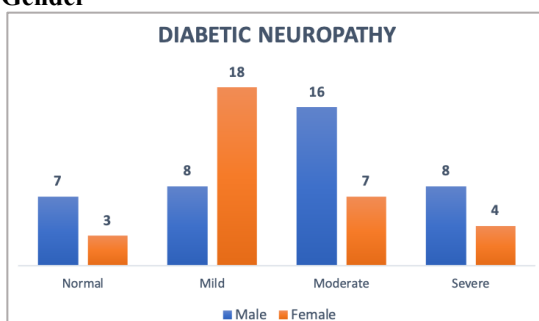
Based on Figure 4, DM sufferers at the Gotong Royong Hospital in Surabaya who have a normal degree of diabetic neuropathy are found to be more at the age of 50-59 years, namely 8.5%, DM sufferers who have a mild degree of diabetic neuropathy are found to be more common at the age of 60- 65 years. namely 23.9%, more DM sufferers who have a moderate degree of diabetic neuropathy are found at the age of 60-65 years, namely 18.3%, and more DM sufferers who have a severe degree of diabetic neuropathy are found at the age of 60-65 years, 9.9%.

**Figure 5. Distribution of Research Samples Based on Degree of Dry Eye Syndrome and Gender**



Based on Figure 5.5, DM sufferers at the Gotong Royong Hospital in Surabaya who had a normal SMK degree were found to be more male, namely 8 respondents (11.3%), DM sufferers who had a mild SMK degree were found to be more female, namely 18 respondents (25.4%), DM sufferers who had a moderate SMK degree were found to be more male, namely 17 respondents (23.9%), and DM sufferers who had a severe SMK degree were found to be 4 respondents (5, 6%) each in men and women.

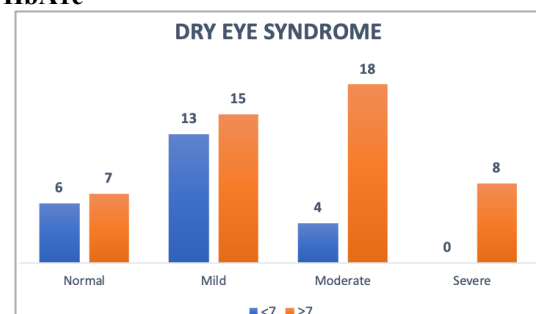
**Figure 6. Distribution of Research Samples Based on Degree of Diabetic Neuropathy and Gender**



Based on Figure 6, DM sufferers at the Gotong Royong Hospital in Surabaya who had a normal degree of diabetic

neuropathy were found to be more male, namely 7 respondents (9.9%), DM sufferers who had a mild degree of diabetic neuropathy were found to be more common in the male gender, female, namely 18 respondents (25.4%), DM sufferers who had a moderate degree of diabetic neuropathy were found to be more male, namely 16 respondents (22.5%), and DM sufferers who had a severe degree of diabetic neuropathy were found to be more mostly male, namely 8 respondents (11.3%).

**Figure 7. Distribution of Research Samples Based on Degree of Dry Eye Syndrome and HbA1c**

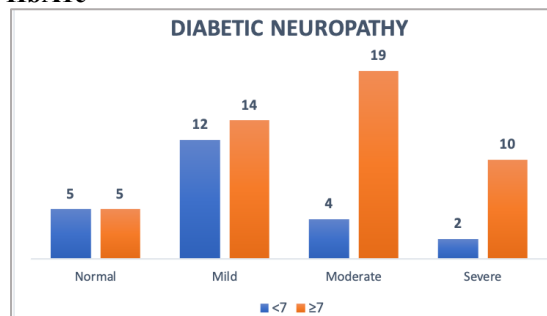


Based on Figure 7, DM sufferers at the Gotong Royong Hospital in Surabaya who had a normal degree of dry eye syndrome were found to have more HbA1c  $\geq 7$  (Uncontrolled), namely 7 respondents (9.9%), DM sufferers who had a mild degree of dry eye syndrome were found more at HbA1c  $\geq 7$  (Uncontrolled), namely 15 respondents (21.1%), DM sufferers who have moderate degrees of dry eye syndrome were found to be more at HbA1c  $\geq 7$  (Uncontrolled), namely 18 respondents



(25.4%), and DM sufferers who had severe dry eye syndrome were more likely to have HbA1c  $\geq 7$  (Uncontrolled), 8 respondents (11.3%).

**Figure 8. Distribution of Research Samples Based on Degree of Diabetic Neuropathy and HbA1c**



Based on Figure 8, DM sufferers at the Gotong Royong Hospital in Surabaya who had a normal degree of diabetic neuropathy had the same number of HbA1c  $< 7$  and  $\geq 7$  respectively 5 respondents (7.0%), DM sufferers who had a mild degree of diabetic neuropathy had more at HbA1c  $\geq 7$  (Uncontrolled), namely 14 respondents (19.7%), DM sufferers who have a moderate degree of diabetic neuropathy found more at HbA1c  $\geq 7$  (Uncontrolled), namely 19 respondents (26.8%), and sufferers DM who had a severe degree of diabetic neuropathy was found to be more likely to have HbA1c  $\geq 7$  (Uncontrolled), 10 respondents (14.1%).

## DISCUSSION

In the research conducted, there were results of the age distribution of type

**Table 2. Results of Analysis of the Relationship between the Degree of Dry Eye Syndrome and the Degree of Diabetic Neuropathy**

Spearman's rho	Degree of DES	Degree of Diabetic Neuropathy	Correlation	
			Correlation Coefficient	Sig. (2-tailed)
rho	Degree of DES	Degree of Diabetic Neuropathy	1.00	.893**
	Degree of Diabetic Neuropathy	Degree of DES	.893**	.000

The results of the Spearman's rho correlation test show that there is a significant relationship between the two variables, with a Sig value. or  $p = 0.000$ . It is said to be significant if the  $p$ -value  $< 0.050$ . The two variables have a strong correlation or relationship with a Correlation Coefficient value of (C) = 0.893. Where the relationship between the two variables is said to be "very strongly related" if a Correlation Coefficient (C) = 0.76-0.99 is obtained.

2 diabetes mellitus patients who experienced dry eye syndrome and diabetic neuropathy mostly at the age of 60-65

years. This research is in line with research conducted by Stefano and colleagues (2022), which found that the largest age group in cases of dry eye syndrome was in subjects over 60 years old, namely 8.4% in patients 60-70 years old, 15% in patients 70 years old, 17%, and 20% in patients over 80 years old.<sup>7</sup> This research is also in line with research conducted by Simona and colleagues (2016) which states that the prevalence of diabetic neuropathy increases with age, namely in the elderly age group as much as 63% of the total population of diabetic neuropathy sufferers.<sup>8</sup>

This is related to the lacrimal gland which is responsible for tear production naturally reducing the number of tears produced as we age, which can result in insufficient water (aqueous) production and affect the eye's ability to retain moisture. In addition, age-related medical conditions, medications, and hormonal changes contribute to the prevalence of dry eyes in the elderly.<sup>9</sup>

Meanwhile, diabetic neuropathy which often occurs in the elderly is related to the prevalence of diabetes mellitus which increases with age, and increasing age is a strong risk factor for diabetic neuropathy. In addition, several biological changes occur during the aging process such as increased production of advanced glycosylation end products (AGEs),

changes in neural vasculature, impaired resistance to oxidative stress, and metabolic factors such as high triglyceride and cholesterol levels, as well as hereditary factors are also associated with increased risk of neuropathy.<sup>10</sup>

Sample distribution based on the gender of type 2 diabetes mellitus patients showed that the majority of people experiencing dry eye syndrome and diabetic neuropathy were women. This research is in line with research conducted by Cynthia and colleagues (2019), which found that the largest gender group in cases of dry eye syndrome was women. The prevalence of dry eye symptoms in women begins to increase from 14% at the age of 50 years to 22% at the age of >80 years.<sup>11</sup> This research is also in line with research conducted by Melanie and colleagues (2008) which states that women (59%) are more likely to suffer from diabetic neuropathy compared to men (41%).<sup>12</sup>

This is related to hormonal changes in estrogen, progesterone, and even testosterone throughout a woman's life which can affect the quantity and quality of the tear film, changes in nerve blood vessels, impaired resistance to oxidative stress, and metabolic factors such as high triglyceride and cholesterol levels, making them more susceptible to dry eye syndrome and increased risk of diabetic neuropathy.<sup>11</sup>

Sample distribution based on HbA1c of patients with type 2 diabetes mellitus found that those experiencing dry eye syndrome and diabetic neuropathy were mostly in the HbA1c  $\geq 7$  (Uncontrolled) group, this grouping was grouped based on The American Diabetes Association (ADA). This research is in line with research conducted by Baqer and colleagues (2022), which found that the highest HbA1c group in cases of dry eye syndrome was the HbA1c  $\geq 7$  group. Glycosylated hemoglobin (HbA1c) levels of 6.5% or higher are an independent risk factor for the development of dry eye syndrome.<sup>13</sup>

This is related to high blood sugar levels which can cause nerve damage in the eyes so that tear production decreases, resulting in dry eye syndrome. In addition, high blood sugar levels also cause weakness in the walls of the small blood vessels that supply oxygen and nutrients to the nerves, which further contributes to nerve damage, making them more susceptible to diabetic neuropathy.<sup>14</sup>

The research results in this study illustrate the relationship between the degree of dry eye syndrome and the degree of diabetic neuropathy. Diabetic neuropathy is a type of nerve damage that can occur in people with diabetes. This can affect the nerves that control tear production, causing dry eye syndrome. This

research is in line with research conducted by Marilia and colleagues (2021), stating that there is a relationship between dry eye syndrome and the degree of diabetic neuropathy. The results of the research state that there is a significant relationship between dry eye syndrome and the degree of diabetic neuropathy in a Brazilian city in January 2021. 2019 to September 2019.<sup>15</sup>

The research carried out is by the theory explained. The results of research analysis using Spearman's rho correlation test showed a significant relationship between dry eye syndrome and diabetic neuropathy which was known from the value of  $p = 0.000$  ( $p < 0.05$ ). Dry eyes are one of the most common problems experienced by patients who frequently experience diabetic neuropathy. Patients with diabetic neuropathy experience corneal nerve fiber damage and reduced corneal sensitivity. According to the International Dry Eye Workshop (DEWS), reduced corneal sensitivity favors DES in two ways: first by reducing reflex-induced lacrimal secretion and second by reducing blink rate and increasing evaporative tear loss.<sup>15</sup>

## CONCLUSION

There is a significant relationship between the degree of dry eye syndrome and the degree of diabetic neuropathy at the

Gotong Royong Hospital Surabaya with p-value = 0.000 ( $p < 0.05$ )

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