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Research Article

# The Significant Relationship between Duration and Fasting Blood Glucose Level to Diabetic Neuropathy in Type-2 Diabetes Mellitus Patients

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## ABSTRACT

Myopia is a common refractive disorder, and its prevalence continues to rise globally, including in Indonesia. In young adults over 21 years of age, the prevalence of myopia with a refractive error greater than -0.5 D reaches 48.1%. Myopia has been associated with various ocular complications, including elevated intraocular pressure (IOP), which has been associated with vision impairment. This study aims to analyze the relationship between the degree of myopia and intraocular pressure in myopic patients. This study employed a cross-sectional design with consecutive sampling of myopic patients at Dr. Wahidin Sudirohusodo Hospital Data from medical records and direct examination. Chi square correlation analysis revealed a significant relationship between the degree of myopia and intraocular pressure. In the right eye, the p-value was 0.03 ($p < 0.05$), while in the left eye, it was 0.01 ($p < 0.05$). Patient characteristics showed that the majority were female (69.6%), and most patients were young adults aged 21–40 years (79.7%). There is a significant relationship between the degree of myopia and intraocular pressure at Dr. Wahidin Sudiro Husodo hospital.

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## INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder characterized by persistently high blood glucose levels. Patients may have a painful loss of distal feeling due to diabetic neuropathy problems, which can cause ulceration of the foot and perhaps necessitate amputation (Kaur et al., 2023). Large amounts of glucose enter the polyol route in this hyperglycemia situation, after which additional glucose enters the cell and binds to amino acids via the nerve epineurial artery and the nerve endoneurial pathway (Thorne, Grey, Lim, & Donaldson, 2024). The primary enzyme in endoneurial tissue, aldose reductase, transforms NADPH into NADP and glucose into sorbitol. This process results in a deficiency of glutathione and NO, which raises oxidative stress and damages nerve cells (Pan, Xu, & Guo, 2022). Sorbitol dehydrogenase is an important enzyme in epineurial arterial tissue that converts sorbitol to fructose, which leads to an increase in diacylglycerol (DAG) and protein kinase C (PKC) isoforms, which in turn raise vasoconstrictor endothelin activity and plasminogen activator inhibitor-1 (PAI-1), so that fibrinolysis is reduced, which causes vascular occlusion. Excessive production of pro-inflammatory cytokines damages blood vessels. Accordingly, these products will cause hypoperfusion of nerve tissue by transforming the vascular endothelium into dysfunctional blood vessels (Srikanth & Orrick, 2022). Advanced Glycation End Products (AGEs) are created when glucose enters the cell and joins with amino acids in a non-enzymatic glycosylation process, in addition to the polyol route (Darsana, 2014). After that, AGE attaches itself to the Receptor for Advanced Glycation End Products (RAGE), which triggers the release of reactive oxygen species (ROS) and activates NADPH oxidase. Meanwhile, RAGE alters gene expression, increases inflammation, and triggers apoptosis, leading to endoneurial microangiopathy (Calcutt, 2020). Chronic hyperglycemia and the activation of multiple metabolic pathways that lead to oxidative stress in diabetic neurons, nerve ischemia, and nerve damage are related when diabetes lasts for a long time (Abdissa et al., 2020).

In 2023, the prevalence of diabetes mellitus remained high at 11.7% in Indonesia, with an increase in the incidence among those aged 15 and above %) (Kementerian Kesehatan Republik Indonesia, 2023). One of the five provinces with the highest prevalence of diabetes is East Java. In East Java Province, the prevalence of diabetes mellitus increased from 2.1% in 2018 to 2.6% in 2022, according to Riskesdas Data Health Office of East Java 2022 (Dinkes Jatim, 2022). The Sidoarjo District Health Profile data indicates that throughout the past five years, there has been a rise in the number of individuals with diabetes mellitus (DM). In 2024, there were 77,877 instances, up from 72,291 in 2019. This pattern indicates that diabetes mellitus is becoming more prevalent in the Sidoarjo District (Dinkes Sidoarjo, 2019, 2024). Numerous variables, including changes in lifestyle, elevated metabolic risk factors, and increased detection in medical institutions, could cause this increase. This study was conducted at Siti Khodijah Sepanjang Hospital in Sidoarjo District in light of these developments. One of the referral hospitals that sees a lot of DM patients, this one is thought to be a good example of the issue of DM complications, particularly diabetic neuropathy.

In a study headed by RSUD Dr. M. Djamil Padang, 44 participants found a relationship between the duration of type II DM and the incidence of diabetic neuropathy (Rahmi AS, Syafrita Y & Susanti R, 2022). However, among the 50 patients chosen through consecutive

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sampling at Surabaya Gotong Royong Hospital, no correlation was found between the duration of diabetes mellitus and diabetic neuropathy (Sabari, Mellow, & Malonda, 2022). There was no correlation between the foot sensitivity value of diabetic patients and their fasting blood sugar levels, according to a 2021 study by Sri Mulyati Rahayu at the Riung Bandung Health Center that included 30 samples (Rahayu, Vitniawati & Indarna, 2021). The small sample size, the unequal distribution of DM, the lack of confounding factor analysis, and the use of a questionnaire rather than a physical examination of diabetic neuropathy due to the COVID-19 pandemic at the time were the reasons for the discrepancies in earlier studies, according to these studies' findings. As a result of the different results of previous studies, more research is required to prove the impact of fasting blood glucose levels and duration of diabetes mellitus on the incidence of diabetic neuropathy, which looks at the physical signs of diabetic neuropathy, analyzes risk factors or confounding factors, and uses a larger sample with a more even distribution of DM. This study aims to evaluate the association between diabetes mellitus duration and fasting blood glucose levels with the incidence of diabetic neuropathy among patients treated at Siti Khodijah Sidoarjo Hospital. This study is expected to control the patient's blood glucose levels properly, comply with diabetes treatment, provide data related to risk factors for diabetic neuropathy at Siti Khodijah Hospital, prevent diabetic neuropathy complications, improve the quality of life of DM patients, reduce the impact of diabetic neuropathy symptoms, and reduce mortality associated with diabetic neuropathy.

## METHODS

### Study Design

This quantitative study uses a cross-sectional approach. The population is type 2 DM patients. The sampling technique uses a purposive sampling method based on certain factors, including the composition or nature of the population. In this study, 51 samples were determined using the sample size formula R6 - Nominal-Nominal Correlational Analytic (Dahlan, 2017).

### Participant

Patients with type 2 DM who are at least 20 years old, have good health, are cooperative, and are willing to participate in the study by signing an informed consent form. Exclusion criteria are patients who have a history of using neurotoxic drugs (such as topiramate and rufinamide) or diseases that can interfere with sensory nerve functions (such as leprosy or stroke).

### Fasting Blood Glucose Examination (FBG) Examination

Clinical chemistry laboratory testing is used to measure fasting blood glucose levels. Blood samples are taken from the median cubital vein using a vacuum tube, and then a glucose reading procedure is performed using a HumaStar spectrophotometer 100/200, Germany (Fajarna, Putri & Irayana, 2022).

### Diabetic Neuropathy Measurement

The Michigan Neuropathy Screening Instrument (MNSI) is a validated and reliable screening tool for identifying diabetic neuropathy. The questions are in Indonesian, which the patient can understand well (Setiawan, 2022). MNSI used to identify the presence of diabetic neuropathy consisting of 15 “yes or no” questions asking about various foot sensations such as pain, numbness, sensitivity to temperature and a brief physical examination including a

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foot examination for abnormalities such as shape, dry skin, hair or nail abnormalities, calluses or infections, semi-quantitative examination of vibration sensation on the back of the big toe, ankle reflex examination and monofilament examination (Pinzon & Sanyasi, 2019).

### Data Analysis

This study analyzed the data using the contingency coefficient test as a bivariate analysis to test the relationships between duration and the incidence of diabetic neuropathy, and between fasting blood sugar levels and diabetic neuropathy. Logistic regression was then used to test the relationship between duration and fasting blood sugar levels to diabetic neuropathy (Dahlan, 2017).

### Ethical clearance

Every participant received written and verbal information about the study, and their informed consent was obtained prior to their registration as subjects. This research was conducted following the Declaration of Helsinki and approved by the Health Research Ethics Committee, Siti Khodijah Muhammadiyah Hospital, Sidoarjo, Indonesia, with a number (No.24/KET-KEPK/8-2024).

## RESULTS

**Table 1.** Characteristics of Type 2 Diabetes Mellitus Patients

| No | Characteristics | | Total (%) (N=51) |
|---|---|---|---|
| 1 | Gender | Male | 9 (17.6%) |
| | | Female | 42 (82.4%) |
| 2 | Age | 20-59 years | 26 (51%) |
| | | >60 years | 25 (49%) |
| 3 | Smoking History | No | 51 (100%) |
| | | Yes | 0 (0%) |
| 4 | History of hypertension | No | 26 (51%) |
| | | Yes | 25 (49%) |
| 5 | Blood Pressure | Optimal | 11 (21.6%) |
| | | Normal | 9 (17.6%) |
| | | Normal-high | 15 (29.4%) |
| | | Grade 1 hypertension | 14 (27.5%) |
| | | Grade 2 hypertension | 1 (2%) |
| | | Grade 2 hypertension | 1 (2%) |
| 6 | BMI (Body Mass Index) | Underweight | 0 (0%) |
| | | Normal | 21 (41.2%) |
| | | Overweight | 6 (11.8%) |
| | | Obese | 24 (47.1%) |
| 7 | Duration | ≤ 5 years | 25 (49%) |
| | | > 5 years | 26 (51%) |
| 8 | Fasting Blood Glucose | Normal (<126 mg/dl) | 21 (41.2%) |
| | | High (≥126 mg/dl) | 30 (58.8%) |
| 9 | Diabetic Neuropathy | No | 26 (51%) |
| | | Yes | 25 (49%) |

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**Table 2.** Characteristics of Respondents According to the Incidence of Diabetic Neuropathy

| No | Characteristics | | Diabetic Neuropathy (N=51) | | Total (%) |
|---|---|---|---|---|---|
| | | | DN - | DN + | |
| 1 | Gender | Male | 7 (26.9%) | 2 (8%) | 9 (17.6%) |
| | | Female | 19 (73.1%) | 23 (92%) | 42 (82.4%) |
| 2 | Age | 20-59 years | 13 (50%) | 13 (50%) | 26 (51%) |
| | | >60 years | 13 (50%) | 12 (48%) | 25 (49%) |
| 3 | Smoking | No | 26 (100%) | 25 (100%) | 51 (100%) |
| | History | Yes | 0 (0%) | 0 (0%) | 0 (0%) |
| 4 | Hypertension | No | 14 (53.8%) | 12 (46.2%) | 26 (51%) |
| | History | Yes | 12 (46.2%) | 13 (52%) | 25 (49%) |
| 5 | Blood | Optimal | 5 (19.2%) | 6 (24%) | 11 (21.6%) |
| | Pressure | Normal | 4 (15.4%) | 5 (20%) | 9 (17.6%) |
| | | Normal-high | 12 (46.2%) | 3 (12%) | 15 (29.4%) |
| | | Grade 1 Hypertension | 4 (15.4%) | 10 (40%) | 14 (27.5%) |
| | | Grade 2 Hypertension | 1 (3,8%) | 0 (0,0%) | 1 (2%) |
| | | Grade 3 Hypertension | 0 (0.0%) | 1 (4%) | 1 (2%) |
| 6 | BMI | Underweight | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| | | Normal | 16 (61.5%) | 5 (20.0%) | 21 (41.2%) |
| | | Overweight | 2 (7.7%) | 4 (16%) | 6 (11.8%) |
| | | Obese | 8 (30.8%) | 16 (64%) | 24 (47.1%) |

**Table 3.** Relationship between duration of DM and incidence of diabetic neuropathy

| Duration of DM | Diabetic Neuropathy | | | | Total | | Contingency coefficient test |
|---|---|---|---|---|---|---|---|
| | DN – | | DN + | | | | |
| | n | % | n | % | n | % | |
| ≤ 5 years | 18 | 35.3 | 7 | 13.7 | 25 | 49 | P = 0.003 |
| > 5 years | 8 | 15.7 | 18 | 35.3 | 26 | 51 | r = 0.381 |
| **Total** | **29** | **51** | **22** | **49** | **51** | **100** | |

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Table 1 shows the characteristics of the study: most participants were female (82.4%), 51% were aged 20–59 years, and 49% were aged 60 years or older. Participants denied ever smoking. On examination, fasting blood glucose levels ≥126 mg/dl were found in 58.8% of patients. Of those surveyed, 51% had no history of hypertension. Blood pressure was within the high-normal range (29.4%), grade 1 hypertension (27.5%), body mass index that met the overweight and obesity criteria (58.9%), and duration of DM for more than 5 years (51%). Diabetic neuropathy was found in 49% of patients.

Based on the results in Table 2, out of 51 participants, 42 were women, and 23 (54.76%) were found to have diabetic neuropathy. The majority of respondents with diabetic neuropathy had a history of overweight and obesity (80%) and grade 1 hypertension (40%).

In Table 3, it can be seen that of 51 participants, 25 with DM for less than 5 years had only 7 (13.7%) with diabetic neuropathy, while the remaining 18 (35.3%) did not have diabetic neuropathy. Of the 26 who suffered from DM for more than five years, there were 18 participants (35.3%) who had an incident of diabetic neuropathy, and only 8 (15.7%) did not experience diabetic neuropathy. Those who have had diabetes for less than five years have a minor incidence of diabetic neuropathy, whereas those who have had diabetes for more than five years have a greater incidence, as shown by the data in Table 3. This indicates that among patients with type 2 diabetes mellitus at Siti Khodijah Hospital, there is a significant correlation between the occurrence of diabetic neuropathy and the duration of DM. The degree of association (correlation) between the duration variable and the incidence of diabetic neuropathy in patients with type 2 diabetes mellitus falls within the weak criteria, as indicated by a correlation coefficient of 0.381. There is a positive link between the occurrence of diabetic neuropathy and the duration of diabetes mellitus. Accordingly, this value might be interpreted as follows: the longer a patient has type 2 diabetes mellitus, the higher their chance of developing diabetic neuropathy.

Table 4 shows that patients with normal fasting blood glucose levels (<126 mg/dl) are less likely to experience diabetic neuropathy. Patients with fasting blood glucose levels (≥126 mg/dl) are more likely to experience it. The incidence of diabetic neuropathy is significantly correlated with fasting blood glucose levels. The degree of association (correlation) between fasting blood glucose levels and the incidence of diabetic neuropathy in patients with type 2 diabetes mellitus falls within the moderate range, with a correlation coefficient of 0.448. There is a positive association between the incidence of diabetic neuropathy and fasting blood glucose levels. Therefore, this figure can be considered as an increased risk of diabetic neuropathy in patients with type 2 diabetes due to increased fasting blood glucose levels.

Table 5 shows that the duration of DM and fasting blood glucose together account for 55.8% of the incidence of diabetic neuropathy in patients with type 2 DM. Fasting blood glucose levels were also found to be a risk factor for diabetic neuropathy in patients with type 2 DM, with a more significant influence than the duration of diabetes mellitus, according to the results of the logistic regression test. This is evident from the logistic regression of fasting blood glucose levels, which shows an Exp(B) value of 35,305, higher than that for the duration of type 2 DM (22,386).

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**Table 4.** Relationship between Fasting Blood Sugar Levels and the Incidence of Diabetic Neuropathy

| Fasting Blood Sugar Levels | Diabetic Neuropathy | | | | Total | | Contingency coefficient test |
|---|---|---|---|---|---|---|---|
| | DN – | | DN + | | | | |
| | n | % | n | % | n | % | |
| Normal (<126 mg/dl) | 17 | 33.3 | 4 | 7.8 | 21 | 41.2 | P = 0.000<br>r = 0.448 |
| High (≥126 mg/dl) | 9 | 17.6 | 21 | 41.2 | 30 | 58.8 | |
| **Total** | **26** | **51** | **25** | **49** | **51** | **100** | |

**Table 5.** Logistic Regression Test Results

| Variable | Exp(B) | *p-value* | Nagelkerke R Square |
|---|---|---|---|
| Duration of DM | 22.386 | 0.005 | 55.8% |
| Fasting Blood Sugar Levels | 35.305 | 0.002 | |

## DISCUSSION

### Duration of DM to Diabetic Neuropathy

The study's findings indicate that diabetic neuropathy is more common in individuals with type 2 DM who have had the condition for more than five years. Theoretically, persistent hyperglycemia and the activation of multiple metabolic pathways that lead to oxidative stress in diabetic neurons, which causes ischemia and nerve damage, are related if diabetes persists for an extended time (Abdissa et al., 2020). If DM has been present for more than five years, the risk of diabetic neuropathy increases four to five times (Eltrikanawati, 2021; Kshatri et al., 2022). This is in line with a study by Afriyeni Sri Rahmi that found that 92.1% of the 44 respondents who had type 2 DM patients with diabetic neuropathy had the disease for more than five years, indicating a correlation between the occurrence of diabetic neuropathy and the duration of suffering in patients with type II diabetes (Rahmi AS, Syafrita Y & Susanti R, 2022). However, among the 50 patients chosen through consecutive sampling at Surabaya Gotong Royong Hospital, no correlation was found between the duration of diabetes mellitus and diabetic neuropathy (Sabari et al., 2022).

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**Fasting Blood Glucose to Diabetic Neuropathy**

According to the findings, diabetic neuropathy was more common in type 2 DM individuals with high fasting blood glucose levels (≥126 mg/dl). According to theory, the polyol pathway is a nerve-damaging pathway triggered by an increase in fasting blood glucose during the conversion of glucose to fructose and sorbitol. This ultimately results in oxidative and osmotic stress on nerve cells, which disrupts nerve conduction and produces pain and tingling sensations (Shanty, Harsa and Noviana, 2017). Different structural and functional proteins become glycated when glucose levels rise, producing Advanced Glycation End Products (AGEs) (Feldman et al., 2019). Then, by releasing reactive oxygen species (ROS), AGEs attach to Receptors for Advanced Glycation End Products (RAGE) and activate Nicotinamide Adenine Dinucleotide Phosphate Hydrogen (NADPH) oxidase. Meanwhile, RAGE communicates with the Nuclear Factor kappa-light-chain-enhancer of activated B cells (NF-kB) by changing gene expression, causing inflammation, and triggering apoptosis (Calcutt, 2020). The research by Alshammari et al. (2022) supports this notion by showing that diabetic neuropathy is more common in those with fasting blood sugar levels greater than 130 mg/dl. Consequently, the findings demonstrated a correlation between diabetic neuropathy and fasting blood sugar levels. However, a study by Rahayu, Vitniawati, and Indarna (2021) among 30 participants, no association was found between diabetic patients' foot sensitivity ratings and fasting blood sugar levels.

**Duration of DM and Fasting Blood Glucose to Diabetic Neuropathy**

The results of the logistic regression indicate that the Nagelkerke R-squared is 55.8%, as shown in Table 5. The findings of this hypothesis test demonstrate that the incidence of diabetic neuropathy in people with type 2 diabetes mellitus is influenced by both fasting blood glucose levels and the duration of DM by 55.8%. The exp(B) value of the logistic regression of fasting blood glucose levels is more significant at 35.305 than the variable duration of suffering from type 2 DM, which is 22.386, according to the findings of the logistic regression test in Table 5. The duration of diabetes mellitus and fasting blood glucose levels have positive logistic regression coefficients. Therefore, the value can be read as the lengthening or increasing duration of type 2 diabetes mellitus and the rising fasting blood sugar levels of those who have the disease, which raises the risk of diabetic neuropathy. Theoretically, one effect of chronic hyperglycemia is inflammation and nerve damage, driven by the production of glycation end products (AGEs) and the activation of biochemical pathways, such as the polyol and protein kinase C (PKC) pathways (Feldman et al., 2019). The findings of Rahmi AS, Syafrita Y, Susanti R (2022) and Pai et al. (2018) are consistent. They found higher odds ratios of 4.08 for the association between fasting blood glucose levels and the incidence of diabetic neuropathy, and 2.16 for the association between duration and the incidence of diabetic neuropathy. However, the findings of Alshammari et al. (2022) showed no correlation between duration and diabetic neuropathy incidence, although they did find a risk ratio of 1.157 for fasting blood sugar levels and diabetic neuropathy incidence.

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**Characteristics**

This study discussed the following respondent characteristics: gender, age, smoking history, hypertension, and body mass index.

**Gender**

Of the 51 patients in this study, 82.4% were female, indicating that they comprised most of the community. Women in this study experienced more occurrences of diabetic neuropathy (Table 2). Women who are pregnant are more likely to develop diabetes mellitus and diabetic neuropathy. By disrupting the gut's ability to absorb iodine, which can prevent the production of nerve myelin, estrogen increases the risk of neuropathy in women (Fields, 2014; International Association for the Study of Pain, 2015). This result is consistent with that of Mildawati, Diani, and Wahid (2019), who discovered a relationship between the female gender and the prevalence of diabetic peripheral neuropathy. However, Suri, Haddani, and Sinulingga's (2015) study revealed no link between nerve injury and gender.

**Age**

According to Table 2, patients between the ages of 20 and 59 had a somewhat greater incidence of diabetic neuropathy (50%) than those 60 and older (49%). This might be because people in the 20–59 age range are productive, engage in more physical activity, and experience greater metabolic stress. However, they frequently neglect to regularly check their blood sugar levels (Chang et al., 2021). Additionally, the risk of chronic problems like neuropathy starts to rise in this group since their diabetes has started to progress into the intermediate to advanced phase (Yahaya, Doya, Morgan, Ngaiza, & Bintabara, 2023). Even when patients have not yet reached senior age, a sedentary lifestyle and high-calorie diets also hasten metabolic and microvascular deterioration, impairing peripheral nerve function. Through several processes, including impaired neuron regeneration function, microvascular damage, and persistent oxidative stress made worse by hyperglycemia, ageing raises the risk of diabetic neuropathy. Peripheral nerve injury is accelerated by age-related declines in metabolic control, such as insulin resistance and dyslipidemia (Assar, Angulo, & Rodríguez-Mañas, 2016). These factors work together to increase the risk of neuropathic problems in the adult age range of 20 to 59 years. These findings are consistent with Khairunnisa's research, which demonstrates that the primary risk group for DM neuropathy is middle-aged individuals, specifically those aged 46 to 59, among whom 20 individuals (46.51%) had diabetic neuropathy (Khairunnisa, Maulina, & Ramadhansyah, 2025). However, a study by Alshammari et al. (2022) found no correlation between age and diabetic neuropathy.

**Smoking History**

There was no single smoker among the study participants (Table 1). One of the leading causes of diabetes problems and neuropathic diseases, smoking can worsen endothelial dysfunction, vascular damage, and oxidative stress, which harms nerve tissue (Campagna et al., 2019; Gündoğdu & Anaforoğlu, 2022; Aarsand et al., 2023). These findings are in line with those of Le Pichon and Chesler (2014), who found that 62% of 193 people with type 2 diabetes who were recently diagnosed had given up smoking after a year. Compared to those who did not smoke, the prevalence of diabetic neuropathy was lower among those who had stopped smoking.

**Hypertension**

Eleven of the 16 hypertensive respondents had diabetic neuropathy (Table 2). Hypertension can impact myelin fibres, decrease sensory nerve conductivity, and raise matrix metalloproteinase expression in myelin,

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according to research by Bondar et al. (2021). This implies that because of the increased activity of Schwann cells and the decreased activity of thinner myelin, hypertension separately impairs nerve function (Esmat et al., 2022). These results are consistent with the study by Asram et al. (2024), which found a correlation between the incidence of diabetic neuropathy and hypertension. On the other hand, Setianingsih (2016) discovered no connection between diabetic neuropathy and hypertension.

**Obesity**

Twenty of the 30 individuals with neuropathy satisfied the requirements for being overweight or obese (Table 2). One explanation behind this link is insulin resistance, which is more prevalent in those with higher body fat percentages. Insulin resistance can lead to microvascular problems, such as diabetic neuropathy, which affects nerve function and blood flow. Research indicates that individuals with diabetic neuropathy tend to have significantly greater levels of abdominal obesity and insulin resistance compared to those without the condition (Oh et al., 2019). According to 89 respondents, there is a correlation between the occurrence of diabetic neuropathy and body mass index (BMI), which is consistent with the findings of Anggraini and Purwanti (2024). However, Putri (2019) found no connection between diabetic neuropathy and body mass index (BMI).

**Diabetic Neuropathy**

In this investigation, diabetic neuropathy was detected in just 49% of cases (Table 3). Diabetic neuropathy has been linked to several risk factors, such as the duration of time a person has had type 2 diabetes, high blood sugar, a high body mass index, smoking, and high blood pressure (Nisar et al., 2015). A slightly higher proportion of responders in our study did not have neuropathy. This is because the study's respondents have low-risk factors, most of whom do not smoke, have no history of hypertension, and have blood pressure that is within normal and high normal ranges.

**Limitation**

This study's strength is that the ideas and findings are consistent with the current theory. Comparing variables with a greater impact on diabetic neuropathy incidence, such as diabetes duration and fasting blood glucose levels, is another discovery. A clinical chemistry laboratory was used in this investigation to assess fasting blood glucose levels, which can improve the accuracy of the results (Fajarna, Putri & Irayana, 2022). However, it is important to consider that this study has several limitations. First, the tiny sample size can impact the results' generalizability. Second, recall bias is possible because the information about the duration of diabetes mellitus was derived from the patient's memory. Third, the study's cross-sectional design makes it difficult to establish a causal link between diabetic neuropathy and fasting blood glucose levels. More longitudinal research is required to validate these results and investigate a more distinct causal link. Furthermore, a larger sample size could be used to measure the duration of patients' type 2 diabetes by having them complete questionnaires and review their medical records. Future studies examining additional characteristics or risk factors that may influence the occurrence of diabetic neuropathy would be beneficial.

The study's conclusions demonstrated a strong correlation between diabetic neuropathy and diabetes duration and fasting blood glucose levels. This finding supports the significance of glycemic management at an early stage, even before the long-term progression of diabetes mellitus. Maintaining optimal blood

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glucose control during the early stages of the illness is thought to reduce the activation of pathophysiological pathways that lead to peripheral nerve injury, including oxidative stress, chronic inflammation, and the accumulation of advanced glycation end products (AGEs). Consequently, a key component of the diabetic neuropathy prevention approach in routine clinical practice should be early intervention against hyperglycemia.

## CONCLUSION

The duration of diabetes mellitus and fasting blood glucose levels have a substantial impact on the occurrence of diabetic neuropathy, according to this study's findings. Fasting blood glucose levels are a higher risk factor for diabetic neuropathy than the duration of diabetes mellitus. In order to prevent complications from diabetes mellitus, it is hoped that patients will be able to maintain regular glycemic control, pay attention to treatment compliance, and know how to prevent complications. Additionally, to further streamline prognosis or therapy in order to minimize complications from diabetic neuropathy, pay attention to additional risk factors that may contribute to diabetic neuropathy occurrences, such as obesity, smoking, and hypertension.

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