International Journal of Health Science (IJHS)

E-ISSN: 2827-9603
P-ISSN: 2827-9603

Overview of Peripheral Neuropathy Risk Factors in DM Patients at the Padang Bulan Medan Health Center

Rut Cahyani Zebua[1*], Murni Sari Dewi Simanullang[2], Imelda Derang[3]

[1-3] Nursing Study Program, Sekolah Tinggi Ilmu Kesehatan Santa Elisabeth Medan, Indonesia ; email : murni.sari.dewi.s@gmail.com

* Corresponding Author : Rut Cahyani Zebua

Abstract: Diabetes Mellitus is a disease characterized by increased blood sugar levels which results in impaired insulin secretion, requiring lifelong treatment. Diabetes mellitus that is not well controlled can cause microvascular complications, namely peripheral neuropathy, Peripheral Neuropathy which is one of the complications of diabetes mellitus. occurs most frequently and can impair quality of life and even lead to amputation. There are several factors that can cause neuropathy, including long suffering from DM, BMI, hypertension, and age. This study aims to determine the risk factors for peripheral neuropathy in DM sufferers at Padang Bulan Health Center. Medan The research design used is descriptive research with cross sectional approach with a population of 974 people. The sampling technique uses Accidental Sampling with a total sample of 91 respondents. The measuring instruments used are Sop IpTT, observation sheets, medical records. The results shows that the duration of diabetes is > 5 years (59.3%), BMI is 25-29.9 kg/m2 (50.5%), hypertension (67%), elderly >56 years (86.8%). and those experiencing neuropathy (12.1%), it is hoped that the results of this study will provide useful information and knowledge for DM sufferers in preventing neuropathy

Keywords: Diabetes Mellitus; Factor; Neuropathy; Peripheral

1. Introduction

Diabetes Mellitus (DM) is a chronic disease caused by increased blood sugar that requires long-term treatment (Munir & Yuiana, 2023), the International Diabetes Federation (IDF) reports that the incidence of diabetes increases annually with 537 million adults worldwide suffering from diabetes in 2021, with a projected increase of 45% or the equivalent of 783 million patients. Indonesia is on alert because it ranks 5th out of 10 countries (IDF, 2022). In Maluku province, the prevalence of diabetes mellitus in 2013 was 1.0% and increased in 2018 by 1.3% (Tofure et al., 2021). This if not treated properly will result in both macrovascular and microvascular complications (Widiasari et a., 2021 macrovascular such as coronary heart, peripheral blood vessels and stroke while microvascular complications, such as retinopathy, nephropathy and neuropathy (Midawati et a., 2019). Microvascular complications can be one of which is peripheral neuropathy which can result in nerve damage caused by weakness and damage to the walls of blood vessels kapier that nourishes the nerves (Prasetyani & Martiningsih, 2019).

Peripheral neuropathy is one of the most common microvascular complications of diabetes mellitus and can worsen the quality of life of the sufferer, peripheral neuropathy is very dangerous because it can cause various problems including leg amputation even to amputation, sexual dysfunction, impotence, other nervous system disorders including diabetic retinopathy, and can result in death (Indriani et a., 2019), Peripheral Neuropathy is one of the complications which is severe for people with diabetes mellitus and is associated with various factors (Rachman & Dwipayana, 2019). Epidemiological data show that the prevalence of Peripheral Neuropathy is 30% in inpatient diabetic patients and 20% in outpatient patients, the prevalence of diabetic Peripheral Neuropathy is higher in eastern

Received: June,16,2025;
Revised: June,30,2025;
Accepted: July,17,2025;
Published: July,31,2025;
Curr. Ver.: July,31,2025;

countries such as Egypt (61.3%), Jordan (57.5%), and Ebanon (53.9%), while the prevalence in Asian countries such as Korea is around 10-50% of DM patients with peripheral neuropathy, In Indonesia, according to the data and information center of the Indonesian Hospital Association (PERSI), the prevalence of diabetic neuropathy in 2011 in DM patients exceeding 50% is corroborated by the results of Basic Health Research (RISKESDAS) in 2018 which shows that the most DM complications are Peripheral Neuropathy and are experienced by around 54% of patients treated at Cipto Mangunkusomo Hospital Jakarta (RSCM) (Tofure et a., 2021)

Peripheral neuropathy is one of the complications of DM caused by nerve damage that causes weakness and damage to the walls of the capillary blood vessels that provide nerve nutrients (Prasetyani & Martiningsih, 2019). The main symptoms of diabetic neuropathy vary, including numbness, tingling and pain to the point of reducing pain sensations starting from the extremities of the dista which can cause patients to often fall, injuries, restriction of movement and decreased quality of life (Rahmi AS et a., 2022), Most of the patients who experience Peripheral Neuropathy do not realize that they have nerve damage because they think it is just part of getting older, there are many factors that cause the occurrence of peripheral neuropathy such as the status of having DM, BMI, hypertension and age (Rachman & Dwipayana, 2019)

Peripheral neuropathy can also be prevented by making various efforts such as conducting initial screening to detect peripheral neuropathy using the Ipswich Touch Test (Iptt) method, examination with this method is quite simple and fast because the peak time does not use instruments so that it only uses 1-2 seconds on each toe when screening patients, the IpTT method also does not require special tools so it is simpler (Suistiani et a., 2022) The prevention of peripheral neuropathy can also be recognized by participating in sports activities, participating in health education, especially in DM patients, and routinely controlling blood sugar to health centers which are strategic public health service units in Indonesia (Indriani et a., 2019)

2. Methods

This study uses a design, which is a descriptive research design with a Cross sectional approach. The population used is DM patients at the Padang Bulan Medan health center, which totals 974 people in 2023.

In this study, the sampling technique used is Non Probability sampling with the accidental sampling method, namely random sampling, that is, anyone who happens to meet the author can be used as a sample, if the person who happens to be met matches the data source (Nursalam, 2020). In this study, sampling was carried out, with a sampling technique using the Slovin formula. The variable in this study was peripheral neuropathy.

The instruments used are IpTT SOPs, medical records and observation sheets. Primary data in this study is observation using the IpTT method in DM patients, Secondary data in this study is medical record data on DM patients at the Padang Bulan Medan Health Center.

In this study, the data analysis used is univariate data analysis on the variables of Length of Suffering from DM, BMI, Hypertension, age and Incidence of Neuropathy which will be presented in the form of a distribution table of frequency and percentage Overview of Risk Factors for Peripheral Neuropathy at the Padang Bulan Medan Health Center.

This research is also ethically feasible from the ethics commission with No.031/KEPK-SE/PE-DT/III/2024.

4. Results and Discussion

Table 1 Distribution of Frequency and Percentage of Risk Factors for Peripheral Neuropathy in DM Patients at Padang Buan Medan Health Center in 2024 (n=91)

Risk factor		Frequency	Percentage
Long Suffering from DM	Long suffering from DM ≤ 5 Years	37	40.7
	Long Suffering from DM > 5 Years	54	59.3
	Total	**91**	**100.0%**
IMT	- That (<18,9 kg/m2)	3	3.3
	- Normal (19-24,9 kg/m2)	25	27.5
	- Fat (25-29,9 kg/m2)	46	50.5
	- Obesity (>30 kg/m2)	17	18.7
	Total	**91**	**100.0%**
Hypertension	- Yes	61	67
	- No	30	33
	Total	**91**	**100.0%**
Age	- Early adults (25-35 years)	0	0
	- Late Adult(36-45 Years)	5	5.5
	- Early Seniors (46-55Years)	7	7.7
	- Late Elderly (> 56 Years)	79	86.8
	Total	**91**	**100.0%**

Table 2 Distribution of Frequency and Percentage of Neuropathy Incidence in DM Patients at the Padang Bulan Medan Health Center

Incidence of Neuropathy	Frequency (f)	Percentage(%)
No neuropathy	80	87,9
Neuropaths	11	12,1
Total	**91**	**100.0**

Table 3 Distribution of Frequency and Percentage of Respondents based on Risk Factors for Neuropathy with Neuropathy Incidence in DM Patients at the Padang Buan Health Center Medan

Risk factor	No Neuropathy		Neuropaths		Total
	f	%	*f*	%	
Long DM					
≤ 5 Tahun	37	100,0	0	0,0	37
> 5 Tahun	43	79,6	11	20,4	54
Total	**80**	**87,9**	**11**	**12,1**	**91**
IMT					
That	2	66,7	1	33,7	3
Normal	23	92,0	2	8,0	25
Fat	40	87,0	6	13,0	46
Obesity	15	88,2	2	11,8	17
Total	**80**	**87,9**	**11**	**12,1**	**91**
Hypertension					
Yes	53	86,9	8	13,1	61
No	27	90,0	3	10,0	30
Total	**80**	**87,9**	**11**	**12,1**	**91**
Age					
Early adulthood	0	0,0	0	0,0	0
Late Adulthood	5	100,0	0	0,0	5
Early Elderly	6	85,7	1	14,3	7
Late elderly	69	87,3	10	12,7	79
Total	**80**	**87,9**	**11**	**12,1**	**91**

5. Discussion

Risk factors for peripheral neuropathy in DM patients at Padang Buan Health Center Medan

In this discussion, 4 risk factors for peripheral neuropathy in DM patients are described Based on the results of the research of 91 respondents that have been carried out, 54 respondents (59.3%) have DM for more than 5 years and 37 people (40.7%) have DM sufferers.

DM sufferers who have suffered from DM for more than 5 years will have an impact on uncontrolled blood glucose levels The longer a person suffers from DM, the higher the risk of worsening nerve damage, chronic hypoglycemia at the stage of DM disease can trigger biochemical homeostatic changes that will affect small nerve fibers and along with the increase in duration the disease will be followed by large nerve fibers and later related to a decrease in speed of nerve conduction and can result in the occurrence of peripheral neuropathy (Rahmi AS et a., 2022).

Suffering from DM for more than 5 years is one of the risk factors for neuropathy but it cannot be associated because in this research using the IpTT Method, quite a lot of patients who have DM for more than 5 years but are not affected by Neuropathy, of 54 patients who have DM for more than 5 years, only 11 (20.4%) people have Neuropathy, compared best to the study (Rahmi AS et a., 2022) Where in the study it was found that suffering from DM for more than 5 years is one of the main factors for Peripheral Neuropathy, out of 44 respondents with DM, 33 people (75%) experienced Neuropathy. It can be said that the majority of peripheral neuropathy is present. DM over 5 Years, Has a risk factor of Peripheral Neuropathy 4-5 times compared to DM less than 5 Years, Patients who suffer from DM for longer can result in a high risk of Peripheral Neuropathy events. The longer DM lasts, the more it will cause damage to various body systems, especially nerves and blood vessels and can lead to worse risks such as heart disease and stroke, foot amputation, infections and even leg amputation (Seano, 2021)

BMI is also a risk factor for peripheral neuropathy. Based on the results obtained by researchers at the Padang Bulan Health Center in Medan, IMT Fat (25-29.9 kg/m2) as many as 46 people (50.5%), Thin (<18.9 kg/m2) 3 people (3.3%), Norma (19-24.9 kg/m2) 25 people (27.5%) and obese (>30 kg/m2) 17 people (18.7%).

Being overweight or overweight causes a decrease in the number of insulin receptors that can work in cells in the skeletal muscle and fat tissue, this is due to peripheral insufficiency resistance, obesity also damages the ability of beta cells to release insulin when there is an increase in blood glucose if not treated immediately, it can lead to complications of peripheral neuropathy (Imaambasi et a., 2022)

The body weight of DM sufferers has BMI (25-29.9 kg/m2) because most patients are in their final age so they have reduced both light and heavy physical activities such as exercise and housework so that body movements are reduced and increase BMI in DM patients, Supported by research (Cahyani, 2024) Physical activity is one of the non-pharmacological treatments recommended for DM sufferers and is very important in controlling blood sugar levels, blood glucose decreases when a person does heavier physical activity every day, this is because when a person is really active it can increase the response of insulin receptors in active muscles thereby reducing complications of DM.

DM sufferers are overweight, eptin levels in the body will increase, eptin levels in the body are related to obesity genes, eptin in the body functions in the peripheral and central nervous systems (Imaambasi et a., 2022)

Hypertension is a risk factor for peripheral neuropathy. Based on the results obtained at the Padang Bulan Medan Health Center, more than half of the respondents had a history of hypertension in 61 people (67%) and no history of hypertension in 30 people (33%).

Hypertension can occur in DM due to reduced physical activity so that it can have an impact on the cardiovascular condition of DM sufferers can cause complications in DM sufferers, Supported by research (Rahmatiah et a., 2020) the higher the blood sugar level, the more blood volume needed for the supply of oxygen and food to the body tissues, so that the arterial walls will be under greater pressure causing an increase blood or hypertension.

HipTension and DM are two interrelated conditions and as a trigger, the onset of microvascular damage to insulin resistance. Hypertension is related to the incidence of Peripheral Neuropathy through the condition of blood vessels that are narrowed and will cause hypoxia, ischemic nerve tissue and cause reduced sensitivity so that peripheral

neuropathy occurs (Duarsa et a., 2019). Hypertension is the cause of an increased risk of peripheral neuropathy by four times, due to the narrowing of blood vessels so that the process of transporting nutrients in the blood to the peripheral nerves decreases and causes neuropathy (Wahyuni et a., 2021)

Age factors are also risk factors for peripheral neuropathy. Based on the results of research obtained at the Padang Bulan Medan Health Center, the age of the elderly at the end of > 56 years 79 people (86.8%), the early elderly 7 people (7.7%), and the late adults 5 (5.5%)

The age of the elderly who experience uncontrolled DM can cause microvascular complications due to the reduced ability of pancreatic beta cells, because increasing age will result in changes in the walls of the blood vessels, where the intima layer thickens so that blood vessels experience stiffness, and results in decreased oxygen and nutrients so that ischemic occurs and over time can lead to neuropathy (Prasetyani & Martiningsih, 2019).

The elderly mostly suffer from DM due to reduced physical activity done, generally the elderly spend more time at home and a diet that is not well controlled. This is supported by research (Meiani et a., 2022), uncontrolled physical activity and diet can cause a sudden increase in blood glucose and if not monitored in the long term, this condition can later cause complications of diabetes mellitus because body cells cannot use insulin optimally. Increasing age can stimulate the degeneration process and cause damage to nerve cells. Changes in both large and small nerve fibers increase the susceptibility of age to neuropathy (Panjaitan et a., 2022).

Based on the observations of researchers during research at the Padang Bulan Medan Health Center, many DM patients are registered as DRR (Good Referred Patients) who are routinely controlled, check blood glucose levels and take medication every month at the Padang Bulan Medan Health Center so as to reduce the risk of neuropathy. supported by research (Simamora, Siregar, 2020) It also states that with effective treatment it will lower the rate of complications, further and fatal complications. Treatment actions that are recognized both pharmacological and non-pharmacology. Among them are pharmacological treatment by administering drugs, while non-pharmacological treatment such as foot care.

The researchers' observations also during the research at the Padang Bulan Medan Health Center, the Health Center has a program to conduct counseling about DM to the elderly, supported by research (Simarmata et a., 2022), with counseling about DM carried out on an ongoing basis is an effective prevention to avoid further complications and prevent peripheral vascular problems such as peripheral neuropathy.

Peripheral neuropathy is a complication of DM caused by nerve damage that causes weakness and damage to the walls of the capillary blood vessels that provide nerve nutrients (Prasetyani & Martiningsih, 2019). Symptoms of diabetic neuropathy vary, including numbness, tingling and pain to result in reduced tactile sensations starting from the extremities of the dista part which can cause patients to often fall, injure and even decrease quality of life (Rahmi AS et a., 2022),

Patients with DM who experience peripheral neuropathy are mostly unaware that they have nerve damage because they have the assumption that it is part of getting older, and many other factors that can cause peripheral neuropathy such as the long-standing status of having DM, BMI, and hypertension (Rachman & Dwipayana, 2019), so that Peru makes efforts to prevent neuropathy by regularly controlling and checking blood sugar, taking drugs regularly and conducting foot examinations by conducting initial screening to detect peripheral neuropathy using the Ipswich Touch Test (Iptt) method (Suistiani et a., 2022)

6. Conclusions

Based on the results of the study with a sample of 91 respondents in DM patients at the Padang Bulan Medan Health Center in 2024, several conclusions can be drawn, namely from the 4 risk factors studied, (59.3%) respondents suffered from DM for more than 5 years, (50.5%) respondents had obese BMI category, (67%) respondents had a history of hypertension, (86.8%) respondents were in late elderly age and the majority of respondents with DM did not experience neuropathy as many as 80 people (87, 9%).

Conflicts of Interest: The authors declare no conflict of interest

References

1) Anugerah, S. N. M. S. H. (2020). Buku ajar: Diabetes dan komplikasinya (Textbook: Diabetes and its complications). https://www.google.co.id/books/edition/Buku_Ajar_Diabetes_Dan_KomplikasinyA/2dZMEAAAQBAJ?hl=jv&gbpv=1
2) Asrizal. (2022). Manajemen perawatan luka: Teori dan aplikasi (Wound care management: Theory and application). https://www.google.co.id/books/edition/Buku_Ajar_Manajemen_Perawatan_Luka_Teori/QC6gEAAAQBAJ?hl=jv&gbpv=1
3) Below is the provided list of references, meticulously formatted according to the APA 7th edition style guidelines. I have standardized the author names, publication years, titles, and journal information, and included DOIs and URLs where they were provided in the original text.
4) Bubun, J., Yusuf, S., Syam, Y., Hidayat, W., & Usman, S. (2020). Diabetic foot screening for early detection of diabetic foot ulcer in diabetic patients. Scientific Journal of Nursing, 6(2), 192–198.
5) Cahyani, C. G. (2024). The relationship between nutritional status, carbohydrate and fat intake levels, and physical activity with the incidence of diabetes mellitus in the elderly in Kricak Village, Yogyakarta. Journal of Nutrition, University of Surabaya, 4(1), 562–570.
6) Duarsa, M. D. V. I., Arimbawa, I. K., & Indrayani, I. A. S. (2019). Hypertension as a risk factor for diabetic neuropathy pain in Type II diabetes mellitus patients at Sanglah Denpasar Hospital. Udayana Medicine, 8(10), 1–6.
7) Febriani, R. P., Prabowo, N. A., Putri, D. P., & Setyawan, S. (2023). Diabetes guidelines for patients and families.
8) Final. (2021). Type 2 Diabetes Mellitus of the Ministry of Health of Yogyakarta. Journal of Nursing, 13–43.
9) Gau, A. L., Djafar, R. H., & Setyo, B. D. (2019). The relationship between body mass index and risk of diabetic feet in Type II DM patients at Tumintang Health Center, Manado City. Journal of Health: Amanah Nurses Study Program, University of Muhammadiyah Manado Tuminting Manado City, 3(2580–4189), 115–122.
10) Imalambasi, N. N., Triwahyuni, T., Nusri, T. M., & Kriswiastiny, R. (2022). Long relationship of suffering from Type 2 Diabetes Mellitus and blood sugar levels with body mass index (BMI) in Type 2 Diabetes Mellitus patients at Pertamina Bintang Amin Husada Hospital Bandar Lampung. Source: Malahayati Health Student Journal, 2(4), 674–684. https://doi.org/10.33024/mahesa.v2i4.5889
11) Indriani, S., Amalia, I. N., & Hamidah, H. (2019). The relationship between self care and the incidence of peripheral neuropathy in Type II diabetes mellitus patients at Cibabat Cimahi Hospital 2018. Bhakti Husada Health Sciences Journal, 10(1), 54–67. https://doi.org/10.34305/jikbh.v10i1.85
12) Kadri, H., & Nurfitriani, N. (2021). The relationship of long suffering and body mass index to neuropathy symptoms in patients with diabetes mellitus in the working area of the Conoci Besar Health Center. Baiturrahim Jambi Academic Journal, 10(2), 446. https://doi.org/10.36565/jab.v10i2.414
13) Khoirul, F., Khoirun, M., Nanda, H., Setya, H., Nur, M., Maulana, Z. A., & Fauziyyah, H. L. (2022). Effectiveness of foot care against peripheral neuropathy symptoms in patients with diabetes mellitus with Michigan Neuropathy Screening Instrument. 4(31601900074), 1426–1434.
14) Last, & Usman. (2021). Practical guide to diabetes and neuropathy risk screening (Vol. 1).
15) Lewis, L. S. (2014). Medical surgical nursing. Geen Kristin.
16) Meilani, N., Azis, W. O. A., & Saputra, R. (2022). Risk factors for the occurrence of diabetes mellitus in the elderly. Politeknik: Journal of Health Sciences, 15(4), 346–354. https://doi.org/10.33860/jik.v15i4.860
17) Mildawati, D., & Wahid, A. (2019). Relationship of age, sex and length of diabetes with the incidence of diabetic peripheral neuropathy. Caring Nursing Journal, 3(2), 31–37.
18) Munir, N. W., & Yuliana, A. (2023). Education on the prevention and control of diabetes mellitus. Diabetes Mellitus Prevention and Control Education, 3(1), 2014–2017.

19) Nurjannah, M. (2023). Hipoglikemi pada penderita diabetes mellitus (Hypoglycemia in people with type 2 diabetes mellitus). https://www.google.co.id/books/edition/Hipoglikemi_Pada_Penderita_Diabetes_MelI/Yl68eaaaqbaj?Hl=Jv&Gbpv=0
20) Nursalam. (2020). Metodologi penelitian ilmu keperawatan (Nursing science research methodology) (5th ed.). Puji Peni Lestari.
21) Panjaitan, N., Siagian, L. O., & Tarigan, M. B. (2022). A long-standing relationship of suffering from type 2 diabetes mellitus with the incidence of diabetic neuropathy at Dr. Pirngadi of Medan City in 2018-2022.
22) Polit, & Beck. (2012). Nursing research (9th ed.).
23) Prasetyani, D., & Martiningsih, D. (2019). Analysis of factors influencing the incidence of diabetic neuropathy in patients with type 2 diabetes mellitus. Journal of Health, Midwifery, and Nursing, 12(1), 40–49.
24) Rachman, A., & Dwipayana, I. M. P. (2019). Prevalence and relationship between glycemic control and diabetic peripheral neuropathy in patients with type II diabetes mellitus at Sanglah Hospital. Udayana Medical Journal, 9(1), 33–37. https://ojs.unud.ac.id/index.php/eum
25) Rahmatillah, V. P., Susanto, T., & Nur, K. R. M. (2020). The relationship between characteristics, body mass index (BMI) and blood pressure in the elderly at Posbindu. Health Research and Development Media, 30(3), 233–240. https://doi.org/10.22435/mpk.v30i3.2547
26) Rahmi, A. S., Syafrita, Y., & Susanti, R. (2022). A long-standing relationship with Type 2 DM with an incidence of diabetic neuropathy. JMJ, 10(1), 20–25.
27) References
28) Riahmah. (2022). Perilaku kesehatan pasien diabetes mellitus (Health behavior of diabetes mellitus patients). https://www.google.co.id/books/edition/Perilaku_Kesehatan_Pasien_Diabetes_Melit/6LZoEAAAQBAJ?hl=jv&gbpv=0
29) Richard Donelly, & Bilous, R. (2014). Buku pegangan diabetes (S. K. N. Barrah Bariid, Ed.). https://www.google.co.id/books/edition/Buku_Pegangan_Diabetes_Edisi_4_Terjemaha/uWFlEAAAQBAJ?hl=jv&gbpv=0
30) Sagita, P., Apriliana, E., Mussabiq, S., & Soleha, T. (2020). The effect of soursop leaves on diabetes. Journal of Medicine Hutama, 3(1), 1266–1272.
31) Selano, M. K. (2021). A long-standing association of suffering with the incidence of diabetic neuropathy in patients with diabetes mellitus. Journal of Smart Nursing, 8(2), 129. https://doi.org/10.34310/jskp.v8i2.505
32) Simamora, & Siregar, H. (2020). The effect of diabetic foot gymnastics on the intensity of neuropathic pain in people with Type II diabetes mellitus. Journal of Health, 1(4), 175–179.
33) Simarmata, P. C., Sitepu, S. D. E. U., . D., & . H. (2022). Education Buerger Allen exercise in preventing peripheral neuropathy in diabetes mellitus patients. Jurnal Pengmas Kestra (JPK), 2(1), 1114–1118. https://doi.org/10.35451/jpk.v2i1.1152
34) Simatupang, R. (2020). Pedoman diet penderita diabetes melitus (Dr. A. Rahman, Ed.). https://www.google.co.id/books/edition/Pedoman_Diet_Penderita_Diabetes_Melitus/Haf1dwaaqbaj?Hl=Jv&Gbpv=1
35) Sulistiani, I., Djamaluddin, N., & Rahim, N. K. (2022). Skrining Kaki Diabetes "Ipswich Touch Test (IPTT)" dalam mendeteksi resiko luka kaki pada pasien DM. Borneo Community Health Service Journal, 2(2), 28–33. https://doi.org/10.35334/neotyce.v2i2.2815
36) Sumarni, T., & H, Y. D. (2023). Foot exercises for the prevention and treatment of diabetic peripheral neuropathy in patients with diabetes mellitus. 2(2). https://doi.org/10.35960/pimas.v2i2.1016

37) Suri, I. K., Medicine, F., Eleventh, U., Surakarta, M., Medicine, M. F., Eleventh, U., Surakarta, M., & Article, I. (2022). Diabetic neuropathy: Contribution of individual characteristics, length of illness, smoking, and hyperglycemia.

38) Tofure, I. R., Humphrey, L. B. S., & Astuty, E. (2021). Characteristics of patients with diabetic peripheral neuropathy at the Neurological Polyclinic of Dr. M. Haulussy Ambon Hospital in 2016-2019. Molucca Medica, 14(Dm), 97–108.

39) Wahidah, N., & Rahayu, S. R. (2022). Determinants of diabetes mellitus in young adulthood. Higeia Journal of Public Health Research and Development, 6(1), 114–125. http://journal.unnes.ac.id/sju/index.php/higeia

40) Wahyudi, D. A., Susanto, G., Stiexs, A., Wahyudi, M. T., & Sadhana, W. (2023). The relationship between glucose and blood pressure levels with the incidence of diabetic ulcers in Type 2 DM patients at the Tiuh Tohou Menggala Health Center. Health Research Journal of Indonesia, 1(6), 229–236.

41) Wahyuni, N. P. A., Antari, G. A. A., & Yanti, N. L. P. E. (2021). Overview of the level of peripheral neuropathy in patients with Type 2 diabetes mellitus at Wangaya Hospital. Coping: Community of Publishing in Nursing, 9(2), 188. https://doi.org/10.24843/coping.2021.v09.i02.p09

42) Widiasari, K. R., Wijaya, I. M. K., & Suputra, P. A. (2021). Type 2 diabetes mellitus: Risk factors, diagnosis, and management. Ganesha Medicine, 1(2), 114. https://doi.org/10.23887/gm.v1i2.40006