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Effectiveness of the Monofilament Test and Ipswich Touch Test (IpTT) in the Early Detection of Neuropathy Complications in Patients with Type 2 Diabetes Mellitus

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ABSTRACT

Backgrounds: Diabetes Mellitus is a condition characterized by high levels of sugar in the blood caused by abnormal insulin production in the body, leading to metabolic disorders that can gradually damage parts or all of the body. Diabetes mellitus can cause serious complications if not properly treated or managed, including neuropathy, which is the most common complication resulting in nerve damage. Neuropathy can be detected early in several ways, including using the monofilament test and Ipswich touch test (IpTT).
Purpose: To compare the effectiveness of the monofilament test and Ipswich touch test (IpTT) in the early detection of neuropathy complications in patients with type 2 diabetes mellitus.
Method: This study is a quantitative quasi-experiment with a posttest-only control group design. The sample in this study consisted of 32 patients with type 2 diabetes mellitus, divided into 2 groups: 16 respondents who were treated with the monofilament test and 16 respondents who were treated with the Ipswich touch test. Due to the results of the statistical analysis indicating non-normally distributed but homogeneous data, the Mann-Whitney test was used for data analysis.
Results: From the results of the tests carried out, a significance value of 0.003 < 0.05 was obtained; this suggests that the Monofilament Test and Ipswich Touch Test (IpTT) are effective in the early detection of neuropathy complications in patients with type 2 diabetes mellitus. However, between the two, the monofilament test was found to be more effective compared to the Ipswich Touch Test, with a mean result of 20.84 > 12.16.
Conclusions: Both the monofilament test and Ipswich touch test (IpTT) are effective in the early detection of neuropathy complications in patients with type 2 diabetes mellitus.

Keywords: ipswich touch test, monofilament test, neuropathy complications

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BACKGROUND

Diabetes Mellitus (DM) is a medical condition characterized by high blood sugar levels (hyperglycemia) where the body has difficulty releasing or is unable to use insulin optimally, which can damage various human body systems (Hardianto, 2021). According to Sakinah, (2020), hypoglycemia is a symptom of diabetes mellitus (DM), a metabolic disorder caused by changes in insulin secretion, insulin action, or insulin receptor function, which prevents cells from receiving glucose for metabolization. Diabetes mellitus is like termites that work silently and damage every organ in the body, which is why diabetes mellitus is often referred to as the "silent killer". The severity of this disease can damage all vital human organs (Febriyan, 2020).

The International Diabetes Federation (IDF) stated that the number of Diabetes Mellitus cases worldwide in 2021 was 10.5% (536.6 million people), and is expected to increase to 643 million in 2030 and reach 12.2% (783.2 million) in 2045. According to the IDF, the prevalence of Diabetes Mellitus in 2021 is higher in cities (12.1%) than in rural areas (8.3%). With 140.87 million people, China had the largest number of adults with diabetes mellitus in the world in 2021, according to the IDF. India had 74.19 million, Pakistan 32.96 million, and the United States 32.22 million. With 19.47 million patients, Indonesia was in fifth place, which is around 10.6% of Indonesia's total population of 179.72 million that year (IDF, 2021).

According to the 2018 Riskesdas results, the prevalence of Diabetes Mellitus in Indonesia for individuals aged 15 years and over, based on a doctor's diagnosis, reached 2%. This figure shows an increase from the prevalence of 1.5% in 2013. However, the prevalence of Diabetes Mellitus based on blood sugar examination increased from 6.9% in 2013 to 8.5% in 2018. This shows that only around 25% of diabetes patients are aware of their condition. In 2019, South Sulawesi had 80,788 cases of Diabetes Mellitus (DM). Makassar City had 18,305 cases, Barru Regency had 881 cases, and Sidenreng Rappang Regency—ranked 19th, has 1,208 cases (South Sulawesi Provincial Health Service, 2019).

Patients with type 2 Diabetes Mellitus at UPT RSUD Nene Mallomo numbered 367 people in 2020, 627 people in 2021, 1377 people in 2022, and 1252 people from January to September 2023.

Diabetes Mellitus can cause various complications that can appear suddenly or develop over a long period of time. One complication that is often encountered is neuropathy, which causes nerve damage in the feet so that they are unable to feel cold, hot or pain.(Fajriyah et al., 2020).

Among the macrovascular complications that often appear in those with diabetes is Diabetic Neuropathy, which can worsen the patient's quality of life. Diabetic peripheral neuropathy (DPN) is a disease that usually occurs in the peripheral parts of the body and attacks all types of nerves, including the sensory, motor, and autonomic nervous systems (Tofure et al., 2021). Because peripheral nerves have limited regeneration capacity, Screening examinations and early identification of complications in patients with type 2 diabetes mellitus can help patients to be more active in controlling sugar levels more optimally before serious morbidity occurs. Clinical research proves that the efficacy of screening and early identification of neuropathy complications, significantly reduces the incidence of diabetic foot ulcers and amputations. The monofilament test and Ipswich touch test (IpTT) can slow or prevent early peripheral nerve damage (Simanjuntak & Simamora, 2020).

Monofilament is a method that has become the standard for examining peripheral nerve damage leading to neurosensory foot issues and is effective for identifying loss of protective sensation (LOPS). In testing the touch sensation of a 10-g Semmes-Weinstein Monofilament (SWM), a 5.07 gauge Semmes-Weinstein monofilament thread with a force of 10 grams is used. This test is performed at nine points on the soles of the feet and one point on the instep. Results are considered abnormal if the patient cannot feel more than three points (Purbasari et al., 2018).

Until now, the use of monofilaments has not been effective because they are considered expensive and are rarely used. Therefore, simpler methods without special equipment can be used to test foot sensitivity in detecting neuropathy in patients with diabetes. One such method is the Ipswich Touch Test (IpTT), which can replace the Monofilament Test (Fajriyah et al., 2020).

The Ipswich Touch Test (IpTT) is a test that can be performed by caregivers and non-professionals alike. It is simple to perform yet provides important information about neuropathy. No instruments are required, it can be sterilized by hand washing, is easy to perform, and provides instant results (Rayman et al., 2019).

The IpTT method has several advantages: it incurs no additional costs and only requires the examiner's finger to perform. It requires minimal training, so that every health practitioner can do it easily—and with its simplicity, authorized parties can perform it effortlessly. Another advantage is that the IpTT can be recommended for early detection of the risk of neuropathy and peripheral arterial disease, potentially leading to cost savings by preventing Diabetic Foot Ulcer (DFU) (Ilham et al., 2021).

METHOD

This study used a quasi-experimental quantitative design with a posttest-only control group design. The research sample was divided into two groups: one group treated with the monofilament test, and the other group treated with the Ipswich touch test. Measurements were taken after the treatment (posttest). This study was carried out from March 9 to April 9, 2024, at UPT RSUD Nene Mallomo, Sidenreng Rappang district.

Samples were taken from 1252 patients with type 2 diabetes mellitus who visited UPT RSUD Nene Mallomo, Sidenreng Rappang Regency, between January and September 2023. The determination of the number of samples in this study was based on Gay & Diehl (in Mahmud, 2011:159) which state that in experimental research, the minimum sample size is 15 subjects per group. Researchers also accounted for potential errors in selecting respondents, such as withdrawals or dropouts. The dropout criterion was set at 5% of the calculated sample size. With 5% of the 15 samples being 1 person, the total number of samples was adjusted to 32.which were then divided into two groups: 16 respondents in the monofilament test group and 16 respondents in the Ipswich touch test (IpTT) group. The selection of the 32 respondents was random.

Statistical tests were carried out using SPSS 16.0, and consisted of univariate analysis and bivariate analysis. Univariate analysis analyzed the research variables as a whole, producing the distribution and presentation of each variable as well as the distribution of respondents' demographic attributes, such as gender, age, and duration of suffering from diabetes mellitus. , bivariate analysis analyzes the relationship between the independent variable and the dependent variable such as the T test which is carried out if the data is homogeneously distributed and meets the assumption of normality, however if the data is homogeneously distributed but the data is not normally distributed then the Mann-Whitney

test can be carried out to determine whether there is a significant difference between both of them.

RESULTS

Table 1. Distribution of respondent characteristics based on gender

Gender	Total	
	n	%
Male	11	34.4
Female	21	65.6
Total	**32**	**100**

In Table 1, it can be seen that out of the 32 respondents in the gender characteristics category, 11 respondents (34.4%) were males, while 21 respondents (65.6%) were females.

Table1. Distribution of respondent characteristics based on age

Age	Total	
	n	%
20-40 years old	2	6.3
41-60 years old	19	59.4
61-80 years old	11	34.4
Total	**32**	**100**

In Table 2, it can be seen that out of the 32 respondents in the age characteristics category, 2 respondents (6.3%) were aged 20-40 years, 19 respondents (59.4%) were aged 41-60 years, and 11 respondents (34.4%) were aged 61-80 years.

Table 3. Distribution of respondent characteristics based on years of suffering from DM

Years of suffering from DM	Total	
	n	%
< 1 year	5	15.6
1-5 years	22	68.8
> 5 years	5	15.8
Total	**32**	**100**

In Table 3, it can be seen that out of the 32 respondents in the years of suffering from DM characteristics category, 5 respondents (15.6%) had suffered for less than 1 year, 22 respondents (68.8%) had suffered for 1-5 years, and 5 respondents (15.6%) had suffered for more than 5 years.

Table 4. Distribution of respondents based on the results of the tests carried out

Results	Monofilament		IPTT	
	n	%	n	%
Low risk	8	50	14	87.5
Medium risk	6	37.5	1	6.3
High risk	2	12.5	1	6.3
Total	**16**	**100**	**16**	**100**

In Table 4, it can be seen that out of the 32 respondents in the test result characteristics category, the monofilament test results showed 8 respondents (50%) at low risk, 6

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respondents (37.5%) at medium risk, and 2 respondents (12.5%) at high risk. The IpTT results showed 14 respondents (87.5%) at low risk, 1 respondent (6.3%) at medium risk, and 1 respondent (6.3%) at high risk.

Table 5. Comparison of the effectiveness of the monofilament test and Ipswich touch test (IpTT)

	Statistical tests				
Results	**Experiment**	**n**	**Mean Rank**	**Sum of Ranks**	**Asymp. Sig. (2-tailed)**
	Monofilament test	16	20.84	333.50	.003
	IPTT	16	12.16	194.50	
	Total	32			

Based on Table 5, the results show that the monofilament test is more effective than the Ipswich Touch Test (IpTT) in the early detection of neuropathy complications. This conclusion is drawn from the higher mean rank value for the monofilament test at 20.84 compared to 12.16 for the Ipswich Touch Test (IpTT).

The Mann-Whitney statistical test shows an Asymp.sig value of .003, which is less than the probability value of <0.05. Therefore, as a reference in the decision making process of the Mann-Whitney test, the conclusion "Ha is accepted" is appropriate—thus it can be seen that there is a comparison of the effectiveness of the monofilament test with the Ipswich touch test (IpTT) in the early detection of neuropathy complications in patients with type 2 diabetes mellitus at UPT RSUD Nene Mallomo, Sidenreng Rappang district.

DISCUSSION

Diabetes Mellitus is a disease characterized by high blood sugar levels (hyperglycemia) resulting from the body's failure to produce adequate insulin. If not properly treated or managed, diabetes mellitus can cause more serious health problems, including neuropathy, which is the most common complication.

Neuropathy, or impaired sensation, which the individual is often unaware of, causes diabetic foot ulcers. The early detection of neuropathy complications in patients with type 2 diabetes mellitus is very important. Preventive measures that can be taken include diabetic foot screening, such as testing sensation using the monofilament test and the Ipswich touch test (IpTT).

The results showed that, on the average, the respondents in this study were females with 21 (65.6%) people, aged 41-60 years with 19 (59.4%) people, Junior High School graduates with 12 (37.5%) people, housewives with 18 (56.3 %) people, suffering from DM for 1-5 years with 22 (68.8%) people. Monofilament test results showed low risk in 8 respondents (50%), medium risk in 6 respondents (37.5%), and high risk in 2 respondents (12.5%), whereas IpTT results showed low risk in 14 respondents (87.5%), medium risk in 1 respondent (6.3%), and high risk in 1 respondent (6.3%).

In the bivariate analysis, homogeneity and normality tests were carried out. The homogeneity test showed that the value was sign. 0.165 > 0.05, so it can be concluded that the data distribution is homogeneous. The normality test showed that the value was sign. 0.004 < 0.05, so it can be concluded that the data distribution is not normal. Therefore, comparisons between groups were determined using the Mann-Whitney test.

Based on the results of the Mann-Whitney test, a statistical test was carried out, and a sign value of 0.003 < 0.05 was obtained. Thus, it can be concluded that there is a significant difference in the effectiveness of the monofilament test and Ipswich touch test (IpTT) in the early detection of neuropathy complications in patients with type 2 diabetes mellitus at UPT RSUD Nene Mallomo. In the monofilament test, the mean rank was 20.84 with a sum of ranks of 333.50, while in the IpTT, the mean rank was 12.16 with a sum of ranks of 194.50. These results show that the monofilament test is more effective than the IpTT in the early detection of neuropathy complications in patients with type 2 diabetes mellitus.

These results are in line with the study conducted by Senthilkumar titled "Comparing the Ipswich Touch Test (IpTT) and 10gm-SMWF (10-gm Semmes–Weinstein Monofilament) in an Indian Population Subset with Type 2 Diabetes Mellitus to Detect Diabetic Neuropathy." The study found that the 10gm-SMWF monofilament test has a sensitivity of 94.7% and a specificity of 85.7%, while the IpTT has a sensitivity of 91.9% and a specificity of 85.7%. Therefore, the monofilament test is more effective and better for detecting neuropathy complications compared to the Ipswich touch test (IpTT). However, in the absence of a monofilament test, the IpTT is a more ideal alternative as it can be performed anywhere, including at the chairside and bedside, and can be conducted by non-professional staff (Senthilkumar et al., 2023).

There is a study that contradicts the aforementioned findings. Conducted by Hapipah and titled "*Efektifitas Ipswich Touch Test Terhadap Pemeriksaan Neuropati Sensori Pada Diabetes Mellitus Di Rumah Sakit Umum Daerah Kota Mataram*" (Effectiveness of the Ipswich Touch Test in Examination of Sensory Neuropathy in Diabetes Mellitus at RSUD Kota Mataram), this cross-sectional study using a diagnostic test method found that the Ipswich Touch Test (IpTT) and the 10-gram monofilament examination had the same effectiveness in the early detection of sensory neuropathy complications in patients with type 2 diabetes mellitus at RSUD Kota Mataram, with an AUC value of 98%.

Another study conducted by Dajrizal et al. (2023), titled "*Metode Monofilament Test dan Ipswich Touch Test untuk Deteksi Neuropati Sensorik Diabetes*" (The Monofilament Test and Ipswich Touch Test Methods for Detecting Diabetic Sensory Neuropathy), reviewed 10 articles from previous researchers. The results revealed that the 10g monofilament is the most common screening tool for diabetic sensory neuropathy due to its simplicity, objectivity, and ease of use--while the Ipswich Touch Test is the easiest screening method as it can be performed without any tools. The conclusion of this study is that both methods are equally effective for identifying diabetic sensory neuropathy disorders, although further research is needed to compare the sensitivity and specificity of the two methods.

CONCLUSION

From the research results, on the average, the respondents in this study were females with 21 (65.6%) people, aged 41-60 years with 19 (59.4%) people, and suffering from DM for 1-5 years with 22 (68.8%) people. Monofilament test results showed low risk in 8 respondents (50%), medium risk in 6 respondents (37.5%), and high risk in 2 respondents (12.5%), whereas IpTT results showed low risk in 14 respondents (87.5%), medium risk in 1 respondent (6.3%), and high risk in 1 respondent (6.3%). Both the monofilament test and Ipswich touch test (IpTT) are effective in the early detection of neuropathy complications in patients with type 2 diabetes mellitus. However, between the two, the monofilament test was found to be more effective compared to the Ipswich Touch Test, with a mean result of 20.84 > 12.16.

The results of this research can then add insight, knowledge and can be useful for future authors regarding the effectiveness of the monofilament test and Ipswich touch test in early detection of neuropathy complications in type 2 diabetes sufferers and also for future researchers to use other methods besides the Monofilament and Ipswich Touch Test in early detection of neuropathy complications in type 2 Diabetes Mellitus sufferers such as using the neuropathy deficit score (NDS) questionnaire and the Michigan neuropathy screening instrument (MNSI).

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CONFLICTS OF INTEREST

The limitations of this studyis that the researcher only used 32 respondents who were then divided into two groups. Suggestions for future researchers could be to use more respondents and also the extended time required to carry out the tests compared to the examination time for each outpatient, and the large number of patients, which resulted in only a few patients with type 2 Diabetes Mellitus being studied by the researchers.

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