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Effect of Massage, Foot Massage, and Warm Blanket Combination on Ankle Brachial Index in Diabetic Ulcer Risk

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ABSTRACT

Background: Diabetic ulcers are chronic complications of diabetes mellitus that can lead to infection and gangrene if not properly treated. Complementary therapies can help prevent diabetic ulcers by improving blood circulation and maintaining vasodilation. Preventive measures include massage, foot massage, and the application of warm blankets to support smooth blood flow.
Purpose: This study aimed to evaluate the effect of a combination of massage, foot massage, and warm blankets on changes in the Ankle Brachial Index (ABI) as a marker of diabetic ulcer risk.
Method: The research employed a quasi-experimental design with a one-group pre-test and post-test approach. A total of 30 respondents were selected using total sampling, with inclusion criteria being female diabetes mellitus patients diagnosed for more than a year, aged over 30 years, and free from leg ulcers. Pre-test ABI measurements were conducted on the second day of week 1. The intervention involved a 30-minute combination of massage, foot massage, and warm blankets, administered twice a week over three weeks. Post-test ABI data were collected at the sixth meeting in the third week.
Results: Before the intervention, the average ABI of respondents was 0.57, indicating a moderate risk. Following the intervention, the ABI improved to an average of 0.74, categorized as mild risk. Statistical analysis using the Wilcoxon test showed a significant effect ($p < 0.05$) of the intervention on ABI changes.
Conclusion: In conclusion, the combination of massage, foot massage, and warm blankets is an effective complementary therapy for maintaining foot health in diabetes mellitus patients, thereby reducing the risk of diabetic ulcers.

Keywords: ankle brachial index, foot massage, massase, ulkus diabetic, warm blanket

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ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.2. January 2025. Page.237-246

BACKGROUND

Diabetic ulcer is one of the chronic complications of Type 2 diabetes mellitus which is characterized by infection, ulceration, and/or damage to the deepest skin tissue of the leg in the sufferer, due to neurological abnormalities and peripheral vascular disorders (Decroli, 2019). Indonesia is the fifth country that has the highest number of people with diabetes mellitus in the world. The number of people with diabetes in Indonesia is estimated to reach 19.5 million people in 2021 In 2045, diabetes is estimated to increase to 28.4 million people according to the International Diabetes Federation (IDF) (Ratnasari et al., 2021). The prevalence of diabetic ulcers in Indonesia is around 15%, the amputation rate is 30%, in addition to the mortality rate 1 year after amputation is 14.8%. This is supported by Riskesdas (2018) data that the increase in the number of diabetic ulcer sufferers in Indonesia can be seen from the increase in prevalence by 11%. East Java Province is one of the regions in Indonesia with 2.02% of people with Diabetes mellitus in 2018 according to a report obtained by Riskesdas in 2018 (Riskesdas, 2018).

Diabetic ulcers are one of the most difficult diseases to fully recover from, and their poor healing conditions can lead to infections and gangrene, which ultimately results in more severe consequences, such as amputation of the lower extremities, or even death. Treatment has achieved good success in physical disorders in diabetic ulcer patients, among other things due to unbearable clinical symptoms, long-term hospitalization or great economic burden (Chen et al., 2020).

Diabetic ulcers can be prevented by doing cosmetic self-care but also reduce work productivity, increase dependence on others and high medical costs (Roza et al., 2015). Diabetic ulcers can also be prevented with complementary therapy. Complementary therapy is an action given as part of health nursing, consisting of various forms of health practice, aimed at improving the degree of health. Some of the most widely used complementary therapy techniques include: meditation, acupressure, massage and massage therapy, warm blankets, yoga, cupping, benson therapy, hypnotherapy and food combining, reduce the risk of diabetic ulcers so that the amputation rate can be reduced (Hartatik & Sari, 2021).

Ankle brachial index being one of the properly validated tests such as the measurement, which is also easily reproducible, will be very helpful in estimating the correct prevalence of peripheral arterial disease (PAD) in diabetics. The ankle brachial index is a simple but non-invasive test to quantitatively measure the patency of the arterial system of the lower extremities. To date, there has been no diagnosis of sufficiently sensitive clinical criteria recommended for the diagnosis of peripheral arterial disease (PAD). The ankle brachial index is rated 95% sensitive, and also 100% specific when validated against angiography (nibedita misra). Based on research. Ankle brachial index is used for noninvasive lower extremity vascular assessment, screening, and diagnosis of peripheral artery disease recommended by the International Working Group on the Diabetic Foot in 2020 (Wu et al., 2022).

Research conducted at PKU Muhammadiyah Gombong Hospital has proven this statement that the results of foot reflexology therapy have a significant effect on increasing the Ankle brachial index with a result of p = 0.000 (Yuwono et al., 2015). Research that has been conducted at the Baukan Baro Health Center, Pidie Regency has also proven the statement that this shows that the actions taken by the respondents have an impact on the change in the value of the Ankle brachial index, with a value of p = 0.00 ($p<0.05$), so it can be concluded that there is a difference in the value of the Ankle brachial index before and after the foot massage is performed.Research that has been conducted at Muhammadiyah Palembang Hospital proves that the results obtained from warm water foot soaking have a significant effect in increasing the Ankle brachial index with a result of p = 0.001 (Maryama

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.2. January 2025. Page.237-246

et al., 2021).

Peripheral abnormalities in the form of blood circulation obstruction in diabetic mellitus patients can be prevented by taking measures to improve blood circulation including massage, massage and warming the feet. The results of the research on reflexology and control of blood sugar levels increased the brachial index. Ankle brachial index is a criterion for smooth peripheral blood circulation (Cicek et al., 2021). Based on research (Wu et al., 2021), the Ankle Brachial Index is used for the assessment of lower extremity vascularization. The risk parameters of diabetic melitus ulcers can be seen from the Angkle Brachial index. Preventive measures for diabetic ulcers are: maintaining blood viscosity by maintaining stable blood sugar levels, maintaining smooth blood circulation with massage and foot massage and keeping blood vessels vasodilated, namely by giving warm blankets. This study uses a combination of therapy in the form of massage, foot massage and warm blanket in preventing the risk of diabetic melitus ulcers. Combination intervention massase, foot massage and warm blanket uses hand pressure to stimulate the skin and underlying tissues to reduce and relax pain or increase blood circulation to tissues, especially in the leg area so as to prevent ischemia. If ischemia can be prevented, hypoxemia and infarction will not occur so that the risk of ulcers can be prevented.

OBJECTIVE

The study aimed to determine the effect of combination intervention massage, foot massage and warm blanket on changes in ankle brachial index of diabetic ulcer risk.

METHODS

Quantitative research, quasy experiments with one group pre and post test design approaches. The independent variables were Combination Intervention Massase, Foot Massage And Warm Blanket. The dependent variable is the risk of diabetic ulcers. The number of samples of 30 respondents using the total sampling technique with the inclusion criteria of patients with diabetes mellitus who have been diagnosed for more than 1 year**,** female gender**,** age >30 years**,** no comorbidities, namely leg ulcers. Prior to the research, the research protocol had passed the ethical review by the UNIMUS Research Ethics Committee Number 0118/KEPK/VII/2022. Combination Intervention Massase, Foot Massage And Warm Blanket (temperature 41^{o}C – 42^{o}C) is a complementary therapy carried out by massaging the legs by stimulating the skin and underlying tissues using various levels of hand pressure and movement. and a warm blanket wrapped the feet with a warm damp towel and ankle brachial index measurements were taken before and after therapy. The therapists in this research are certified. Ankle brachial indexmeasuring device using a sphygmomanometer. The treatment of combination Intervention Massase, Foot Massage And Warm Blanket therapy began in the 1st week, the duration of therapy was 30 minutes, the implementation was carried out 2x in 1 week, a period of 3 weeks, ankle brachial index post test data was carried out at the 6th meeting, 3rd week. Ankle brachial index one group pre test post test design data collection for the 1st and 3rd weeks. This research was conducted at the Kalibaru Kulon Health Center, Banyuwangi Regency on September 27 – October 17, 2022. Statistical analysis of the study used the wilcoxon test because the data is not distributed normally.

RESULTS

The study was conducted on patients suffering from diabetes mellitus who were > 30 years old at the Kalibaru Kulon Health Center, Banyuwangi Regency. A total of 30

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.2. January 2025. Page.237-246

respondents. The presentation of the respondents will be described including name, age, gender, education, occupation, length of illness, and medication consumed by the respondent.

Table 1. Respondent characteristics based on education

Education	Frequency	Percent
Primary school	14	46.7
Junior High School	11	36.7
High School	5	16.7
Total	**30**	**100.0**

Based on table 1. above, it shows that most of the respondents have a primary school education of 14 respondents (46.7%).

Table 2. Respondent characteristics by occupation

Work	Frequency	Percent
Housewives	11	36.7
Farmer	11	36.7
Pedangang	3	10.0
Private	5	16.7
Total	**30**	**100.0**

Based on table 2. The above shows that most of the respondents work as farmers as many as 11 respondents (36.7%) and Housewives 11 respondents (36.7%).

Table 3. Characteristics of respondents based on the length of time the respondent has suffered

Long Suffering	Frequency	Percent
> 1 year	30	100%
< 1 Year	0	0%
Total	**30**	**100%**

Based on table 3. The above shows that all respondents have had diabetes mellitus for more than 1 year (100%).

Table 4. Characteristics of respondents based on Age of respondents

Age	Frequency	Percent
45-50	10	33%
51-55	7	23%
56-60	7	23%
61-65	6	20%
Total	**30**	**100.0**

Based on table 4. showed that the most respondents aged 45-50 were 10 respondents (33.3%) and 20% were 61-65 years old.

Table 5. Changes in Ankle brachial index risk of diabetic ulcers before and after Combination Intervention Massase, Foot Massage And Warm Blanket at Kalibaru Kulon Health Center, Banyuwangi Regency

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.2. January 2025. Page.237-246

Variable		Mean	Lowest	Highest	Standard Deviation
Change in Ankle brachial index risk Ulcer Risk	Before	0.57	0.30	1.32	0.179
	After	0.74	0.36	0.94	0.116

Based on table 5. the Mean score after the Combination Intervention Massase, Foot Massage And Warm Blanket was 0.74, an increase from the Mean value before the intervention (0.57).

Table 6. Categories of changes in Ankle brachial index risk risk of diabetic ulcers before and after Combination Intervention Massase, Foot Massage And Warm Blanket at Kalibaru Kulon Health Center, Banyuwangi Regency

	Category	Sum	Percent		Category	Sum	Percent
Before the Intervention	Light	2	7%	After the intervention	Normal	2	7%
	Keep	21	70%		Light	24	80%
	Heavy	3	10%		Keep	3	10%
	Calcification	1	3%		Heavy	1	3%

Based on table 6. Above in the first week before the intervention, the researcher measured the Ankle brachial index, obtained data for most of the Ankle brachial index scores in the medium category with an Ankle brachial index value of 0.40 – 0.69. The researcher carried out Combination Intervention Massase, Foot Massage And Warm Blanket 2x in 1 week and was evaluated in the 3rd week after the intervention with a mild category with an Ankle brachial index value of 0.70-0.90 and the complaints felt had decreased.

Table 7. Ankle brachial index score before and after being given Combination Intervention Massase, Foot Massage And Warm Blanket at the Kalibaru Kulon Health Center, Banyuwangi Regency

Variable	Mean	Standard Deviation	Asymp. Sig. (2-tailed)
Before	0.57	0.745	.000
After	0.74	0.116	

Based on table 7. After the Wilcoxon test, it was found that the value of Sig. (2-tailed) with a value of 0.00 < 0.05 showed that there was an effect of Combination Intervention Massase, Foot Massage And Warm Blanket Changes in Ankle Brachial Index Risk of Diabetic Ulcers.

Based on the table above, in the first week before the intervention, the researcher measured the Ankle brachial index, obtained data on most of the Ankle Brachial Index scores in the medium category with an Mean Ankle brachial index value of 0.57 with complaints felt by patients in the legs feeling numbness, tingling, pain like being pricked by a needle. The researcher conducted a Combination Intervention Massase, Foot Massage And Warm Blanket intervention 2x in 1 week and was evaluated in the 3rd week after the intervention with a mild category with an Ankle brachial index value of 0.74 and the complaints felt had decreased.

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.2. January 2025. Page.237-246

DISCUSSION

Respondent Characteristics Analysis based on Age, Gender and Last Education

This study shows that the most respondents are 45-50 years old with a total of 10 respondents (33.3%). The age factor is related to the physiology of old age where the older you get, the more body functions also decrease, including the action of the hormone insulin so that it cannot work optimally and causes high blood sugar levels (Rita, 2018). Risk factors for diabetes mellitus appear after the age of 45. This is because people at this age are less active, gain weight, lose muscle mass, and due to the aging process which results in progressive shrinkage of β cells. In addition, the incidence of diabetes increases with age, especially at the age of >40 years because at that age there begins to be an increase in glucose intolerance (Nugroho & Sari, 2019).

The study conducted by the researcher, all respondents were female, This study is supported by the results of research conducted by patients (Rita, 2018). In the Working Area of the Mataram Health Center, it was found that 59% of respondents had a female gender. Sex is a sex difference acquired from birth that is differentiated between males and females. Both men and women are at risk of developing diabetes mellitus. Women have a greater risk of developing Diabetes Mellitus, than men, because physically women have an increased chance of increasing the Ankle Brachial Index of the body with a greater monthly cycle syndrome (premenstrual syndrome). Post-monoupouse, which makes the distribution of body fat easily accumulated due to the hormonal process, makes women at risk of suffering from diabetes mellitus (Rita, 2018).

The study found that most of the respondents had an education level equivalent to elementary school with a total of 14 (46.7%) respondents, The level of education has an influence on the incidence of diabetes mellitus (Nugroho & Sari, 2019). People with a high level of education will usually have a lot of knowledge about health. With this knowledge, people will have awareness in maintaining their health. The level of knowledge also affects a person's physical activity because it is related to the work done. People with a high level of education usually work more in the office with little physical activity. Meanwhile, people with low education levels are more likely to become laborers and farmers with sufficient or strenuous physical activity. Increasing the level of education will increase awareness to live a healthy life and pay attention to lifestyle and diet. Individuals with low education are at risk of paying less attention to lifestyle and diet and what to do to prevent diabetes mellitus (Nittur et al., 2023).

Description Changes in Ankle Brachial Index Risk of Diabetic Ulcers Before Being Given Combination Intervention Massase, Foot Massage And Warm Blanket Treatment

The study showed that before the Combination Intervention Massase, Foot Massage And Warm Blanket was carried out in most of the respondents had a moderate level of change in the Ankle Brachial Index risk of diabetic ulcers as many as 24 (80%) respondents. Abnormal Ankle Brachial Index values can occur due to chronic or long-lasting hyperglycemia. Hyperglycemia that occurs due to excessive carbohydrate input, reduced glucose consumption in tissues, increased liver glucose production, insulin defect which, if it lasts for a long time, will start various forms of disorders such as neurological disorders (neuropathy) and peripheral arterial disease (PAD) (Silaban et al., 2021).

There is a relationship between a decrease in Ankle Brachial Index and age, a history of diabetes, a history of hypertension, the use of antidiabetic drugs, an increase in HbA1c, serum creatinine and a history of retinopathy. Increased HbA1c, poor glucose control, is a risk

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.2. January 2025. Page.237-246

factor for cardiovascular disease complications. Blood viscosity depends on the presence of blood cells and plasma proteins including nutrients such as glucose, amino acids, fats and residual substances such as keratin and bilirubin (Hijriana & Sahara, 2020). In diabetic patients with complications of peripheral arterial disease (PAD), a decrease in foot sensitivity begins with hyperglycemia resulting in excess glucose (hyperglycolia) in the nerve tissue. Hyperglycylolia alters the activity of various biochemical pathways (Advance Glycosilation End Products (AGEs) and Protein Kinase C). Activation of these various biochemical pathways leads to a lack of vasodilation of blood vessels, which causes blood flow to the nerves to decrease. The Ankle Brachial Index examination is used to determine changes in the Ankle Brachial Index risk of peripheral arterial disease (PAD) which can turn into a diabelic ulcer. An Ankle Brachial Index value of less than 0.90 indicates a decrease in blood circulation to the peripheral nerves of the lower extremities (Wu et al., 2022).

Efforts are made to prevent complications in patients with type 2 diabetes mellitus by modifying lifestyle and providing antidiabetic therapy to control blood glucose. The antidiabetics given to patients are adjusted to clinical conditions based on a therapy algorithm that starts with oral antidiabetic monotherapy of the biguanid group with the type of metformin, if there are no contraindications, if it is not possible to control blood glucose levels, a combination of therapy can be given. The combination therapy begins with two antidiabetics both oral and insulin (Raja et al., 2023).

Description of Changes in Ankle Brachial Index Risk of Diabetic Ulcers After Combination Intervention Massase Treatment, Foot Massage And Warm Blanket Treatment

The study showed that after Combination Intervention Massase, Foot Massage And Warm Blanket was carried out in most of the respondents had a change in the Ankle Brachial Index of diabetic ulcer risk in a mild range as many as 24 (80%) respondents. Foot massage has a significant influence in reducing complaints of diabetic peripheral neuropathy in patients with type 2 diabetes mellitus type 2 diabetes mellitus. Foot massage can increase blood flow. Good blood flow will support the supply of oxygen and nutrients to nerve cells so that nerves will work optimally and reduce the rate of diabetic peripheral neuropathic complaints (Hijriana & Miniharianti, 2022). Massage therapy can affect clinical and laboratory symptoms such as decreased blood glucose, hemoglobin A1c (HbA1c) levels and complications of diabetes mellitus, but it is also influenced by various conditions such as the quality and quantity of pressure and duration, as well as the number of sessions, type of massage, and the patient's psychophysical state that can change the results of massage therapy (Bayat et al., 2020).

Research similar to this study is the administration of Buerger allen exercise, which is an exercise to increase circulation to the legs by using gravity changes and using muscle contractions through active movements from the ankle or active postural movements of the patient's lower extremity circulation which aims to increase peripheral vascular circulation. The results of the study showed that foot massage was effective in increasing the Ankle Brachial Index value in patients with type 2 diabetes mellitus at Ungaran Hospital, Semarang Regency (Sunarti & Anggraeni, 2018). Foot massase increases the sensation of protection in the feet of type 2 diabetes mellitus patients at the North Denpasar I Health Center. Foot masage can be used as a nursing intervention in foot care in patients with type II diabetes mellitus, especially diabetic mellitus patients who experience symptoms of diabetic peripheral neuropathy (DPN), because the legs in diabetic mellitus patients who experience DPN are more at risk of developing diabetic foot ulcers due to loss of protective sensation, weakness in the leg muscles and impaired blood circulation to the legs. Results showed that

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.2. January 2025. Page.237-246

the mean Ankle Brachial Index score after the intervention was significantly higher than that of the control group. After the intervention, the capillary filling time becomes lower and the patient's leg perfusion is more increased (Hijriana & Sahara, 2020).

Preventive measures for diabetic ulcers to maintain blood viscosity by maintaining stable blood sugar levels, maintaining smooth blood circulation with massage and foot massage and keeping blood vessels vasodilated, namely by giving pwarm blankets. This study uses a combination of therapies in the form of Combination Intervention Massase, Foot Massage and Warm Blanket in preventing the risk of diabetic ulcer mellitus. Combination Intervention Massase, Foot Massage And Warm Blanket uses hand pressure to stimulate the skin and underlying tissues to reduce and relax pain or increase blood circulation to tissues, especially in the foot area so as to prevent ischemia from occurring. Ischemia can be prevented, so hypoxemia and infarction do not occur, so the risk of ulcers can be prevented. Patients do not need to be amputated and their quality of life improves.

Effect of Combination Intervention Massase, Foot Massage and Warm Blanket on Changes in Ankle Brachial Index Risk of Diabetic Ulcers in Diabetes Mellitus

The Mean Ankle Brachial Index at the examination at the Kalibaru Kulon Banyuwangi Health Center before the Ankle Brachial Index treatment was 0.57. After the treatment, the Ankle Brachial Index score was 0.74. The results of the analysis show that the Mean Ankle Brachial Index value has increased by 0.23. The results of this study are supported by previous research conducted by (Yuwono et al., 2015). foot massage therapy in type 2 diabetes mellitus patients has direct benefits both physiologically and psychologically. The benefits of foot massage therapy include creating a relaxation response, improving metabolic function, improving lymphatic tissue function, accelerating muscle healing and relaxation, reducing muscle tension, and stress levels. Foot massage can cause vasodilation of blood vessels due to a decrease in the work of the sympathetic nervous system and increase the work of the sympathetic nerve so that massage can reduce vasoconstriction of blood vessels and brachial systolic pressure. In addition, massage will stimulate the release of histamine, which plays a role in vasodilation of blood vessels. This is supported by the nature of blood vessels having the ability to stretch and affect systolic pressure.

The results obtained on the blood circulation of the legs in patients with diabetes mellitus showed that the Mean Ankle Brachial Index value before the foot soaking was 0.73 which showed that most of the respondents had moderate disorders in the legs. After soaking the feet, it showed that there was a significant increase in the blood circulation of the respondents' feet. Where the Mean picture of the Ankle Brachial Index value before and after soaking the feet in warm water is 0.73-0.83. It can be seen that the Ankle Brachial Index value has increased from moderate disturbances to mild disturbances.

CONCLUSION

The conclusions of this research are as follows:

1. Respondent characteristics: from the results of the study, most of the respondents were 45-50 years old 33%, working as farmers 36.7%, and housewives 36.7%, having an elementary school education 46.7%, suffering from 5 years of < 56.7%.
2. Change in Ankle Brachial Index Risk of Diabetic Ulcers Before Combination Intervention Massase, Foot Massage And Warm Blanket Treatment 80% Ankle Brachial Index value in the medium category (0.40 – 0.69), normal (0.91-1.31).
3. Change in Ankle Brachial Index Risk of Diabetic Ulcers After 1-3 Weeks of Combination Intervention Massase, Foot Massage And Warm Blanket 80% of the Ankle Brachial Index value is in the mild (0.70 – 0.90), normal (0.91 – 1.31) categories.

4. There is an effect of Combination Intervention Massase, Foot Massage And Warm Blanket on the risk of Diabetic Ulcers as evidenced by the results of the analysis of the value of sig (2. tailed) with a P value of 0.00 < 0.05.

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CONFLICTS OF INTEREST

There was no conflict of interest and the research went smoothly until the end.

REFERENCES

Bayat, D., Mohammadbeigi, A., Parham, M., Mehrandasht, A., Hashemi, M., Mahlooji, K., & Asghari, M. (2020). The Effect of Massage on Diabetes and its Complications: A Systematic Review. Crescent Journal of Medical and Biological Sciences. http://www.cjmb.org

Chen, H., Cai, C., Xie, J., & Yan, L. J. (2020). The effect of an intensive patients' education program on anxiety, depression and patient global assessment in diabetic foot ulcer patients with Wagner grade 1/2: A randomized, controlled study. Medicine (United States), 99(6). https://doi.org/10.1097/MD.0000000000018480

Cicek, S. C., Demir, S., Yilmaz, D., & Yildiz, S. (2021). Effect of reflexology on ankle brachial index, diabetic peripheral neuropathy, and glycemic control in older adults with diabetes: A randomized controlled trial. Complementary Therapies in Clinical Practice, 44, 101437. https://doi.org/10.1016/j.ctcp.2021.101437

Decroli, E. (2019). Diabetes melitus tipe 2 : buku ajar. Bagian Ilmu Penyakit Dalam Fakultas Kedokteran Universitas Andalas/RSUP Dr. M. Djamil.

Hartatik, S., & Sari, R. P. (2021). Effectiveness Of Foot Massage Therapy In 2020. Nusantara Hasana Journal, 1(2).

Hijriana, I., & Miniharianti, M. (2022). Foot Massage dan Joint Mobility Exercises terhadap Nilai Ankle Brachial Index (ABI) pada Pasien DM Tipe 2. Jurnal Keperawatan Silampari, 5(2), 650–658. https://doi.org/10.31539/jks.v5i2.3100

Hijriana, I., & Sahara, T. (2020). Overview of Ankle Brachial Index (ABI) Values in Type 2 DM Patients. Idea Nursing Journal, 3.

Maryama, N., Sulistini, R., Ikob, R., Kesehatan Kemenkes Palembang, P., & Selatan, S. (2021). Pengaruh Rendam Kaki Air Hangat Terhadap Ankle Brachial Index Pada Pasien Diabetes Melitus. Jurnal Keperawatan Merdeka (JKM), 1(1).

Nittur, A., Pavan, B., Ganapathy, R., Dorai, V. K., & Singhal, S. (2023). Pranic Healing as a Complementary Therapy in Diabetic Foot Ulcer Management: A Randomised, Controlled, Double-Blind Trial. Global Advances in Integrative Medicine and Health, 12. https://doi.org/10.1177/27536130231183429

Nugroho, P. S., & Sari, Y. (2019). Hubungan Tingkat Pendidikan dan Usia dengan Kejadian Hipertensi di Wilayah Kerja Puskesmas Palaran. Jurnal Dunia Kesmas.

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.2. January 2025. Page.237-246

Raja, J. M., Maturana, M. A., Kayali, S., Khouzam, A., & Efeovbokhan, N. (2023). Diabetic foot ulcer: A comprehensive review of pathophysiology and management modalities. World Journal of Clinical Cases, 11(8), 1684–1693. https://doi.org/10.12998/wjcc.v11.i8.1684

Ratnasari, D., Daniati, E., Suliyawati, E., & Farhan, Z. (2021). The Effect of Wound Care with Palm Sugar on Diabetic Ulcer Repairing in Type 2 Diabetes Patients. Eduvest-Journal of Universal Studies, 1(12), 1473–1477. http://eduvest.greenvest.co.id

Riskesdas. (2018). Riset kesehatan dasar. Badan penelitian dan pengembangan kesehatan. Kementrian kesehatan RI.

Rita, N. (2018). Hubungan Jenis Kelamin, Olah Raga Dan Obesitas Dengan Kejadian Diabetes Mellitus Pada Lansia. Jurnal Ilmu Kesehatan (JIK), 2(1).

Roza, L. R., Afriant, R., & Edward, Z. (2015). Faktor Risiko Terjadinya Ulkus Diabetikum pada Pasien Diabetes Mellitus yang Dirawat Jalan dan Inap di RSUP Dr. M. Djamil dan RSI Ibnu Sina Padang. Jurnal Kesehatan Andalas, 4(1). http://jurnal.

Silaban, R., AZ, R., & Astuti, A. (2021). Korelasi Kadar Glukosa Darah Dengan Nilai ABI Pada Diabetes Melitus Tipe II. REAL in Nursing Journal (RNJ). https://ojs.fdk.ac.id/index.php/Nursing/index

Sunarti, S., & Anggraeni, R. (2018). Efektivitas Kombinasi Senam Kaki Diabetes Melitus Dan Pijat Kaki Terhadap Nilai Ankle Brachial Index (ABI) Pada Pasien Diabetes Melitus Tipe 2. Jurnal Ilmiah Permas: Jurnal Ilmiah STIKES Kendal , 8(1).

Wu, J., Liu, M., & Huang, H. (2021). Risk Factors Associated With Diabetic Foot Ulcers and Its Relationship With ABI and Brachial-Ankle Pulse Wave Velocity. International Journal of Lower Extremity Wounds. https://doi.org/10.1177/1534734620982233

Wu, J., Liu, M., & Huang, H. (2022). Risk Factors Associated With Diabetic Foot Ulcers and Its Relationship With ABI and Brachial-Ankle Pulse Wave Velocity. International Journal of Lower Extremity Wounds, 21(4), 609–616. https://doi.org/10.1177/1534734620982233

Yuwono, P., Khoiriyati, A., & Sari, N. K. (2015). Pengaruh Terapi Pijat Refleksi Kaki Terhadap Ankle Brachial Index (ABI) Pada Pasien Diabetes Melitus Tipe 2. MOTORIK.