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Essential Oil for Diabetic Neuropathy Pain

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Abstract

Introduction*: Diabetic Neuropathy is nerve damage due to metabolic disorders associated with DM. 30-50% of DN patients experience pain, most often spontaneous burning pain in the feet. DN pain is a condition of concern, having a negative impact on quality of life, morbidity, and mortality.*

Objective*: To further analyze the efficacy and safety of Effleurage Massage with herbal Essential Oil to reduce peripheral limb pain in DPN patients.*

Methodology*: A randomized three-group controlled trial with a pre-post design was conducted on 30 diabetic neuropathy patients. The patients were randomly allocated into the herbal Essential Oil group (n = 10), reflexology massage group (n = 10), and hydrotherapy group (n = 10). Patients in the intervention group used 2.5 cc of 3% herbal oil on their feet as a gentle massage for 10 minutes every night before bed for a month. Data collection was done using the Visual Analog Scale (VAS) and Douleur Neuropathique 4 (DN4).*

Findings*: This study showed that foot health in diabetic patients with neuropathy who received Effleurage Massage with herbal Essential Oil had fewer pain complaints compared to foot exercises and massage without herbal Essential Oil.*

Keywords*: Effleurage Massage 1, Oil Essensial herbal 2, Peripheral Neuropathy Pain 3*

1. Introduction

Diabetic Neuropathy (DN) is a debilitating and life-threatening complication of Diabetes Mellitus (DM) (International Diabetes Federation, 2019). DN is nerve damage due to metabolic disorders related to DM, affecting approximately 60% - 70% of patients to varying degrees, with sensory neuropathy being the most common among DM sufferers (Lewis, Dirksen, Heitkemper, & Bucher, 2014). The prevalence of DN ranges from 16% - 87% (IDF, 2019), with 30-50% of DN patients experiencing pain, most commonly spontaneous burning pain in the feet (Feldman et al., 2019). DN symptoms include pain and numbness in the legs and feet, and can extend to digestive, urinary, vascular, and heart issues (IDF, 2019). The pain is described as an unpleasant stabbing sensation in the hands and feet (Gylfadottir et al., 2019) and diabetic sensorimotor

polyneuropathy often causes pain (Peltier, Goutman, & Callaghan, 2014). DN pain is a concerning condition that negatively impacts quality of life (QoL) (Aslam, Singh, & Rajbhandari, 2014), morbidity, and mortality, making it a major driver in DN pain management (Spallone, Lacerenza, Rossi, Sicuteri, & Marchettini, 2012). DN treatment typically focuses on pain control along with risk factor modification (Zakin, Abrams, & Simpson, 2019) and often requires referral to pain centers (Zavoreo, Bornstein, Rundek, & Demarin, 2011). Proper DN pain management is crucial, involving both pharmacological and non-pharmacological treatments. Various symptomatic pharmacological agents are available for pain control. The goal of pharmacotherapy is to reduce DN pain maximally while balancing side effects (Zavoreo et al., 2011), necessitating the best combination to alleviate DN pain (Peltier et al., 2014). In DN management, pain specialists are beginning to incorporate essential oil and herbal therapies. Essential oils have been used since the time of Cleopatra, Ayurveda, Mesopotamia, Babylonia, and China. Linalool shows sedative effects, and linalyl acetate exhibits notable narcotic actions. It is believed that inhaled aroma molecules are absorbed through the nasal mucosa and converted into nerve signals in the olfactory bulb and limbic system, amygdala, producing therapeutic effects by releasing neurotransmitters, including endorphins, enkephalins, and serotonin (Mozhgan Rivaz, et.al, 2022). This also increases skin permeability to enhance drug absorption, which is efficient in the lower extremities. Additionally, this action reduces collateral damage due to blood stasis, preventing the flow of Qi and blood to the extremities, causing numbness and pain. Several herbs have shown efficacy in enhancing microcirculation (Xu WG, 2007). Some studies indicate that herbal foot soak therapy is effective for treating DPN. However, these studies were not well-designed and did not provide convincing clinical data to support the application of herbal foot soaks (Xiong GH, Li Y, 2015). In this study, in addition to providing herbal essential oil, clients received massage. The composition of the herbal essential oil includes lemongrass, black cumin, ginger, cinnamon, black cumin, turmeric, apple cider vinegar, and chili, which can improve blood flow and reduce pain. Previous research shows that herbs used for neuropathic pain treatment include *Acorus Calamus, Artemisia Dracunculus, Butemonosperma, Citrullus Colocynthis, Curcuma Longa, Crocus Sativus, Elaeagnus Angustifolia, Ginkgo Biloba, Mitragyna Speciosa, Momordica Charantia, Nigella Sativa, Ocimum Sanctum, Phyllanthus Amarus, Pterodon Pubescens Benth, Rubia Cordifolia, And Salvia Officinalis*, which are beneficial for pain relief through antioxidant, anti-inflammatory, anti-apoptosis, neuroprotective, and calcium-inhibition activities (Fatemeh Forouzanfar, Hossein Hosseinzadeh, 2018).

2. Materials and methods [This section provides detailed methodology carried out to achieve the objective]

2.1 Materials

1. Type of Research

   In this study, the researcher uses a repeated experiment design (Pretest-Posttest Control Group Design). This experimental design involves conducting initial measurements or observations before and after the treatment is given to the experimental and control groups.
2. Time and Place of Research

   This research is conducted starting from March 2024, with the essential oil trial taking place in the last week of April 2024. The research is carried out in the elderly community of LUNA MAYA in Surabaya.
3. Population, Sample, and Sampling

   The population in this study includes all patients suffering from diabetes mellitus. The sample consists of diabetes mellitus patients who experience neuropathic pain. The sampling technique used in this study is purposive sampling.
4. Research Variables
   1. Independent Variable: Administration of essential oil and massage
   2. Dependent Variable: Reduction in neuropathic pain

The dependent variable will be assessed using instruments such as the Visual Analog Scale (VAS) and Douleur Neuropathique 4 (DN4).

2.2 Data collection procedures

The type of data collection is a study by correspondence. And divided into 3 groups: group 1 with *Effleurage Massage* and *Oil Essensial Herbal*, group 2 with reflection massage and group 3 with hydrotherapy 4 times a week. After 4 week, GDA, and ABPI were examined. Intervention *Effleurage Massage* and *Oil Essensial herbal* : 1) Patients are given written instructions, 2) prepare a container that has been given oil essensial, 3) *Effleurage Massage* 4) Inform the patient of the initial reaction, namely initial.

2.3 Data analysis

Data were analyzed descriptively, using a T-Test, paired where appropriate. The outcome parameters were symptom scores before and after the procedure.

3. Results and discussion [A good scientific paper has minimum 5 sections]

3.1 Results and discussion

The researcher received completed questionnaires from 30 patients (4 men, 26 women). The average age of the patients is 60 years. Ankle-Brachial Index (ABI) examination shows that most patients have mild peripheral artery disease. Random Blood Sugar (RBS) examination in elderly patients indicates early signs of diabetes.

Table 1. Frequency Distribution of Random Blood Sugar Examination.

Sugar Test Results	ency	ntage
00		

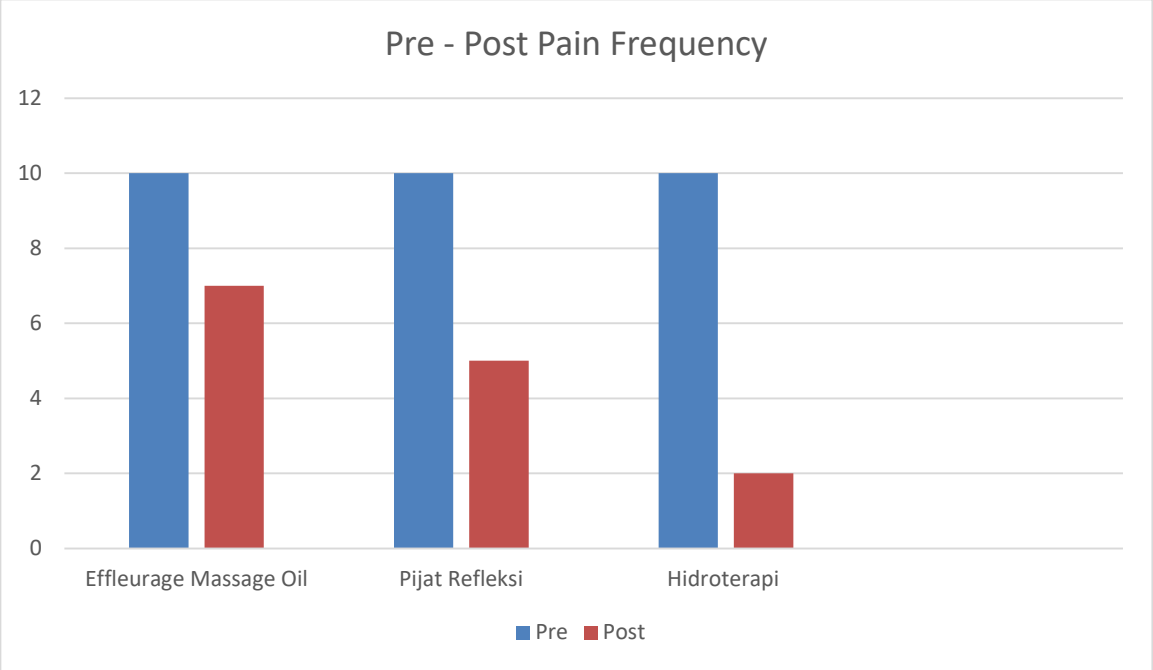
Based on Table 1, the research findings indicate that for random blood sugar (RBS), there were 2 patients (6.7%) with RBS < 200 mg/dL, 24 patients (80%) with RBS between 200-300 mg/dL, and 4 patients (13.3%) with RBS > 300 mg/dL

Table 2. Frequency Distribution of ABPI Examination

Results	ency	ntage
al		
table		
m		

Based on Table 2, the ABPI research results are as follows: 2 patients (6.6%) had Acceptable results, 13 patients (43.3%) had mild results, 11 patients (36.6%) had medium results, and 4 patients (13.3%) had high results.

Figure 1. The Results of Neuropathic Pain Reduction Before And After Treatment



Based on Figure 1 above, in Effleurage Massage with herbal Essential Oil, there were 10 patients experiencing pain initially, and after this therapy, 7 patients experienced reduced pain. In reflexology massage, 10 patients initially reported pain, with 5 patients experiencing reduced pain after treatment. In hydrotherapy, out of 10 patients initially experiencing pain, 2 patients reported reduced pain after treatment.

Table 3. The Effect of *Effleurage Massage* with Herbal *Essential Oil* on Reducing Pain Levels

	Paired Difference					
		td iation	95% Convidance al of The Difference			-taile)
Pre-Post						

Based on Table 3, the statistical t-test results show a significance value of 0.000 (P-Value < 0.05), indicating that the alternative hypothesis (Ha) is accepted. This means that Effleurage Massage with herbal Essential Oil has an effect in reducing peripheral neuropathic pain in diabetic patients.

Table 4. The Effect of Foot Massage on Reducing Pain Levels

	Paired Difference					
	lean	Std eviation	95% Convidance al of The Difference			-taile)
Pre-Post		4,100				

Based on Table 4, the statistical t-test results show a significance value of 0.035 (P-Value < 0.05), indicating that the alternative hypothesis (Ha) is accepted. This means that reflexology massage has an effect in reducing peripheral neuropathic pain in diabetic patients.

Table 5. The Effect of *Hydrotherapy* on Reducing Pain Levels

	Paired Difference					
	lean	Std eviation	95% Convidance al of The Difference			-taile)

Pre-Post	1	4,100		4	0

Based on Table 5, the statistical t-test results show a significance value of 0.057 (P-Value > 0.05), indicating that the null hypothesis (Ho) is not rejected. This means that there is no significant effect of hydrotherapy on reducing peripheral neuropathic pain in diabetic patients.

3.2 Results and discussion

Assessment of Pain Scores Before and After Receiving *Effleurage Massage* with Herbal *Essential Oil*

Based on the study findings, before Effleurage Massage with herbal Essential Oil, 10 patients experienced neuropathic pain. After receiving this therapy, 7 patients reported reduced pain. Neuropathic pain can manifest as increased sensitivity (hyperalgesia) or pain from non-painful stimuli (allodynia) (Gilron I, Watson CPN et al., 2006). After injury, inflammation and recovery processes occur, leading to hyperexcitability known as peripheral sensitization. Various peripheral mechanisms have been described; for most patients, this condition resolves as healing occurs and inflammation subsides. The use of natural products, especially medicinal plants, is an ancient therapy practiced by humans (Li JW-H, Vederas JC, 2009). In recent years, many people have turned to herbal remedies due to lower complications and fewer side effects compared to conventional medications (Boyd et al., 2019). The composition of herbal Essential Oil for Effleurage Massage includes Apple Cider Vinegar, which helps alkalize the body, remove toxins, and deliver vitamins and minerals to address nutritional deficiencies that can exacerbate neuropathic pain. Epsom salt aids in relieving muscle pain, reducing swelling, and increasing magnesium levels. Turmeric's anti-nociceptive properties through curcumin can reduce mechanical allodynia, cool, and weaken serum cyclooxygenase-2 (COX-2) concentrations in neuropathic pain. Black cumin contains antioxidants, which oxidative effects can also reduce neuropathic pain, and improve serum glucose and insulin levels. Chili pepper contains capsaicin, which helps reduce pain signal intensity sent to the entire body. Cinnamon helps reduce blood glucose levels and thus prevent the development of neuropathic symptoms. Ginger's anti-inflammatory and antioxidant effects, can reduce reactive oxygen species (ROS) and oxidative stress leading to a decrease in cellular hypoxia and lower levels of sFlt-1.

Assessment of Pain Scores Before and After Reflexology Massage

Research results obtained data before foot reflexology massage showed 10 patients experiencing pain, while after the foot massage, there were 5 patients whose pain decreased. The reduction in pain scores is attributed to the comfortable effect generated during foot massage, inducing relaxation and enhanced comfort. Foot reflexology is a method used to alleviate pain in the peripheral nerves of diabetic patients. One of the exercises in Burger Allen and Reflexology is a key to improving and assisting lower extremity perfusion, as well as enhancing blood flow, skin sensation, and joint movement (Ari Novita, Rika Elvriede Hutahaen, Dr. Riswani Tanjung Balige, 2023).

Assessment of Pain Scores Before and After Hydrotherapy

Research findings revealed that before hydrotherapy, there were 10 patients experiencing pain, and after this therapy, there were 2 patients whose pain decreased. Hydrotherapy is a technique for alleviating pain and treating diseases with therapeutic effects that induce muscle relaxation affecting the limbic system, thereby providing a comfortable sensation (Permady, 2015; Apriliani, 2018). Hydrotherapy provides physiological effects on the body in the form of relaxation; it channels warmth through the skin to the feet where sensitive nerves are located. From these nerves, stimulation continues to the posterior horn, then to the spinal cord, dorsal root, ventrobasal thalamus affecting the hypothalamus to produce melatonin hormone, and subsequently the brain responds by producing synthetic effects that provide a comfortable feeling (Dionesia, 2017; Prananto, 2016; Utami & Suratini, 2015; Permady, 2015). The use of warm water for treatment in hydrotherapy has hydrostatic and hydrodynamic effects. Scientifically, warm water has physiological impacts on the body; in blood vessels, warm water can enhance blood circulation. While in water, energy or heat exchange occurs through mechanisms of conduction, convection, radiation, and evaporation. Water is an absorbing medium, generating heat that has therapeutic effects. The muscle relaxation obtained can increase tissue flexibility and affect the limbic system, providing a comfortable sensation and relieving emotional stress. By immersing the

body part into water, it helps restore a weak body to strength, reduce nerve and muscle spasms, normalize heart rate, anxiety, and insomnia (Rinawati & Isnaeni, 2012; Darmadi, 2017; Putra, 2018).

4. Conclusion

The results of this study indicate that the combination of Effleurage Massage and Oil Essential herbs interventions is very helpful in reducing neuropathic pain in Diabetes Mellitus patients. These findings provide evidence that Effleurage Massage with Oil Essential herbs may be effective for non-pharmacological interventions and help future clinical treatments compared to Effleurage Massage with Oil Essential herbs.

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Conflict of interest

The authors declare that there is no conflict of interest and the final manuscript of this paper has been approved by all authors.

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