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The Effect of Electrical Stimulation & Citrus Essential Oils Therapies "ESCO's" Model for Diabetic Foot Ulcer: A Systematic Review

Naziyah[1], Mohamed Saifulaman Mohamed said[2], Faridah Mohd Said [3], Rizki Hidayat [4]

[1]*Lincoln University College, Malaysia*

[1]*National University Jakarta, Indonesia*

[2]*Lincoln University College, Malaysia*

[3]*Lincoln University College, Malaysia*

[4]*National University Jakarta, Indonesia*

Abstract

Diabetes mellitus, more commonly referred to as diabetes, is a dangerous disorder that lasts for an extended period (sometimes known as "chronic") and develops when elevated levels of blood glucose arise. This is because the body is unable to create any or sufficient amounts of the hormone insulin, or it is unable to make effective use of the insulin that it produces. There are currently around 537 million persons between the ages of 20 and 79 who have been diagnosed with diabetes. This accounts for 10.5% of the global population in this age bracket. Methods research: Solomon's design technique of four groups serves as the research design. This design decreases the effects of confounding variables and enables the researcher to determine if the pretest itself affects the subject. The Solomon Four Group Test employs a conventional two-group design consisting of a pretest and posttest, with a posttest-only control. The researcher employed several combinations of tested and untested groups as well as treatment and control groups to ascertain that confounding variables and extraneous factors did not influence the outcome. Meanwhile, the control group will receive standard interventions carried out by officers at primary care facilities. Result: electrical stimulation and citrus essential oil will affect the healing process of Diabetic Foot Wounds.

Keywords: Diabetic Foot Ulcer; Electrical stimulation; Citrus essential oil; Wound healing process

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1. Introduction

Diabetic foot ulcers, also known as DFUs, are among the most devastating consequences of diabetes. They are responsible for high rates of morbidity and mortality, as well as significant expenses associated with medical care [1]. In 2017, the prevalence of foot ulcers among diabetic individuals anywhere in the world ranged from three percent to thirteen percent [2]. Even though there has not been a recorded increase in the frequency of diabetic foot ulcers in Indonesia, this can inferred from the rise in the prevalence of diabetes over time. There were 10.3 million people living with diabetes in Indonesia in 2017, and it anticipated that this number would rise to 16.7 million people by the year 2045. Indonesia rated seventh among the countries with the most significant incidence of diabetes in the world. At present, the prevalence of diabetes mellitus in Indonesia has reached 10.9 [3]. 10.7 million Individuals in Indonesia have diabetes in 2019, making it one of the countries with the highest absolute prevalence of diabetes worldwide. Diabetes, along with its consequences, is the third leading cause of mortality in Indonesia [4]. This number anticipated to rise to 16.6 million by the year 2045. Diabetes is one of the top three conditions that can be aggravated by diabetes that is under control, and it hurts almost every system in the human body [4]. Diabetes mellitus in Indonesia is 9.1 million or 5.7% of the total population. This number is only for diabetes mellitus sufferers who have diagnosed and many diabetes mellitus sufferers are still undiagnosed. Indonesia is a country ranked 5th with the most Diabetes Mellitus sufferers in 2014, while in the previous year, it was ranked 7th with a total of 7.6 million sufferers [5]. Electrical stimulation (ES) has been demonstrated to have a statistically significant impact on the healing process of wounds. The recovery of citrus essential oils was accomplished using the hydro-distillation of freshly collected peels. It is vital to evaluate ES's impact on the healing process of wounds to guarantee optimal performance in clinical settings [6].

The total phenolic and flavonoid content were used to evaluate the antioxidant activities, while the disc diffusion test was utilized to determine the antibacterial activity.

Following the application of oil to the skin, rabbits used for in vivo evaluation of the potential for wound healing. After the wound grading was determined, a histological examination was performed [7]. Research from Ayuningtyas et al 2023, stated scientific evidence has demonstrated the efficacy and safety of lemon as a treatment for diabetic ulcers. Lemon is a chemical that acts as a healing agent by stimulating the production and activation of macrophages, leading to an increase in VEFG levels and a faster wound-healing process [8].

2. Materials and Methods

This systematic review used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A protocol was prearranged and formulated based on the International Perspective Register of Systematic Reviews (PROSPERO). The frame of PICO used to generate the study question. Several scoping searches were carried out before the systematic search was carried out. It was decided to do scoping searches to understand the current level of knowledge regarding the research subject and to determine whether or not similarly titled articles have been published recently, avoiding unnecessary repetition.

2.1 Search Strategy

A consultation was held with a seasoned librarian to devise a search strategy that would yield a well-rounded selection of articles, considering both sensitivity and specificity. The search phrase was merged using Boolean operators using the included terms: ((“diabetic foot” OR “diabetic foot ulcer” OR “diabetic foot wound” OR ‘diabetic foot sore’) AND (“electrical stimulation” OR “electrotherapy” OR “transcutaneous electrical stimulation”)). The following databases were searched: MEDLINE, CINAHL Plus, AMED, EMBASE, Web of Science, PubMed, and Cochrane Library. In addition, a search conducted for grey literature using the Open Grey database. Appendix A displays the search approach utilized for each database. The authors conducted a reverse reference search of the papers to obtain other relevant studies to include in the systematic review. This study's purpose to test and evaluate the ESCO model. The chosen design is an Experimental design that enables researchers to randomly sample from the population without necessitating the random allocation of individual cases to the comparative groups. The procedure was carried out by selecting respondents as an experimental group with diabetic foot ulcers.

2.2 Study Selection

The research methodology utilized is the Solomon four-group design technique, which minimizes the influence of extraneous variables and allows the researcher to investigate whether the pretest is the main focus of the study. The Solomon 4 group test is a frequently employed research design that integrates the pretest-posttest two-group and posttest-only control designs. The advantage of using the Solomon 4 design method is that it can control threats to internal validity: Such as bias and confounding. Something that can be controlled by a standard experimental design (two groups). Controlling threats to external validity: As pretest sensitization. Something that cannot be controlled by standard experimental designs (two groups). The advantages of using the Solomon 4 design methodology are minimizing threats to internal and external validity and differences between groups can be related to experimental treatment. The population is the entire subject that is the target of research or a collection of elements that form the basis for inference or induction [9].

The population in this study were patients with diabetic foot ulcers who underwent treatment at several wound care at public health wound care centers in East Jakarta Indonesia. In this study, the sample population will be taken from health centers that have high DFU cases each year, namely Duren Sawit Wound Care Center and Cakung Wound Care Center in East Jakarta, Indonesia. The highest population of patients with DFU is located in the Duren Sawit with a frequency is 10.049 and Cakung has a 12.628 population in East Jakarta, Indonesia. In this study, there were 59 diabetic ulcer patient respondents at the wound care center. The instrument for this study used BWAT assessment for the step proliferation phase, ABPI scale for Vascularization measurement, and Monofilament test for Sensation neuropathy measurement. The instrument used in this study was a BWAT wound assessment Bates-Jansen Wound Assessment Tool which examines the status of wounds caused by various causes and due to pressure.

The BWAT comprises 13 components that evaluate several aspects of a wound, including its size, depth, borders, tissue damage, type and quantity of necrotic tissue, amount of granulation and epithelial tissue, type, and quantity of exudate, skin color surrounding the wound, presence of edema, and induration [10]. Pre-testing in the research is Before the intervention, the researchers took measurements to identify Wound Proliferation, Wound Vascularization, and Sensory Neuropathy in Diabetic Foot Wound Patients and then documented them in the data tabulation sheet [11]. Data processing in this study has several stages, namely, the researcher will input data from the results of the study and interviews on the BWAT sheet. Re-checking to anticipate errors or lack of data needed for answers given by respondents. The coding stage for grouping data from the answers given by respondents according to research variables. The purpose of coding is to simplify the tabulation process and the next stage of data analysis. Next, the stage in data processing is entering data into a table with a statistical program on the computer.

2.3 Quality Assessment

Table 1. The criteria for inclusion and exclusion of the selected research. Data was collected using the ABPI, Monofilament Test, Vibration Perception Using a 128 Hz Tuning Fork and Electrical stimulation (ES), and Using Citrus/Lemon Essential Oil (CO’s).

3. Results and Discussions

3.1 Result

Electrical stimulation (ES) has been demonstrated to affect the wound healing process substantially. Evaluating the impact of ES on wound healing is crucial to providing optimal outcomes in clinical settings. Electrical stimulation (ES) is a highly effective technique for expediting the healing process of chronic wounds. Chen, Zong BS, 2020 [12] found that electrical stimulation is a beneficial additional treatment for diabetic foot ulcers.

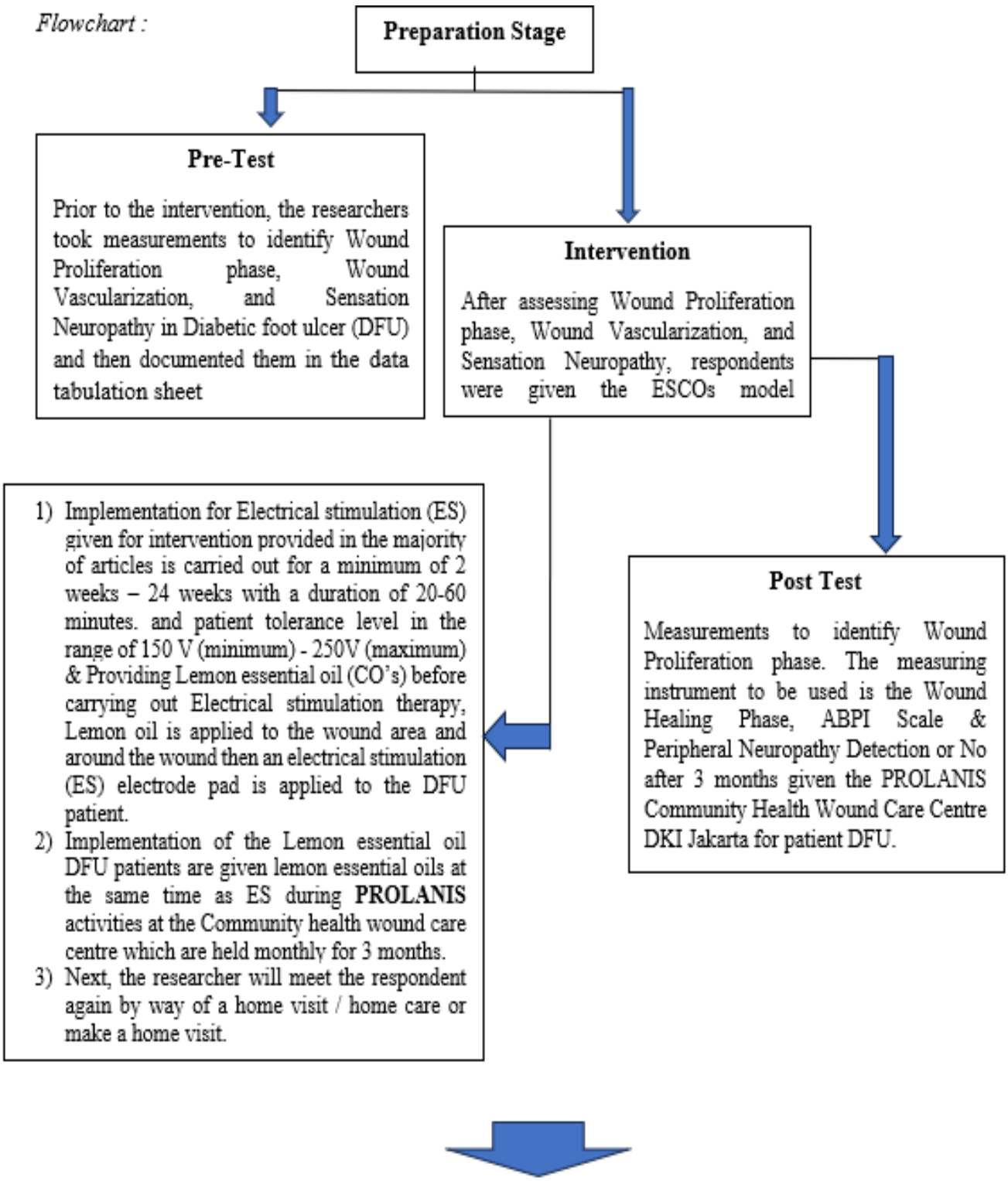

Figure 1. Flow chart

Table 1. The criteria for inclusion and exclusion of the selected research

	Inclusion criteria	**Exclusion criteria**
Publication year	From September 2022	
Language	English	
Study design	• Experimental design • Multivariate analysis • Oneway Anova test	• Quantitative study • Analysis time-series
Study sample	• Oedema leg, cold acral, pain, burn sensation, muscle stiffness & Reednes • Age 20 – 70 years • Type 2 DM patients with wounds on their feet (toes, soles and heels) for more than 1 month willing to be a respondent with wound stage 2-3 • Patients who can mobilize independently	• Not Respondent with DM Type 1 • Not Cooperative
Study intervention	Therapy Electrical stimulation and citrus essential oils (ESCO's) Model which is one of the therapeutic modalities	Electrical stimulation therapy used in conjunction with other physical therapies.

Please note that the table thoroughly lists the qualifying criteria used in this systematic review. Publication year, language, study methodology, study sample, and intervention were used as criteria for inclusion/exclusion

Table 2. Summary of Included Papers (Electrical Simulation)

Purpose	Methode (Design, sample, Variable, analysis)	Research instrument	Result	Reference
Analyze the impact of cathodal direct current of low intensity on ischemic diabetic foot ulcers.	D: Randomized Control Trial S: 30 type 2 diabetes patients with diabetic wounds (DFU) V: Diabetic wounds, Electric Stimulation (low-intensity cathodal direct current) Analysis: ANOVA	Direct current is given via a Stimulator (BTL-5000 series) and positive and negative electrodes, wound evaluation is carried out using a camera and ELISA kits	Low-intensity Cathodal Direct Current (CDC) has a positive effect on the release of HIF-1a and VEGF in ischemic diabetic wound area. The results also showed that applying electrical stimulation to Ischemic diabetic foot ulcers (DFU) can be a promising way to assist the angiogenesis process and to achieve better results in the healing process of diabetic wounds	[19]
Examining the impact of microcurrent as an additional therapy to expedite the healing process of chronic wounds and alleviate patient discomfort.	D: case study (triangulation method) S: A total of 100 individuals suffer from persistent wounds, including diabetic foot ulcers, venous leg ulcers, and pressure ulcers. V: Diabetic foot wounds, Electric stimulation, Microcurrent Analysis: ANOVA to analyze additional variables (swelling in the legs, stiffness in the legs, quality of sleep), pre-post actions were analyzed using paired T-test	BEST Microcurrent device, adhesive pad, ruler/length measuring instrument	The findings of this study demonstrate a considerable decrease in both the wound area and the pain scale during treatment. Using Microcurrent is also easy and can speed up wound healing.	[20]
How of electrical Stimulation on foot circulation in type 2 DM patient.	D: Quasi Experiment with pre-post without control S: 63 patients with type 2 DM V: ABI, electrical stimulation Analysis: Wilcoxon	Vascular doppler (Bistos Hidop Model BT-200), aneroid sphygmomanometer (Onemed), electrical stimulation using Veinoplus (AD Rem Technology Paris) with battery type 9V, blood sugar levels checked using GlucoDr type D-144	Patients with diabetes mellitus can significantly benefit from electrical stimulation to improve their leg circulation.	[21]
How the treatment with focused shockwave therapy for DFU patients.	D: Randomized Control Trial S: The total number of research subjects was 336 patients, 172 received active therapy, 164 received sham therapy, and people with Diabetic Foot Ulcers (DFU) were randomly divided into control and intervention groups. In this article, researchers conducted 2 studies in turn with several different characteristics of respondents. In study 2 the minimum age was higher (≥22 years) and was additional for kidney disease V: Diabetic foot wounds, electric stimulation	VAS, to measure pain, Canon Powershot G7 Digital 10MP camera to find out whether there is a difference with the sham-therapy group, ESWT device, And VAS, to measure pain, Canon Power shot G7 Digital 10MP camera to find out whether there are differences with the sham-therapy group, ESWT device, and Healed Ulcer Appearance Questionnaire	The results of these two trials showed that on average the group with ESWT (active therapy) recovered after 24 weeks and 24 weeks compared to the group that did not receive ESWT therapy.	[22]

	(extracorporeal shockwave therapy (ESWT)) Analysis: Chi-Square			
How the effect focused shockwave therapy on diabetic foot ulcer patients.	D: Randomized Control Trial S: The total number of research subjects was 336 patients, 172 received active therapy, 164 received sham therapy, and people with Diabetic Foot Ulcers (DFU) were randomly divided into control and intervention groups. In this article, researchers conducted 2 studies in turn with several different characteristics of respondents. In study 2 the minimum age was higher (≥22 years) and was additional for kidney disease V: Diabetic foot wounds, electric stimulation (extracorporeal shockwave therapy (ESWT)) Analysis: Chi-Square	VAS, to measure pain, Canon Powershot G7 Digital 10MP camera to find out whether there is a difference with the sham-therapy group, Research Results ESWT device, and Healed Ulcer Appearance Questionnaire	Subjects whose wound area was reduced by more than 90% at week 12 were significantly higher in the active therapy group. The active therapy group did not report any pain during the procedure. The results of studies No. 5 and No. 6 show that diabetic wounds with the same characteristics in studies No. 5 and No. 6 can be healed with Standard Wound Care and ESWT as adjuvant therapy	[23]
How the Electrical Stimulation accelerates wound healing.	D: RCT S: 33 type 2 diabetes patients with chronic diabetic wounds (DFU) and moderate to severe peripheral arterial disease (PAD). V: High voltage pulsed alternative current (HVPAC) electric stimulation for diabetic foot ulcers. Analisis: Chi Square	Electoda pads, also known as E-Stim, are utilized to provide electric stimulation. A 3D camera, a Sensi Lase Pad-IQ SPP device that the FDA has approved, and a Horwell Neurothesiometer are used to evaluate diabetes.	E-Stim therapy performed at home is effective as additional therapy to accelerate wound healing in patients with chronic DFU and mild to severe PAD	[24]
What is the effectiveness of electrical stimulation delivered to the lower extremities to enhance skin perfusion?	D: RCT S: 38 patients with DFU V: Diabetic wounds, electric stimulation Analysis: Pearson correlation analysis	Electric stimulation is delivered using an E-Stim Device, electrodes, Food and Drug Administration (FDA)–approved Sensi Lase Pad-IQ SPP device to measure skin perfusion, an infrared camera to measure SatO2	This research shows the effectiveness of E-Stim therapy to increase skin perfusion and O2 saturation. Daily and regular application is necessary for effective wound healing	[25]
How to the Combined use of modulated ultrasound and electrical current stimulation with diabetic foot ulcers.	D: case series (case study) S: 7 patients with DFU V: Diabetic wounds, electric current stimulation (CUSECS) Analysis: independent samples t-test	electric stimulation distributed via the BRH-A2 wound healing device, wounds evaluated with the Photographic Wound Assessment Tool,	There was an average reduction in wound size of 71% and none adverse reactions to therapy	[26]
Significant improvement in painful neuropathy symptoms	D: This study is a blinded, randomized clinical trial that follows a crossover design, with a 1-week washout interval between treatment periods. Diabetic painful neuropathy S: initially in treatment (n = 25) or sham (n = 25) V: Diabetic foot in inpatients with sensation neuropathy A: independent-t-test	The frequency of the electrical pulses is set at 15 and 30 Hz, lasting 3 seconds. The highest current used is 25 mA, and the pulse width is 0.5 ms. This treatment is administered for 30 minutes thrice weekly over three weeks.	Pain VAS: decreased in treatment (6.2 to 2.5; $p < .05$) and sham (6.4 to 6.3; $p > .05$; $p < .05$) Daily oral nonopioid analgesic: use reduced for treatment (49%; $p < .05$) and sham (14%; $p > .05$; $p < .05$) AE: None	[27]

Table 3. Summary of Included Papers (Citrus Essential Oils)

Purpose	Method	Research instrument	Result	Researchers
The objective of this study is to assess the therapeutic potential of lemon as a treatment for diabetic ulcers.	30 Wistar rats (Rattus novergicus) were used in the study. These rats were induced with DM and traumatic ulcers on the lower lip mucosa. The rats were separated into six groups, with three groups assigned to the control group and three to the treatment group. The control groups were subjected to applying a 5% gel containing carboxymethyl cellulose (CMC). In contrast, the treatment groups were given a gel containing essential oil extracted from the peel of Citrus limon (C. limon). VEGF and CD-31 expression was detected on days 5, 7, and 9. The immunohistochemical investigations utilized monoclonal antibodies targeting VEGF and CD-31. An analysis of variance (ANOVA) was used to examine the disparities across the groups ($p < 0.05$).	It was a laboratory experimental study conducted in vivo on experimental animals, namely Wistar rats (Rattus norvegicus), and it utilized a randomized post-test-only control group design. Every animal used in the experiment was cared for per the guidelines established by the Animal Care and Use Committee of Universitas Airlangga.	The treatment group exhibited a significant upregulation of VEGF and CD-31 expression compared to the control group ($p < 0.05$).	[8]
This research was conducted to determine whether a topical application of 0.78% citrus lemon essential oil might increase the expression of fibroblast growth factor-2 (FGF-2) and fibronectin expression.	The procedures used in this investigation were random sampling and an actual experimental and analytical study.	The study used 30 male Wistar rats (Rattus novergicus) given a traumatic wound on their lower lip mucosa and 50 mg/kg of Streptozotocin intraperitoneally to make them diabetic. They were split into six groups, three in each treatment and one in the control group. Five rats were in each of the control and treated groups. The treatment groups were given Citrus limon peel essential oil gel, and the control groups were given CMC 5% gel. FGF-2 and Fibronectin levels rise on Days 5, 7, and 9.	An analysis of variance (ANOVA) was conducted to examine the statistical significance of the differences between groups ($p<0.05$). The treatment group exhibited higher FGF-2 and Fibronectin expression levels than the control group. There were statistically significant variations ($p<0.05$) in the expression of FGF2 and Fibronectin between the two groups.	[28]
This study aims to investigate	It was possible to get C. limon L. gel from C.	Twenty individuals are male and have diabetes.	The treatment groups exhibited a greater count of lymphocytes and	

the strong impact of C. limon L. on traumatic diabetic oral ulcers, specifically about the levels of lymphocytes and interleukin (IL)-10 expression.	limon L. peel by steam distillation. Twenty male Wistar rats with diabetes and sores on the lower part of their intestines were split into four groups of five each. 3% carboxymethyl cellulose atrium was used to treat the control groups, while C. lemon L. gel was used to treat the treatment groups. For either 5 or 7 days, each medicine was given once a day. Hematoxylin and eosin staining were used to look at lymphocytes, and immunohistochemistry staining was used to look at IL-10 expression. An independent t-test ($P < 0.05$) was used.	Wistar rats with traumatic ulcers on the inferior labial mucosa were separated into four groups.	increased expression of IL-10 on the fifth and seventh days compared to the control groups ($P < 0.05$).	[29]
A nanoemulsion of oregano essential oil was created using homogenization and chitosan as the coating agent. After preparation, the nano emulsion had an average particle size of 293.7 ± 8.3 nanometers.	from hydrogel and comprises biological polymers such as chitosan, gelatin, and polyvinyl pyrrolidone.	The healing patch is made from hydrogel and comprises biological polymers such as chitosan, gelatin, and polyvinyl pyrrolidone.	The in vivo findings demonstrated the prompt healing properties of dual therapy in diabetic rat models with foot ulcers. These effects included a maximum healing rate of 97.5%, minimal scar formation, heightened granulation, improved reepithelization, and a significant reduction in inflammation and neutrophil infiltration within the treatment period. These outcomes were superior to those observed with monotherapy and the control group.	[30]
The current investigation assessed lemongrass essential oil's in vivo topical and oral anti-inflammatory properties (LGEO) and its in vitro antifungal efficacy in both liquid and vapor forms.	As ascertained by gas chromatography-mass spectrometry analysis, LGEO's two main components were geranial (42.2%) and neral (31.5%). Disc diffusion and vapor diffusion techniques assessed LGEO's antifungal properties against several filamentous fungi and pathogenic yeasts.	The antifungal activity of LGEO	LGEO demonstrated promising antifungal action against Candida albicans, C. tropical, and Aspergillus niger at 35–90 mm IZDs. Oil volume boosted IZD. Vapor phase anti-Candida activity increased considerably. LGEO (10 mg/kg, orally) reduced carrageenan-induced paw edema like the positive control, oral diclofenac (50 mg/kg). Oral LGEO was dose-dependently anti-inflammatory. LGEO administered topically to Croton oil-induced ear edema mice reduced inflammation. It appears to be the first report. LGEO administered topically at 5 and 10 mL/ear reduced Croton oil-induced acute ear edema in 62.5% and 75% of mice. LGEO also reduced skin inflammation histologically in animals.	[31]

Out of the 145 randomized clinical trials initially identified, seven studies (including 274 patients) matched the inclusion criteria. There was a statistically significant difference in the percentage decrease in ulcer area at four weeks between patients who were treated with ES and SWC and those who were treated with SWC alone (standardized mean difference, 1.09; 95% confidence range, 0.62-1.57; P <.001). At 12 weeks, the ulcer healing rate was considerably faster in the ES group (risk difference, 0.19; 95% confidence range, 0.06–0.32; P =.005). A statistically significant difference measured this. The subgroup analysis demonstrated similar effectiveness between different waveforms (monophasic vs biphasic). Electrical stimulation shows promise as a beneficial additional treatment for expediting the healing process of diabetic foot ulcers (DFUs).

ECOS's model is a combination of an application of electrical stimulation and citrus essential oils on Diabetic foot ulcers (DFU) which has the effect of accelerating the wound healing process, especially in the proliferation phase, optimally improving blood vascularization and restoring sensory function in neuropathies [13]. In ESCO's Model therapy, the aim is to accelerate wound healing so that wound nurses can be helped in treating wounds in diabetic foot ulcer patients by assessing the scale of success through assessing the proliferation phase, assessing blood vessel circulation or Vascularization, and assessing neuropathy sensations [14]. Recently harvested citrus peels subjected to hydro-distillation to extract the essential oil. Gas chromatography-mass spectroscopy (GC-MS) analysis was utilized to ascertain the oil's chemical components [15]. The total phenolic and flavonoid content used to assess the substance's antioxidant properties. It was determined that rabbits that had been given oil had antibacterial action topically [16].

Application with Lemon essential oil (Citrus essential oils) combined with electrical stimulation therapy in DFU patients can improve the vascularization system. Thus, emerging treatment targets to enhance the healing process in diabetic wounds are variables associated with angiogenesis and vasculogenesis [17]. The action of lemon essential oils on chronic diabetic ulcers is achieved by stimulating the production of VEGF and CD-31, which play a crucial role in forming new blood vessels (angiogenesis) and the development of blood vessels (vasculogenesis) [8]. These naturally occurring compounds are seen as new and promising targets for improving the healing of wounds that are compromised due to diabetes. By activating and stimulating factors that promote the growth of new blood vessels, known as angiogenic factors, it may be possible to restore the formation of new blood vessels and enhance healing in individuals with diabetes [18].

3.2 Discussion

This systematic review shows that the ESCO model of therapy can accelerate the wound healing process in diabetic foot ulcer (DFU) patients, which can assessed from changes in vascularization values, proliferation phase, and neuropathic sensation in DFU patients. For now, combination therapy of electrical stimulation and citrus essential oils (ESCO's) has performed simultaneously to speed up the wound healing process in diabetic foot ulcer patients. This combination expected to be successful and become a therapeutic model that can applied to patients with diabetic foot problems. To advance this field of research, further work should base on theory, matching indicators measurement and using methods appropriate statistics to collect data from each patient with Type2 DM with diabetic foot ulcers (DFU). Therefore, that it can provide additional therapeutic results in diabetic foot wounds by measuring changes in vascularization, proliferation phase and neuropathic sensation in DFU patients.

Limitations certain characteristics of the base research cause difficulties in drawing strong conclusions. Variations of quantitative studies with various designs, several using a control group and No. In addition, some research relies on sample reports it does not match what it is researchers hope. Implications for Clinical Practice Implications for clinical practice in Wound care use. This model can be a model recommended in clinical practice & has become standard as additional therapy to help speed up the wound healing process in DFU patients. Suggestions for Future Research immediately advance research about the electrical stimulation model and citrus essential oils (ESCO's) being the model (combination) applied for patients with diabetic foot wounds. This change will need more samples to meet design assumptions and statistics like that recommended. Research with mixed methods design, a combination of qualitative and quantitative methods, is necessary to assess various relevant constructs.

4. Conclusions

Electrical stimulation model therapy and citrus essential oils by choosing lemon essential oils can increase changes in the wound healing process by looking at changes in vascularization values, proliferation phase, and neuropathic sensation in diabetic foot ulcer (DFU) patients by measuring the dependent variable with ABPI, BWAT tools, and Monofilament test.

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Conflict of Interest

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