

The Influence Of Diabetic Ulcus Treatment Methods With Larva Therapy On The Healing Process Of Diabetic Ulcus In Patients Post-Hospital Treatment

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ABSTRACT

Diabetic ulcers are a complication of diabetes mellitus. Diabetic ulcers tend to be chronic and difficult to treat because the patient has metabolic disorders. Larvae therapy is an alternative treatment for diabetic ulcers because larvae can eat necrotic tissue while larval enzymes increase granulation tissue. This study aims to determine the effect of treating diabetic ulcers with larval therapy on the healing process of diabetic ulcers in patients with diabetes mellitus at Wisma Rini Pringsewu General Hospital, Lampung.

This study uses a pre-experimental design with a pre-post test without control. The sample of this study were patients with grade 3-5 diabetic ulcers and was willing to be respondents. The number of pieces is 20 people with the Simple Random Sampling technique. The study was conducted in June 2020 using larval therapy for 12-14 days. Data analysis using Paired T-test

The results of the study obtained an average age of 56.7 (7.34) years; most of the respondents were female (55%), most of the respondents worked (70%), while the rest did not work 30%. The average score of injuries was 51,7 (2.17) before the study, and the average wound score after the study was 30.7 (1.74). Statistical test results obtained a p-value of 0.000, which means that there is an effect of treating diabetic ulcers with larval therapy on the healing process of diabetic ulcers in patients with diabetes mellitus at Wisma Rini Pringsewu General Hospital, Lampung. The conclusion is that there is an effect of treating diabetic ulcers with larval therapy on the healing process of diabetic ulcers; larval therapy can be an alternative for wound healing in patients with diabetes mellitus who have diabetic ulcers.

Keywords: Diabetes mellitus, Larval Therapy, Diabetic Ulcer

Introduction

Diabetes mellitus (DM) is a chronic, progressive disease characterized by the body's inability to metabolize carbohydrates, fats, and proteins, the initial cause of hyperglycemia (high blood sugar levels). Chronic hyperglycemia in diabetes mellitus is associated with long-term damage, dysfunction, or failure of organs, especially the eyes, kidneys, nerves, heart, and blood vessels. (Black and Hawk 2015)

DM is one of the non-communicable diseases that ranks 6th in the world in the 2013 IDF results and experienced an increase in presentation in 2018 which was ranked 7th in the world with 7.6 million people with DM. According to the International Diabetes Federation (IDF 2017), the total number of people with diabetes mellitus in the world is 425 million people with a prevalence of 48% of the world's population

living with diabetes mellitus; if not handled properly, the incidence of diabetes mellitus will increase to 629 million people in 2045. It is estimated that 10.3 million people are diagnosed with diabetes mellitus. With this number, Indonesia is ranked 6th in the world or up to one rank compared to IDF data in 2013, ranked 7th with 7.6 million people with diabetes mellitus (IDF, 2017).

According to a report by the International Diabetes Federation (IDF) that the prevalence of diabetic foot ulcers is 9.1 million to 26.1 million people every year (Ezy, 2018). In recent years the majority of diabetic ulcers globally has been reported at 6.3%, the prevalence in South America, Asia, Europe, Africa, and Oceania has been reported at 13.0%, respectively; 5.5%; 5.1%; 7.2%, and 3.0% (Zhang et al., 2017). In Indonesia, the prevalence of diabetic ulcer sufferers is 15%, with mortality and amputation rates of 32.5% and 23.5%. It is the most common treatment cause for people with diabetes in hospitals, which is 80% with the cost of care for a patient ranging from Rp. 1,3-1.6 million per month and IDR 43.5 million per year (Kurnia, Sumangkut, et al. 2017). The prevalence of DM with ulcer complications in Lampung Province in 2017 was 62% of patients (Harist, 2016). Based on data obtained from Wisma Rini Hospital in 2019, there were 164 patients with DM and 105 patients suffering from diabetic ulcers (data from Wisma Rini Pringsewu Hospital 2019).

One of the complications of DM with chronic hyperglycemia is the diabetic ulcer. The prevalence of DM with diabetic ulcers from year to year is increasing. The prevalence of DM with ulcer complications globally ranges from 4-10%, which causes 40-7-% of DM cases with diabetic ulcers to be amputated with non-trauma. The cause of amputation in DM patients is caused by ischemic factors 50-7-%, and complications with infection 30-50%. (IDF, 2017)

Treatment of diabetic wounds can use non-pharmacologic therapies, one of which is with larvae. The benefits of larval therapy have been reported by various studies spread throughout the world. larval therapy can accelerate wound healing, reduce the duration of antibiotic use, reduce hospital stays, reduce the risk of amputation, reduce the number of outpatient visits, be relatively economical, and improve quality of life. (Wangko, 2015).

Maggot therapy or MDT is one of the therapies that can be used as an alternative in wound healing is the Maggot Debridement Therapy (MDT) method. This method is done by placing a certain number of live larvae on diabetic ulcers. The live larvae will feed on the necrotic skin tissue and help in wound healing, and this method does not cause pain and bleeding. Besides being able to clean wounds, live larvae can also kill microorganisms and help form new tissue. (Mulyati, 2016).

Based on the description above, the researchers wanted to know how treating diabetic ulcers with larval therapy affects the healing process of diabetic ulcers in post-treatment patients at Wisma Rini Pringsewu General Hospital Lampung.

Method

This study uses a quasi-experimental. The research design used in this study was "One Groups Pretest-Posttest Design," namely a research design that contained a pretest before being given treatment and a

posttest after being given treatment. The population in this study were 103 diabetic ulcer patients who underwent post-treatment at Wisma Rini Hospital. The research sample consisted of 20 diabetic ulcer patients who underwent post-treatment at Wisma Rini Hospital. The sampling technique in this study uses probability sampling. This study uses a standardized questionnaire from the Bates-Jensen Wound Assessment Tool, consisting of 13 questions with a scale of 1-5. Total question scores 13 -65.

Results

Univariate

This study found that most of the respondents were female 55%, the most age was 56-65 years 65%, the most work was working 70% of the respondents

Table 1. Distribution of respondents

Variable	Frequency	Percentage
Gender		
Woman	11	55
Man	9	45
Age		
46 - 55 years old	5	25
56 – 65 years old	13	65
66 – 80 years old	2	10
Work		
Work	14	70
Does not work	6	30
Total	20	100

Table 2 Description of diabetic ulcers in patients with diabetes mellitus before and after after being treated with larval therapy

Wound score	Mean(SD)	median	Minimum	Maximum
before	51.7(2.17)	51.5	49	56
After	30.7 (1.74)	31.0	38	35

Table 2 shows that before treating the wound with larval therapy, the average score of the Bates-Jensen Wound Assessment Tool before the study was 51.7 (2.17) with a median value of 51.5, a minimum score of 49, and a maximum score of 56. In larval therapy, the average score of the Bates-Jensen Wound Assessment Tool was 30.7 (1.74), with a median value of 31.0, a minimum score of 28, and a maximum score of 35.

Bivariate

To see the effect of the wound care method with larval therapy on the healing process of diabetic ulcers in patients with diabetes mellitus, a paired T-test analysis was performed with 95% CI and $\alpha = 0.05$. This study obtained a p-value of $0.509 > 0.05$, which means that the data distribution is normal. Analysis of the effect of wound care methods with larval therapy on the healing process of diabetic ulcers in patients with diabetes mellitus.

Table 3. Analysis of the effect of wound care methods with larval therapy on the process healing of diabetic ulcers in patients with diabetes mellitus

Effect of Larval Therapy on Wound Healing	Mean(SD)	SE Mean	95% CI	t	P-value
	-21.0(2.29)	0.513	-22,074 sd -19,926	-40,937	0.000

This study found a decrease in the Bates-Jensen Wound Assessment Tool's wound score, namely -21.0 (2.29). Statistical test results obtained a p-value of 0.000 which means H_0 is rejected and H_a is accepted. This means that there is an effect of treating diabetic ulcers with larval therapy on the healing process of diabetic ulcers in post-treatment diabetes mellitus patients at Wisma Rini Pringsewu General Hospital, Lampung.

Discussion

In this study, the average age was 56-65 years, and this is in line with the theory of Tarwoto et al. (2016), the incidence of diabetes mellitus generally occurs in people over 45 years of age. This is because, at an older age, the body's organs are getting weaker. One of the liver functions also weakens and causes insulin resistance, resulting in diabetes mellitus.

Bhalerao's (2014) study also said that age was significantly associated with a higher risk of diabetes mellitus. This may be due to prolonged exposure to stress, obesity, genetic factors, and age. Therefore, the focus on diabetes prevention among young people is essential.

Age was significantly associated with the prevalence of diabetes mellitus. According to bivariate analysis, the proportion of respondents with diabetes mellitus increases with age, especially in the population over

40 years, due to the development of glucose intolerance. Age was significantly associated with diabetes mellitus and those aged 55-64 years had the highest chance of developing this disease (Idris, 2017).

Most of the respondents were female (55%) in this study, while the rest were male (45%). According to the theory of Tarwoto et al. (2016), both men and women have the same level of risk for developing diabetes mellitus into early adulthood. However, after the age of 30, women are more at risk than men.

In line with the research of Idris (2017), it shows that the proportion of diabetes mellitus among women is higher than among men. This finding is in line with several studies which have found that women have a higher risk of developing type 2 diabetes mellitus than men. This is because, physically, women have a higher chance of increasing their body mass index. Post-menopausal monthly cycle syndrome allows easier distribution of accumulated body fat due to various hormonal processes, leading to a higher risk of other types of diabetes mellitus in women.

In this study, it was found that most of the respondents worked (70%), while the remaining 30% did not work. According to Tarwoto's (2016) theory, occupational, environmental factors play a role in the development of diabetes mellitus, the prevalence of this disease is expected to be lower in patients who do not work.

There is a working relationship with an increase in the prevalence of diabetes mellitus. Similar findings reported by several other studies in India that this diabetes with work could be due to the combined effect of physical activity on employees, homemakers, and work-related stress among those working in agriculture (Bhalerao, 2014).

Wound healing in diabetic patients is prolonged until a diabetic ulcer occurs. In line with Bentley and Foster (2017), Sibbald, Woo, and Queen (2017) state that macrophages and neutrophils are essential agents in wound healing, especially at the inflammatory stage that underlies all subsequent steps. In patients with DM, this function is impaired due to perfusion problems. Oxygen insufficiency can increase the number of bacteria and interfere with the collagen formation process, which in turn causes the incidence of infection to be longer. In diabetic foot ulcers, there is an increase in proteases released by neutrophils and pro-inflammatory cytokinins released by macrophages during the inflammatory phase. In addition, diabetic foot ulcers have an excess of MMPs and a decrease in TIMMPs, resulting in a reduction of growth factors.

The delay in healing diabetic foot ulcers is caused by prolonged hyperglycemia resulting in non-enzymatic glycosylation Maillard reactions between proteins and reactive carbonyl and dicarbonyl compounds. Protein degradation and glycosylation result in the formation of α -dicarbonyl, 3-deoxyglucosone (3DG), which will then form advanced glycation end products (AGEs), and ultimately have an impact on increasing the healing time of diabetic foot ulcers because wound repair depends on fibroblast migration, proliferation, and expression of extracellular matrix proteins (Loughlin, DT, & Artlett, CM 2009).

This is in line with Azad et al. (2016) research, which stated that the average patient with diabetic ulcers had an average wound scale of 45 before being given larval therapy. The area of diabetic wounds reaches 50 to 66 cm². The importance of a thorough evaluation cannot be overstated. The findings of specific assessment results will directly affect the actions to be taken. Initial assessment and detailed description are emphasized, including location, size, depth, shape, inflammation, edema, exudate (quality and quantity), previous procedures, duration, callous, maceration, erythema, and quality of the wound bed (Frykberg, Zgonis, et al. 2016).

This study found that the Bates-Jensen Wound Assessment Tool's wound score decreased -21.0 (2.29). Statistical test results obtained a p-value of 0.000 which means H_0 is rejected and H_a is accepted. This means that there is an effect of treating diabetic ulcers with larval therapy on the healing process of diabetic ulcers in patients with diabetes mellitus at Wisma Rini Pringsewu General Hospital, Lampung.

The use of live larvae is known as Maggot debridement Therapy (MDT). Maggot or live larvae used are larvae of *Lucilia sericata* *Lucilia sericata*, which have been sterilized first. Maggot therapy uses young larvae with one larva for 50-80 cm² of the wound area. Maggot is usually used for about 72 - 120 hours or 3-4 days or depending on the patient's tolerance and medical wound evaluation. (Sun et al., 2014).

This therapy offers advantages in managing chronic, infected wounds and is used in hundreds of clinics worldwide. MDT is believed to have benefits, namely (1) effectively removing dead tissue, (2) helping to fight infection by reducing bioburden, and (3) assisting the remodeling process. In addition, secretions from live larvae have antibacterial effects, reduce inflammation and neo-genesis, and promote wound healing (Sun et al., 2014).

In line with the research of Sun et al. (2014), found that MDT plays a role in diabetic wound healing, reducing tissue necrosis and the formation of new healthy granulation tissue by up-regulating endothelial cell activity. The results of the study showed a significant decrease in wound scores before and after the study.

She is supported by a literature review (Wangko, 2015) which states that larvae reduce necrotic tissue by eating them. Larvae produce various proteolytic enzymes, including collagenase, which breaks down necrotic tissue and extracellular matrix (including laminin and fibronectin) into semisolid forms that can be absorbed and digested by the larvae. The larvae feed on infected debris, producing a broad spectrum of bactericidal material against Gram-positive and Gram-negative bacteria.

Supported by a systematic review of research by Yazdanpanah (2015), the use of Maggot Debridement Therapy has the advantage that larvae eat necrotic tissue first, and larval enzymes increase granulation tissue in wounds. However, this therapy is reluctant to be used by patients and health workers, considering the larval form that makes patients uncomfortable.

The same is true of the results of a meta-analysis by Wilasrume et al. (2014), which stated that pain therapy could provide a 20% higher chance of healing than conventional wound therapy (RR 1.77 CI 95% 1.01 – 3.11) which showed the effect of larval therapy was very heterogeneous depending on the degree of the wound and the duration of wound healing.

In the opinion of the researcher, in addition to the benefits obtained from larval therapy treatment, there are several limitations, namely 1) Patients feel pain and disgust when they feel maggot larvae walking on wounds, 2) Researchers must be skilled and trained to know when the study is stopped so as not to give excessive effects. . 3) Researchers did not continue the study until the wound was closed by continuing therapy for diabetic ulcers. Another limitation is that the researchers did not control for diabetes treatment factors, lifestyle, diet, and physical activity of respondents, so confounding factors in this therapy were not measured. However, the researchers concluded that larval therapy effectively treated grade 3-5 diabetic ulcers until the necrotic tissue was clean and granulation tissue was present.

In the researcher's opinion, the administration of this larval therapy showed a significant effect on the clearance of necrotic tissue and stimulated granulation tissue. Once granulation tissue has grown, therapy is discontinued, and wound treatment is continued until the wound is closed. They were suspended after cleaning necrotic tissue and granulation tissue because the larval effect only cleans dead tissue and stimulates growth. If therapy is continued after granulation, it is feared that the larvae will eat healthy tissue.

Conclusion

There is an effect of treating diabetic ulcers with larval therapy on the healing process of diabetic ulcers in patients with diabetes mellitus.

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