

Healing Diabetic Ulcers with Pure Honey dressing: Literature Review

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Abstract: *Patients with diabetes mellitus with diabetic ulcers require wound care to reduce the risk of amputation. One alternative material that can be used for wound care is the topical application of pure honey. The purpose of the study was to determine the effect of honey dressing on the healing process of diabetic ulcers through a literature review. The databases used include PubMed, ScienceDirect, Google Scholar, and Garuda. Keywords using ((honey) OR honey dressing) AND wound healing) AND diabetic ulcer) OR diabetic foot ulcer. The library sources used are from 2010-2020. The search results obtained 9,507 articles. Furthermore, articles were selected based on inclusion and exclusion criteria and obtained 11 articles. The results showed that eleven articles showed the effect of giving honey dressing on the healing process of diabetic ulcers. A total of 3 articles showed wound healing based on changes in score, 2 articles based on changes in grade, 5 articles based on changes in wound characteristics, and 2 articles based on healing time. Of the eleven journals analyzed, honey dressing on diabetic ulcers was most effectively used in wound Grade I and II (Wagner Classification) ulcer patients who received drug therapy with a GDS <200 mg/dL and received daily wound care for 1 month. Health care professionals may consider using honey dressings for the treatment of diabetic ulcers.*

Keywords: honey dressing, diabetes mellitus, diabetic ulcers, wound healing

INTRODUCTION

Along with advances in technology, there are many impacts on all aspects of life, including the impact on health. Riskesdas data shows that currently Indonesia is experiencing a shift in health problems, namely shifting from infectious diseases to non-communicable diseases (PTM) and degenerative (aging)(1). NCDs are the cause of 70% of deaths in the world (1). Changes in lifestyle and lack of application of healthy living are the main factors for the emergence of non-communicable diseases. While degenerative diseases can arise due to the physiological functions of the body which begin to decline due to age or aging. According to the Indonesian Ministry of Health (1), the most frequently occurring PTMs include heart disease, stroke, diabetes and Chronic Obstructive Pulmonary Disease

(COPD). There is an increasing trend in cases of diabetes. Globally, data on cases of Diabetes Mellitus has increased significantly from year to year. The World Health Organization (WHO) estimates that in 2014 8.5% of adults aged 18 years and over had diabetes and in 2016 diabetes was the direct cause of 1.6 million deaths in the world (2). The results of the 2019 WHO survey, Indonesia ranks 6th in the world with the highest number of diabetics after China, India, the United States, Brazil and Mexico. The prevalence of diabetes in Indonesia based on Riskesdas data in 2018, nationally increased from 6.9% in 2013 to 8.5% in 2018 and is predicted to continue to increase.

Diabetes Mellitus is a group of metabolic diseases characterized by hyperglycemia, resulting from defects in insulin secretion, insulin activation, or both (3). Diabetes Mellitus (DM) is a non-communicable

disease characterized by high blood sugar levels (hyperglycemia) due to decreased insulin secretion by the pancreas, reduced insulin sensitivity or both (4). From the above opinion it can be concluded that DM is a metabolic disorder caused by a decrease in insulin secretion and activation in the pancreas, causing excess glucose in the blood. DM is classified based on its etiology into three, namely type 1 DM due to beta cell destruction which is generally associated with absolute insulin deficiency. Type 2 diabetes is caused by insulin resistance and deficiency to the dominant secretory defect accompanied by insulin resistance. Gestational diabetes or diabetes during pregnancy, i.e. before pregnancy there was no diabetes, and a specific type associated with other causes (5).

Uncontrolled blood sugar can lead to life-threatening conditions. Emergencies that arise due to DM are very diverse including diabetic ketoacidosis (DKA), hyperosmolar hyperglycemic (HHS), and hypoglycemic. DKA and HHS are characterized by insulinopaenia and severe hyperglycemia, clinically these conditions are almost the same, only differing from the degree of dehydration and the severity of metabolic acidosis. While hypoglycemia is characterized by blood sugar conditions below normal due to side effects of antidiabetic therapy (6). DM causes various complications in the heart, blood vessels, eyes, kidneys and nerves. Complications can arise due to comorbidities. The most common complication is the appearance of gangrene/diabetic ulcers in the lower extremities or legs. Diabetic ulcer is a condition where infection, ulcer and/or destruction of the deepest skin tissue on the patient's feet are found. These ulcers occur due to nerve abnormalities and peripheral arterial vascular disorders (7). Diabetic ulcers most often occur in the legs because the condition of blood vessels in DM patients is very poor and inelastic, besides that the location of the feet far from the heart also affects the supply of nutrients that are not optimal in the peripheral areas. The prevalence of patients with diabetic wounds in Indonesia has reached 15% with a risk of amputation of 30%, and treatment of

diabetic ulcers is the cause of the highest hospital care costs of 80% (8). Therefore, it is necessary to provide appropriate wound management to reduce the risk of sepsis and amputation.

In the medical world, there are 4 pillars of DM management which include education, nutrition, physical exercise, and pharmacology. The most common pharmacological therapy given to DM patients is anti-hyperglycemia. Administration of anti-hyperglycemic drugs aims to stimulate the pancreas to secrete insulin and increase insulin sensitivity (5). In addition to pharmacological therapy, patients with diabetes mellitus with diabetic ulcers require dressings or wound care for wound healing. Giving dressings in DM patients aims to prevent more infections and reduce amputations. Standard practice in the management of diabetic ulcers includes surgical debridement, dressings to facilitate moisture in the wound area and control of exudate, wound off-loading, vascular assessment, and infection control, and blood sugar levels (9). Treatment of DM patients with diabetic ulcers must be carried out comprehensively and holistically. In this case, not only doctors and nurses collaborate, but also involve nutritionists, surgeons, podiatrists and other health workers who play a role with the aim of accelerating the wound healing process (10). In addition to clinical and pharmacological actions, DM patients also need education and physical exercise. The role of education is very important, especially education on foot care with diabetic ulcers. Physical exercise is also needed to improve peripheral circulation and prevent new ulcers from forming.

Many studies have stated that there are herbal treatments that can be used as an alternative to healing diabetic ulcers/gangrene, one of which is honey. Honey is a saturated thick sugar solution derived from nectar assembled and processed by honey bees (eg *Apis mellifera*) containing approximately 40% fructose, 30% glucose, 20% water and 5% sucrose, as well as many bioactive compounds including amino acids, vitamins, minerals and enzymes (11). Besides being natural, honey is also easy to find and the price is relatively more

affordable. Natural honey is a credible alternative treatment for chronic ulcers because honey has been proven to be antibacterial, antifungal and antiviral, and can even fight life-threatening bacteria such as Methicillin-resistant *Staphylococcus aureus* (MRSA) and Vancomycin resistant enterococci (12). Honey provides an ideal medium for fibroblast proliferation, migration and organization of collagen thereby enabling new granulation processes in wounds (12). Several experimental studies have documented that the relative acidity of honey can aid in the distribution of oxygen from hemoglobin, because it can make the wound environment acidic and reduce bacterial growth (11). Based on this background, researchers are interested in conducting a summary/literature review to determine the effect of honey dressing on the healing process of diabetic ulcers in patients with diabetes mellitus.

METHODS

The research design used in this study is a literature review. This study uses secondary data, namely data obtained from literature and

other scientific articles that have been published in national and international journals. Journal searches were conducted in September-December 2020 through the PubMed, ScienceDirect, Google Scholar and Garuda databases using the keywords (((honey) OR honey dressing) AND wound healing) AND diabetic ulcer) OR diabetic foot ulcer.

RESULTS AND DISCUSSION

Based on the article search results, researchers got 9,507 articles. Because the number is too large, the researcher narrows the search by filtering journals by year, type of research, and full text. Journal filter results obtained 238 articles. Articles are then checked for duplication. There were 11 similar articles that were issued. Then the articles were screened based on the title (n=33), abstract (n=33) and fulltext (n=31). The final stage of the article was assessed through inclusion and exclusion criteria, 11 articles were obtained that matched. The process of searching and selecting articles is shown in Figure 1.

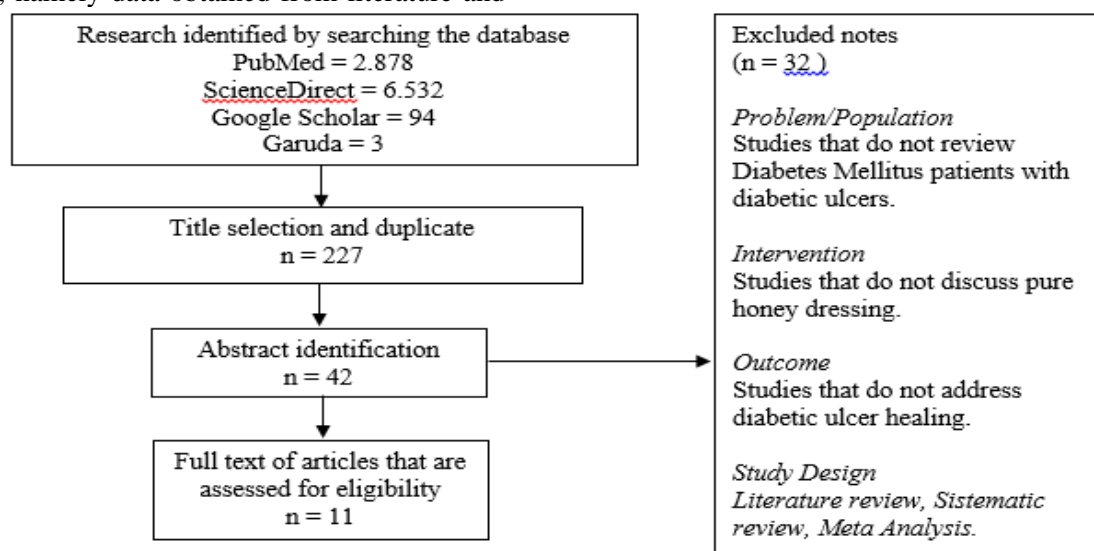


Figure 1. Flow Chart

Table 1. Literature Search Results

Researcher	Publication Title	Result
Radiant Eka Pramana W, Maria Suryani, 2012	The Effectiveness of Natural Honey Treatment Against Diabetic Foot Infection Wound Healing (IKD)	In the honey group, the wound score changed. From the range of 8-10 increased to 10-14.
Awaluddin et al., 2019	Differences in the Effectiveness of Honey and Sofratulle Against Diabetic Wound Healing in Diabetes Mellitus Patients	In the honey group, the average wound scores before and after the wound care intervention using honey were 24.60 and 32.40.
Sundari F	Effect of Honey Therapy on Diabetic Wounds in Patients with Type 2 Diabetes Mellitus in RW 011 Pegirian Village, Surabaya	The results showed that before being given honey therapy, 9 respondents (90%) were in the heavy category. After giving honey therapy, 4 respondents (40%) were in the moderate category.
Nabhani N, Widiyastuti Y.	Effect of Honey on Gangrene Wound Healing Process In Diabetes Mellitus Patients	The wound score at the time of the initial assessment was 21. After being given honey intervention, the wound was reduced and the wound score became 11.
Karimi Z, Behnamoghada m M, Rafiei H, Abdi N, Zoladl M, Talebianpoor MS, et al.	Impact of olive oil and honey on healing of diabetic foot: a randomized controlled trial	After the intervention, the mean scores of surrounding tissue, wound level, wound drainage, and wound healing were significantly higher in patients in the honey and olive oil group compared to patients in the control group.
Moghazy AM, Shams ME, Adly OA, Abbas AH, El-Badawy MA, Elsakka DM, et al.	The clinical and cost effectiveness of bee honey dressing in the treatment of diabetic foot ulcers	Complete healing was achieved significantly in 43.3% of ulcers. Significant reduction in size and healthy granulation was observed in the other 43.3% of patients. The bacterial count of all ulcers was reduced after the first week of using honey.
Ns. Riani, S.Kep., M	Comparison of the Effectiveness of Modern Wound Treatment "Moist Wound Healing" and Complementary Therapy "NaCl 0.9% + Original Honey" on Healing Grade II Diabetic Foot Wounds at Bangkinang Hospital	In the group using 0.9% NaCl + Honey, there was a change in the condition of the wound, namely a decrease in the amount of exudate, for epitelization there was no significant change. But leads to good healing.
Anita Sukarno,	The Effectiveness Of Indonesian Honey On Diabetic Foot Ulcers Healing Process: Observational Case Study	In the main dressing with honey, the wound size is reduced, there is an improvement in the type of necrotic tissue, the amount of necrotic tissue is reduced, there is an increase in wound granulation and epithelialization.
Waqar Alam Jan,	Comparison Of Conventional Pyodine Dressing With Honey Dressing For The Treatment Of Diabetic Foot Ulcers	Recovery time was significantly faster in Group B (honey dressing) compared to group A (conventional Pyodine dressing).

Researcher	Publication Title	Result
		Thirty patients made a full recovery within 2-4 weeks after treatment with honey.
Siavash Mansour Siavash,	The efficacy of topical royal jelly on healing of diabetic foot ulcers: a double-blind placebo-controlled clinical trial	The healing parameters of these wounds are as follows. In the RJ honey group, there was a reduction in depth, length and width. The mean (SD) duration of healing completion was 38 days in the RJ . honey group.
Muhammad Imran,	A Randomized, Controlled Clinical Trial of Honey-Impregnated Dressing for Treating Diabetic Foot Ulcer	One hundred and thirty-six wounds (75.97%) of the 179 wounds were completely healed with honey dressing within the healing period of 18.00 (6 - 120) days.

Analysis of Diabetic Ulcer Healing Process Based on Wound Score After Honey Dressing

From the journals obtained, there are 3 research journals that discuss the effect of honey dressing on wound scores. In research conducted by Radiant Eka Pramana W, Maria Suryani (13) Wound care was carried out for 1 week. The wound is cleaned first with NaCl solution then honey is applied. On the 7th day of intervention, the wound was evaluated. The condition of the wound showed a significant presentation of pre and post wound scores with honey dressing. In the honey group, granulation was seen in the wound area and no signs of inflammation were found. Seven respondents in the comparison group had a fixed range of wound scores.

Other research conducted by Awaluddin, Syarifah and Nurhayatina, (2019) show significant. The wound was treated for 1 week using a honey bandage. On the seventh day the wound condition was evaluated, the wound score increased. So it can be concluded that there is an improvement in the condition of the wound. In addition, the research conducted (14) also showed similar results. Before being given topical pure honey therapy, the wound is cleaned first with sterile liquid. Wound care was performed for 2 weeks and evaluated on day 14. After two weeks of mass follow-up, the wound showed a reduction in size and improvement in wound scores.

In general, healing parameters in all types of wounds depend on changes in wound characteristics. According to Karimi *et al.*, (2019) higher scores indicate better wound healing. While in (16) in the Bates-Jensen WOUND ASSESSMENT TOOL, the smaller the score, the better the wound condition. Each instrument used has its own parameters in assessing wound healing.

Based on the facts and theory, the researcher argues that honey has an influence on the healing process of diabetic ulcers. Improvements in the wound score indicate progress in the condition of the wound, so it can be concluded that the wound healing process can run as it should.

Analysis of Diabetic Ulcer Healing Process Based on Wound Grade After Honey Dressing

There are 2 journals that describe the effect of honey dressing on the healing process of diabetic ulcers based on wound grade. Research conducted Sundari and Djoko showed a change in the degree of wound after being given a wound care intervention using honey (17). Wound care procedures are carried out every day with the rule of using twice a day for 2 weeks. The wound was cleaned first using NaCl solution and then a debridement procedure was carried out if there was necrotic tissue. After the debridement procedure, the wound was rinsed again with NaCl solution and 2-3 drops of honey were added. After two weeks of follow-up, the number of respondents

with minor injuries, which was originally only 1 respondent, increased to 3 respondents. The moderate degree from the beginning was not present to 4 respondents, and the degree of serious injury decreased from 9 respondents to 3 respondents.

Other research conducted by Moghazy *et al.*, (2010), showed there was improvement in the grade and stage of the ulcer. Wound care procedures are carried out every day or if the wound oozes it needs to be re-treated. The wound is cleaned first with sterile liquid and then given a sufficient amount of honey. At the initial visit, the highest grade frequency was 1-b with characteristics of superficial wounds and infection. At the end of the study, the highest grade found was grade 1-a (superficial wound). From the results of the study, it was seen that during the study process there was a decrease in the grade of the wound.

According to The smaller the size and depth of the wound, the lower the degree of the wound so that the wound heals faster. Large and deep wounds will take a long time to heal. The decrease in grade of the wound is an indicator of improvement in the condition of the wound so that the hope of wound healing increases (13).

Based on the facts and theory, the researcher argues that honey dressing has an effect on healing diabetic ulcers. With its anti-inflammatory and anti-bacterial properties, honey can stimulate the growth of granulation tissue and epithelialization thereby accelerating wound healing.

Analysis of Diabetic Ulcer Healing Process Based on Wound Characteristics After Honey Dressing

There are 5 journals that discuss the effect on wound characteristics after being given wound care interventions/dressings using honey. Research conducted by Karimi *et al.*, (2019) is to compare the effectiveness of honey with olive oil on the healing of diabetic ulcers. In the honey group, the wound was bandaged using gauze with honey every day for 1 month. After a follow-up period of 1 month, the wound showed a decrease in grade, there was new tissue growth and improved wound drainage.

The patient's mean score increased and showed better wound healing.

Other research conducted by Moghazy *et al.*, (2010) showed a change in ulcer size throughout the follow-up period. After 1 month the size of the ulcer shrank and showed no signs of inflammation. In addition, the presence and nature of the exudate in the wound showed a significant development. At the start of the assessment, the exudate on the ulcer was foul-smelling and profusely drained. At the end of the study, all ulcers showed a very small amount of serous type exudate. The overall outcome of the honey dressing was that the wound was completely closed or showed healthy granulation and reduced surface area at the end of the study.

In research conducted by Riani and Handayani, (2017) showed a change in exudate in the wound after being given honey dressing therapy. The study was conducted in the operating room ward with the frequency of treatment once a day for six days of follow-up. The wound was cleaned first using 0.9% NaCl solution and then pure honey was applied. There is a change in the condition of the wound, namely a decrease in the amount of exudate, for epithelialization there has been no significant change but leads to good healing. This study was conducted relatively short, because the patient's follow-up period was only carried out for 6 days.

Research conducted by Sukarno, Hidayah and Musdalifah, (2019) using pure nectar honey from kapok flowers. Each wound was observed for the healing process and treated regularly using honey as the main dressing for 2 weeks. This study found that the use of honey dressing significantly affects the healing of diabetic ulcers. There is a decrease in wound size, improved necrotic tissue, decreased amount of necrotic tissue, increased granulation tissue and increased epithelialization of the entire diabetic ulcer. It is proven that Indonesian honey has an influence on the healing process of diabetic foot ulcers.

In contrast to the four studies above, the research conducted by Siavash *et al.*, (2015) statistically showed less significant results. However, the condition of the wound still

showed good repair results. Each patient will be given wound care three times a week and will be followed up for 3 months or until the ulcer has healed. In the Royal Jelly honey group, the wound experienced a reduction in depth, a decrease in length and a decrease in width. Wound condition is getting better and showing signs of healing.

In theory, a wound is said to be healed if it changes in characteristics and reaches several parameters. These parameters include wound size, depth, type and amount of necrotic tissue, type and amount of exudate, color around the wound, edema, granulation and epithelialization. Wounds show healing if there is a reduced area and depth of the wound, the absence of blackish/necrotic tissue and exudate, the color around the wound shows a pink color, and there is granulation and epithelialization as a sign of new tissue growth (22).

In line with the facts and theory, the researcher argues that there is an effect of giving honey dressing on changes in wound characteristics. Honey has good content for wounds including vitamin B complex, vitamin A, vitamin C, antibiotics, riboflavin, biotin, folic acid (22). The content of vitamin C in honey is three times more than vitamin serum. So that honey can provide adequate nutrition to wounds because of its osmotic properties and can accelerate blood circulation. Not only nourishes the wound area, but white blood cells or leukocytes are also stimulated to release cytokines and growth factors (Ningsih *et al.*, (2019). In addition, honey also has antibacterial, anti-inflammatory, and autolytic properties. The antibacterial properties of honey can treat wound infections. Bacteria will be difficult to grow in wounds due to the very high osmolarity of honey. The acidity in honey is very low, it also does not support bacteria to live. As well as the presence of hydrogen peroxide in honey, it is very useful as an antiseptic so that it can inhibit bacteria from growing (22).

Honey also has anti-inflammatory properties which can reduce odor and pain so that circulation will increase. This will affect the wound healing process. Besides being able to speed up wound healing, honey can also

stimulate the growth of new tissue and reduce scars or scars on the surface of the skin. Another important characteristic of honey is the presence of autolytic debridement properties. Where necrotic tissue will be degraded enzymatically by the body or natural debridement.

Analysis of Diabetic Ulcer Healing Process Based on Wound Healing Time After Honey Dressing

There are two journals that describe the healing process of diabetic ulcers based on wound healing time after honey dressing. Research conducted Jan *et al.*, (2012) showed significantly faster recovery times in Group B (honey dressing) compared to group A (conventional Piodine dressing). The group with honey dressing, diabetic ulcers healed in 2-4 weeks. Other research conducted by Imran, Hussain and Baig, (2015) showed that during the follow-up period, as many as one hundred and thirty-six of the 179 wounds healed completely with honey dressing. While in the group with saline dressing, only 97 wounds healed out of 169. The average wound healing time was 18 days in group A and 29 days in group B. In the group with honey dressing, it was much faster than the group treated only with normal dressing saline.

According to Huang, Y (2015) the higher the grade or grade of the wound, the more time it will take for healing. With the reduction in size, reduction in depth, granulation and epithelialization indicate an improvement in the wound so that the grade of the wound will decrease and the required healing time will be shorter.

Based on the facts and theory, the researcher argues that honey has a role in healing diabetic ulcers. Honey is able to create moisture in the wound area so that the wound healing process can occur. The faster the growth of granulation tissue and epithelialization, the faster the wound will heal.

CONCLUSIONS

All articles analyzed showed that there was an effect of honey dressing on diabetic

ulcer wound healing. Eleven journals analyzed proved that there was a change in wound condition after administration of honey dressing after a predetermined follow-up period. The results showed that there were changes in the characteristics of the wound, including size reduction, reduction in wound depth, the appearance of granulation and epithelialization in the wound, thereby reducing the score and grade of the wound. The lower the grade of the wound, the faster the healing process of diabetic ulcers. With regular care and according to procedures, the wound can be dry and closed completely.

CONFLICT OF INTEREST STATEMENT

There is no conflict of interest in this study.

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