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**Review Article**

# Honey for The Treatment of Diabetic Foot: A Literature Review

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**Abstract**

**Background:** Honey known as wound healer, but the use of honey for diabetes population is lack. Scientific studies needed to provide enough evidence to justify the benefits of honey for the treatment of diabetic foot ulcers.
**Aims:** To identify the benefit of honey as healing diabetic foot ulcer.
**Methods:** The author was used PICO question as the first step of this study, then the second step was searching the articles from several databases. The inclusion and exclusion criterias were using only honey as a diabetic foot treatment on human, randomized control trial study or quasy experimental study, published less than 10 years ago (2009 – 2019), available in English and provide full text. Meanwhile, for the exclusion criteria were literature review, systematic review or meta-analysis study, using honey as a treatment to animal such as rat and rabbit, combine honey with another treatment. By using PRISMA guideline, researchers were systematically review several articles from 4 databases.
**Results:** After conducted search strategy by using Boolean search strategy, 4 articles were included. The articles used different types of honey and the population ranged from 8 to 63 peoples. According to the results, majority of study showed honey is effective as wound healer and safe
**Conclusion:** Honey wound dressing is an option for managing diabetic foot
**Recommendation:** As a nurse, we can offer the honey as an effective treatment or intervention tools for targeted patients or populations

**Keywords:**
**Diabetes, Honey, Diabetic foot**

## INTRODUCTION

One of the most catastrophic complications of diabetes is diabetic foot ulcers (1). The prevalence of diabetic foot ulceration among diabetic population is 4–10%. Among diabetes population, the lifetime risk of diabetic foot ulcers is 15% (2). The management of diabetic foot ulcers is challenging and need further review of strategies and treatments, so we can reduce cost effectively (1).

Wound dressing is an essential aspect in managing diabetic foot ulcers. Different types of wound dressings can be applied to diabetic foot ulcers (3). Honey has some unique natural features as a wound healer, can combat many microorganisms that are involved in the wound process and possesses antioxidant activity which can control inflammation (4). Despite of their advantages, in the real situation honey is rare to use by health worker as a treatment for diabetic foot ulcers in the hospital. Thus,

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find a good evidence to support the utilization of honey in clinical area is needed.

According to the data from International Diabetes Federation (2020), the number of diabetes patients in the worldwide is approximately 463 million ranged from 20 to 79 years old. It is predicted to rise to 700 million in 2045. Majority of diabetes patients are living in low-and middle-income countries. Indonesia is included as middle- income country. The population of diabetes patients in Indonesia is around 10.6 million people (International Diabetes Federation, 2020). Due to the high number of patients with diabetes, conduct a study among this population is essential (5).

# METHODS

### Searching Strategies

Before conduct literature review, researcher develop research questions. Then a Boolean search strategy was established and used. Using PRISMA guideline, researcher systematically review studies reporting the effectiveness of honey dressing for treatment diabetic foot from several databases included Embase, Medline, and Ovid. This study conducted in 2019 (6).

### Eligibility Criteria

The inclusion criteria were using only honey as a diabetic foot treatment on human, randomized control trial study or quasy experimental study, published less than 10 years ago (2009 – 2019), available in English and provide full text. Meanwhile, for the exclusion criteria were literature review, systematic review or meta-analysis study, using honey as a treatment to animal such as rat and rabbit, combine honey with another treatment.

### Data Extraction

The literature search in this study was performed in two phase. In the first phase the titles and abstracts were reviewed for relevancy, and in the second phase the full articles were reviewed by the authors; if the article matched with the inclusion criteria, it was selected .

**Table 1. PICO**

| PICO | English Synonyms | Emtree/MeSH Controlled Vocabulary |
|---|---|---|
| P | Foot ulcer, diabetic<br>diabetic feet, diabetic foot,foot ulcer | Diabetic foot<br>Diabetic foot |
| I | Bee honey, honey distillate<br>honey | Honey<br>honey |
| C | No comparison | No comparison |
| O | granulation, wound healing, wound regeneration; wound repair<br>Wound healing | Wound healing<br>wound healing |

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PICO question was made: In Diabetic foot (P), what is the effect of honey (I) on wound healing (O)?. After made PICO Questions, the first step on search strategy is find *search term* including controlled vocabulary (*emtree and mesh*) and English synonym. Based on the *search term*, *search syntax* was made. By using *search syntax*, searching strategy conducted through three databases including Embase, Medline, and Ovid. After conduct search strategy, 51 articles identified (30 Embase + 16 Medline + 5 Central/ Ovid). All of articles (51) export to endnote. In endnote, we screened the articles three times based on the sequence: *(1) secondary title, volume, pages, (2) year, title, volume, (3) year, title* to find duplicates. Based on duplicates screening, 21 remove and the rest of the articles are 30.

The next step is checking for the eligibility based on abstract and title, and 9 articles deleted because did not eligible (did not match with the purpose of study or PICO questions). The rest of articles until this step is 21. Endnote was used to find the full text articles and the results were 6 full text articles, 1 article only found URL, and 14 articles do not provide the full text. All articles which do not provide the full text in endnote will search one by one, manually from google scholar by researchers. After the search of full text articles completed, 17 articles deleted because not related with the PICO question, conducted experimental study to rats or other animals, combine honey with another treatment such as aloe vera, and published before 2009. Thus, the articles included in this literature review were 4.

**Fig. 1. Schematic representation of studies using PRISMA checklist and flow diagram**

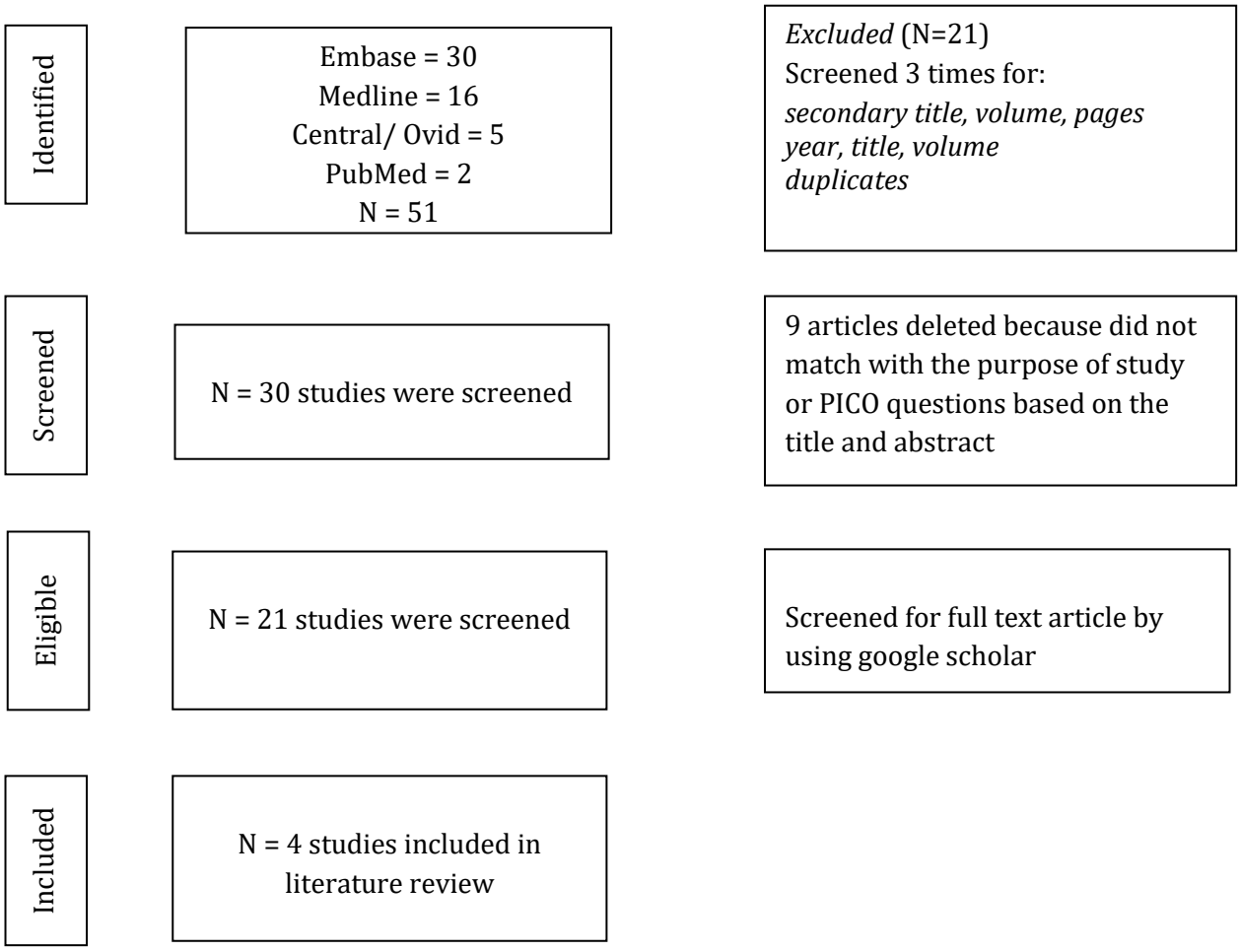


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**Table 2. Effect of honey for diabetic foot**

| Authors and Title | Study design | Sample size | Patient selection | Outcome measured | Conclusion |
|---|---|---|---|---|---|
| Siavash et al. (7) | Randomized control trial | 60 | Diabetes patients | Depth reduction rate in placebo group and in royal jelly (RJ) group was same. It was 0.04 mm/day and the width reduction rate in placebo and in RJ group also similar, it was 0.2 mm/day, respectively<br><br>Mean duration of complete healing in placebo group was shorter than in RJ groups. It was 36 days and in RJ group was 38 days<br><br>But the number of diabetic ulcers which completely healed in RJ group (30) higher rather than placebo group (29)<br><br>P value 0.6 | Not significantly different between placebo and RJ group |
| Kamaratos et al. (8) | Randomized control trial | 63 | Diabetes mellitus type 2 patients | Mean duration of healing in honey group was shorter (31 ± 4 days) than in the conventional group (43 ± 3 days). | The conclusion is patients in honey group healed faster than in conventional dressing group. |
| Ritonga and Daulay (9) | Quasi experiment | 8 | Diabetes patients | • 3 patients – 6th day of treatment<br>• 1 patient – 8th day of treatment<br>• 2 patients – 12th day of treatment<br>• 1 patient – 14 day of treatment<br>• 1 patient - > 14 day of treatment<br>P value 0.011 | Sialang honey was effective for diabetic foot ulcer |
| Mujica et al. (10) | Randomized control trial | 32 | Diabetes patients | Propolis showed effective to reduce the wound's area by an average of 4 cm2, and there is an increase in the connective tissue deposit compared to the control group. | Propolis can improve the wound based on its anti-inflammatory and antioxidant profile. |

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## RESULT

The first study entitled—the efficacy of topical royal jelly on healing of diabetic foot ulcers: a double-blind placebo-controlled clinical trial with total 64 Diabetes patients. The patients divided into two groups: 32 patients in placebo group and 32 patients in royal jelly group. In the end of study, only 60 patients available for follow up. The results showed that the depth reduction, width reduction, and mean duration of complete healing has not significantly different. However, the researchers reported that in the end of trial, 29 ulcers in placebo group completely healed and 30 ulcers in royal jelly group completely healed. There is slightly differences in the number of completely healed ulcers.

The second study entitled *manuka honey-impregnated dressings in the treatment of neuropathic diabetic foot ulcers* from (8) with total sample 63 patients Diabetes mellitus type 2. This study is individual RCT (1b). The patients divided into two groups: group I ($n$ = 32) patients were treated with MHID (Medihoney Tulle Dressing) and group II ($n$ = 31) patients with conventional dressings (CD, saline-soaked). Mean duration of healing was 31 ± 4 days in the MHID group versus 43 ± 3 days in the CD group [$P$ <0·05, confidence interval (CI) 95% −10·7N to −8·7] gauze dressings). The conclusion is patients in honey group healed faster than in CD group.

The third study entitled *effectiveness of using sialang honey on wound bed preparation in diabetic foot ulcer or* from (9). The study design is quasy experiment with one group pre-test and post-test design approach. The population in this study were all patients with diabetic foot ulcer in Padangsidimpuan City, North Sumatra, Indonesia. The result showed the day of treatment to remove dead tissue starts from the 6th day. However, until day 14th there is one respondent showed ineffective wound healing. After analyzing the data, it could be concluded that sialang honey was effective in stimulating wound bed preparation in diabetic foot ulcer with a p value of 0.011.

The fourth study entitled *Propolis as an Adjuvant in the Healing of Human Diabetic Foot Wounds Receiving Care in the Diagnostic and Treatment Centre from the Regional Hospital of Talca* from (10). The study design is randomized control trial study. The participants were 32 type 2 diabetes mellitus patients. The result showed that propolis turned out to be an effective therapeutic strategy for diabetes foot wounds. Propolis can improve the wound because there is an anti-inflammatory and antioxidant profile in propolis.

## DISCUSSION

In this literature review, most of study were randomized control trial study which the highest evidence-based practice in health according to the hierarchy of research. The aim of diabetic foot wound dressing is to provide clean wound and low bacteria count, thus it can provide optimal environment for healing process. The benefit of honey as a dressing material has been studied by many authors in several countries. The range of wound healing is 6 days to 1 month. Each study used different types of honey and each honey had character as accelerate wound healing by absorb water from interstitial tissue through its higher osmolarity.

In this literature review, the types of honey used by researcher were local honey, Medi honey tulle dressing, Sialang honey, and royal jelly. As a non-pharmacological wound dressing, honey creates a moist and antimicrobial environment. Honey has some benefits such as anti-inflammatory, decrease the number of exudate and oedema, promotes angiogenesis granulate of tissue formation which leads to accelerates wound epithelialisation, stimulates collagen synthesis, promotes wound contraction, and facilitates debridement (11).

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Medi honey has been known and used for the treatment of a variety of pathological conditions. Another type of honey is propolis spray (3%). Propolis spray has benefit to cover the wound surface in each dressing from week 0 until 8 weeks as a maximum (12).While Sialang honey is applied to the diabetic foot for 6 until 14 days treatment. According to the literature, the duration of healing of neuropathic diabetic foot ulcers in diabetic type 2 patients that were treated with manuka honey-impregnated dressings was 31 days. The antibacterial activity of honey had a deodorizing effect on the wounds and its anti-inflammatory actions reduced the level of pain.

Kamaratos (8) found that none of the patients in group I who received honey needed treatment with antibiotics, while 9 (29%) patients in group II needed antibiotic treatment during the follow-up period. Furthermore, four of these patients were hospitalised for 28 days. Antibacterial mechanisms include the acidic pH of honey which ranges from 3.2 to 4.5 will inhibit the metabolism of Gram negative and positive bacteria. By inhibiting bacterial metabolism, it will cause bacteria to easily undergo lysis (13).

Honey creates significant wound contraction and it promotes the formation of granulation tissue and epithelialization of wounds. Honey can stimulate new blood vessels and growth in the wound tissue and synthesis of collagen. Based on the research from (12) the data showed a decrease in the wound area by an average of 4 $cm^2$ in the propolis group compared with the control group, which reduced 3 $cm^2$. Furthermore, next evaluation is needed whether the propolis treatment has an effect on collagen deposition and formation of fibrotic tissue (potential scar) or not.

In this literature review, each study used different tools or method to evaluate the diabetic foot ulcer such as tools of wound bed score (scale 0-16), PEDIS (Perfussion, Extent, Depth, Infection, and Sensation) System, Macroscopic aspect (wound area measurement) and Microscopic aspect (histopathology evaluation), and Texas University Wound Classification System. The study limitation is using only three databases to search the articles, so the findings still have limitation.

## CONCLUSION

Honey is applicable to use in clinical practice for diabetic foot because honey is effective to wound healing with reduce the time of healing and as disinfection for the ulcer. Indonesia is a forest country; thus, Indonesia is one of the best place to find honey. Honey can be applied by spray, gel, or smeared in its original form.

## RECOMMENDATION

As a nurse we can offer the honey as effective treatment or intervention tools for targeted patients or populations. There are no socio-economic issues affecting applicability of honey as a treatment because honey is easy to find and inexpensive. Use another type honey may need further consideration and study. Finally, to apply honey in the treatment of diabetic wounds, care is needed in choosing the type of honey to ensure the purity of the honey.

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