

Case Report

Honey as a Wound Dressing on Superficial Partial-Thickness Burn Injury in a Resource-Limited Setting: An EBCR at Ende General Hospital

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ABSTRACT

Background: The standard burn wound treatment protocol at Ende General Hospital involves wound cleansing, application of 1% silver sulfadiazine (SSD) cream, and moist gauze dressing. However, research has demonstrated that SSD exhibits cytotoxic effects on fibroblasts and keratinocytes in vitro and may impede wound healing in vivo. Honey has emerged as a promising alternative treatment for both acute and chronic wounds, including burn injuries. Clinical evidence suggests its efficacy in reducing healing time and preventing wound infection through its ability to maintain a moist wound environment while promoting tissue growth and epithelialization. **Objective:** This study aimed to compare the efficacy of honey and conventional SSD cream in accelerating burn wound healing, specifically in resource-limited healthcare settings. **Methods:** A comprehensive literature search was conducted using PubMed and Cochrane databases. Following systematic screening of titles and abstracts based on predetermined inclusion and exclusion criteria, six articles were selected for analysis, comprising four systematic reviews, one randomized controlled trial (RCT), and one cross-sectional study. The methodological quality of the selected studies was critically appraised using validated tools from the Centre for Evidence-Based Medicine, University of Oxford. **Results:** The analysis included six studies: four systematic reviews, one randomized controlled trial (RCT), and one cross-sectional study. Quality assessment indicated that the systematic reviews and cross-sectional study demonstrated robust methodological quality. These high-quality studies consistently reported significant reductions in burn wound healing time when honey dressings were utilized. However, the included RCT failed to report effect measurements, limiting the interpretation and clinical significance of its findings. **Conclusion:** Honey has a faster healing effect on superficial thickness burns than SSD cream and is affordable. Therefore, honey can be used as an alternative wound dressing in areas with limited facilities.

KEYWORDS

Burns, silver sulfadiazine, honey, wound healing, bandages

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INTRODUCTION

The management of burn injuries remains a significant global healthcare challenge, particularly in resource-limited settings [1]. The incidence of burns tends to decrease in developed countries but is contradictory in developing countries. The WHO estimates that 11 million cases of burns occur annually worldwide, 180,000 of which are fatal [2]. This burden is particularly pronounced in rural areas where burn injuries often result in more severe outcomes.

Socioeconomic factors are among the determining factors in the level of severity, compliance with seeking treatment, time for decision making, morbidity, mortality, and length of stay for patients with burns in rural areas [3,4]. Furthermore, the current standard treatment protocol at Ende Regional Hospital involves cleaning the wound, followed by the application of 1% silver sulfadiazine (SSD) cream and covering it with moist gauze. However, the conventional approach has several limitations. Several studies have shown that SSD has a cytotoxic effect on fibroblasts and keratinocytes in vitro and can inhibit wound healing in vivo. This cytotoxicity primarily occurs through the disruption of cellular proliferation and migration, which are crucial processes in wound healing. Large burn areas are associated with argyria, leukopenia, and liver and kidney toxicity [5]. Additionally, SSD's limited penetration into the wound bed and the need for frequent dressing changes can cause increased patient discomfort and delayed healing.

Given these limitations, a critical question emerges: can alternative treatments provide more effective and safer outcomes for burn patients in resource-limited settings? One promising alternative is honey, which is a traditional remedy with modern scientific support. Since then, honey has been used to treat acute and chronic wounds, including burns. Several studies have reported its effectiveness in reducing healing time and preventing infection [6–12]. Honey exhibits multiple beneficial properties, including potent antimicrobial activity through its high osmolality and hydrogen peroxide production, promotion of angiogenesis, and immunomodulatory effects that enhance tissue repair. However, it is important to note that while rare, some patients may experience allergic reactions to certain components in honey, necessitating careful patient screening. Honey can provide a moist wound environment and increase tissue growth and epithelialization [13]. Therefore, this study aimed to evaluate whether burn wound treatment with honey is more effective than SSD cream in accelerating burn wound healing in areas with limited facilities.

CASE PRESENTATIONS

A three-year-old male patient presented to the emergency department with his parents exhibiting full consciousness, with a primary complaint of burn injury to the right chest caused by hot water scalding that occurred one hour prior to hospital admission. The burn site was not subjected to initial wound irrigation. The patient reported a localized heat sensation and pain at the burn site. His medical history included simple febrile seizures and pneumonia, with an age-appropriate immunization status. Initial vital sign assessment revealed tachycardia with a pulse rate of 170 beats per minute, a respiratory rate of 24 breaths per minute, a body temperature of 36.8°C, and a pain intensity of 5 on the Wong Baker Face Pain Scale (WBFS). The patient weighed approximately 11 kg.

A systematic primary survey revealed the following findings: airway patency with spontaneous vocalization, spontaneous breathing with symmetrical chest expansion, absence of retractions, a respiratory rate of 24 breaths per minute, and an oxygen saturation (SpO₂) of 98%; circulatory assessment revealed tachycardia with a regular pulse of 170 beats per minute and warm extremities; and neurological status indicated full consciousness with a Glasgow Coma Scale score of E4V5M6. A secondary survey, comprising a comprehensive head-to-toe examination, revealed partial-thickness burns with a total body surface area (TBSA) of 16%. The results of laboratory investigations were within the normal range.

The emergency department management protocol included fluid resuscitation with Ringer's lactate solution, which was administered at 264 mL during the initial 8 h, followed by an additional 264 mL over the subsequent 16 h. Maintenance fluid therapy consisted of D5 ¼ normal saline at 1,100 mL with 10 mEq potassium chloride over 24 h. The therapeutic regimen included

intravenous ceftriaxone 550 mg twice daily and oral paracetamol 120 mg three times daily for analgesia. The patient was scheduled to undergo surgical wound excision by a general surgeon. The postoperative wound care protocol included the application of "Murni Nusantara" honey with a moist gauze dressing. The patient was deemed suitable for discharge to outpatient care three days after hospitalization.

Several studies have identified the cytotoxic effects of silver sulfadiazine (SSD) as a contributing factor to prolonged wound healing. On the basis of this evidence, we formulated a structured clinical inquiry utilizing the patient, intervention, comparison, and outcome (PICO) framework. The components are delineated as follows: (a) patient (P): individuals presenting with burn injuries; (b) intervention (I): honey- and honey-based dressing applications; (c) comparison (C): standard silver sulfadiazine treatment; (d) outcome (O): duration of wound healing and overall wound outcomes. Our primary clinical research question subsequently emerged: in patients with burn injuries in resource-limited settings, does the application of honey-based dressings demonstrate superior efficacy compared with that of silver sulfadiazine in accelerating the wound healing time? This study aimed to evaluate the comparative effectiveness of these therapeutic approaches in burn wound management within constrained healthcare environments.

MATERIAL AND METHODS

Search strategy

A comprehensive systematic literature search was conducted via two major electronic medical databases (PubMed and the Cochrane Library) on October 19, 2023. The search strategy included Medical Subject Headings (MeSH) terms, Boolean operators, and free-text keywords, including "burn", "honey", "silver sulfadiazine", and "wound healing", along with their relevant synonyms and associated terms. The search syntax was developed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological rigor [14,15]. To ensure the inclusion of contemporary evidence while maintaining relevance to current clinical practice, the publication timeframe was set to 2013-2023, capturing a decade of significant developments in burn wound management while excluding potentially outdated treatment approaches. Study selection was based on title and abstract screening, considering the language of the introduction, burn wound care protocols, and their relevance in addressing predefined clinical questions. The complete search strategy was documented and peer reviewed to ensure reproducibility. Articles were independently screened by two reviewers via a standardized assessment form, and disagreements were resolved through consensus.

Research question framework

The research question was systematically developed via the Population, Intervention, Comparison, and Outcomes (PICO) framework, as outlined in Table 1 [15]. This structured approach was chosen to ensure the clarity and clinical relevance of the research objective.

Table 1. PICO framework for research question development

Patient	Intervention	Comparison	Outcomes
Adult and pediatric patients with documented thermal burns	Intervention, Honey and honey-based dressing applications with standardized protocols	Topical Silver Sulfadiazine (SSD) following standard treatment guidelines	Primary outcome: Quantified wound healing time; Secondary outcomes: Wound infection rates and scar formation assessment
Clinical questions based on PICO			
In burn patients, could honey serve as a more effective alternative to topical SSD in reducing wound healing time within resource-limited settings?			
Type of Study/Methodology			
Systematic review incorporating meta-analysis of randomized controlled trials, systematic reviews, and analytical cross-sectional studies			

Eligibility criteria and article selection

The inclusion criteria were systematically defined as follows: clinical studies involving patients with documented total body surface area (TBSA) burns <40%; direct comparative studies between honey-based interventions and SSD; quantifiable measurement of wound healing time as the primary outcome variable; and study designs limited to systematic reviews, meta-analyses, randomized controlled trials (RCTs), or analytical cross-sectional studies published between 2013 and 2023, available in full text. The exclusion criteria were explicitly defined: studies involving patients with significant comorbidities, correspondence pieces, commentaries, and noncomparative studies. To maximize comprehensive evidence capture, no restrictions were placed on sample size or the language of publication.

Critical appraisal

The methodological quality and risk of bias of the selected studies were evaluated via standardized critical appraisal tools from the Center for Evidence-Based Medicine (CEBM), Oxford University (www.cebm.net). Two authors independently conducted the quality assessment via a predetermined scoring system, and the interrater reliability was assessed via Cohen's kappa coefficient.

Data extraction and management

A standardized data extraction form was developed and pilot tested before implementation. Two authors independently extracted data regarding the study characteristics, population demographics, intervention protocols, control treatments, and outcome measures. Any discrepancies in data extraction were resolved through discussion and consensus with consultation from a third reviewer when necessary. The extracted data were organized in structured evidence tables to facilitate synthesis and comparison.

RESULTS

Search results

We conducted a comprehensive literature search across major databases, yielding 242 articles from PubMed and 16 from the Cochrane Library (Table 2). Through rigorous application of the inclusion criteria and thorough screening of titles and abstracts, five non duplicate articles were identified as relevant to the clinical question. Following a detailed full-text assessment, all five articles were deemed suitable for a comprehensive review. The systematic search strategy and selection process are illustrated in Figure 1.

Table 2. Database search results

Database	Search Strategy	Hits
Pubmed	(((((((((burn) OR (burn injury)) AND (honey)) AND (silver sulfadiazine)) OR (silver)) OR (SSD)) OR (topical antimicrobial)) AND (wound healing))	242
Cochrane Library	("burn") AND ("honey") AND ("silver sulfadiazine") AND ("wound healing") (Word variations have been searched)	16

Evidence from reviews

Lindberg et al. [16] conducted a systematic review and meta-analysis encompassing six RCTs to evaluate the comparative efficacy of honey versus silver cream dressings for acute and chronic wounds. Their meta-analysis demonstrated that honey achieved 20% greater efficacy in wound healing within 21–40 days than silver cream did (pooled risk difference: -20, 95% CI -0.29, -0.11, $p < 0.0001$), with heterogeneity at 69.65% ($p = 0.006$). In a broader context, Norman et al. [7] performed a systematic review of the effectiveness and safety of various antiseptics for burn treatment. The subgroup analysis of six RCTs revealed that honey significantly reduced the mean wound healing time compared with SSD (HR 2.45, 95% CI 1.71 to 3.52; I^2 , 66%).

Jull et al. [17] conducted a comprehensive systematic review of twenty-six RCTs investigating the effectiveness of honey versus alternative wound dressings and topical therapies for acute and chronic wound healing. Their subgroup analysis of four RCTs specifically focusing on burn patients revealed a significant five-day reduction in healing time with honey compared with SSD (WMD -5.12, 95% CI -9.51 – -0.73, $I^2=93\%$). In support of these findings, Aziz et al. [9] conducted a systematic review of nine RCTs that specifically examined the efficacy of honey versus SSD in burn wound healing. An analysis of four RCTs demonstrated the superior performance of honey in terms of healing time for superficial and partial thickness burns (WMD -4.62, 95% CI -7.37 – -1.88, $I^2=93\%$).

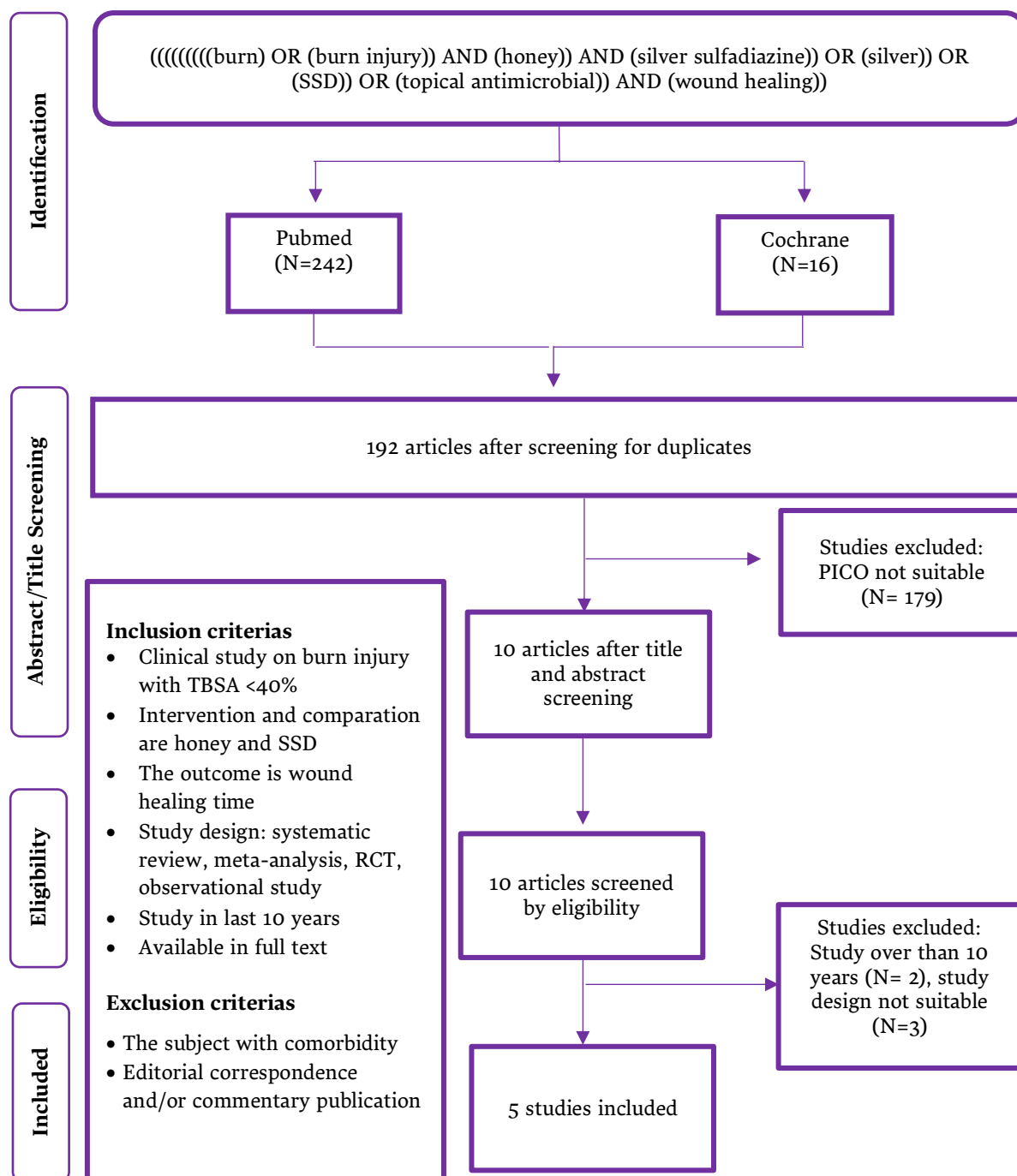


Figure 1. Flowchart of the search strategy

Moniruzamman et al. [18] implemented a prospective comparative study evaluating honey versus 1% SSD cream in burn treatment. The study employed purposive sampling due to the limited number of pediatric burn cases, with clearly defined inclusion criteria: superficial partial-

thickness burns, TBSA 5–20%, and parental informed consent. The exclusion criteria included burns in critical areas (face, hands, feet, genitalia, perineum, and large joints) with infection, delayed presentation (>24 hours), allergies to treatment materials, and systemic comorbidities. The study population comprised 70 patients equally divided into honey therapy (group 1) and SSD therapy (group 2) groups. The results revealed significantly accelerated healing in the honey group, with exudation cessation by day three (OR 13.8, 95% CI 3.68 to 52.2, $p < 0.001$) and a significant decrease by day five (OR 39.8, 95% CI 5.88 to 269.5, $p < 0.001$).

Quality assessment, study characteristics and summary of results

The detailed study characteristics and outcomes are presented in Table 3. Each study underwent rigorous critical evaluation of validity, importance, and applicability via the CEBM tool from the University of Oxford. The results of the systematic review critical analysis are detailed in Table 4, and the results of the comparative research evaluation are presented in Table 5.

Table 3. Summary of results

Study	Study Design	Study Population	Intervention and Control	Results	Level of Evidence
Lindberg et al. [16]	Meta-analysis	Six RCTs	Honey (intervention) vs silver sulfadiazine (control)	Honey as a wound dressing, is 20% more effective in healing wounds in appointed time (21-40 days) compared to silver. The pooled risk difference was -20 (95% CI -0.29 to -0.11, $p < .001$)	1A
Jull et al. [17]	Systematic Review	Four RCTs	Honey (intervention) vs silver sulfadiazine (control)	People whose burns were treated with honey experienced an average reduction in healing time of 5 days (WMD -5.12 days, 95% CI -9.51 to -0.73).	1A
Norman et al. [19]	Systematic Review	six RCTs	Honey (intervention) vs silver sulfadiazine (control)	Honey probably on average reduced time to healing: HR 2.45 (95% CI 1.71 to 3.52, I ² = 66%).	1A
Aziz et al. [20]	Systematic Review	Ten RCTs	Honey (intervention) vs silver sulfadiazine (control)	The duration of wound healing was shorter in the group treated with honey compared to the group treated with silver for superficial thickness wounds (MD -4.62; 95% CI -7.37 to -1.88, I ² = 93%)	1A
Moniruzaman et al. [18]	Prospective comparative study	70 patients divided into two groups.	Honey (intervention) vs silver sulfadiazine (control)	The Exudation process was reduced by day 3 in the group treated with honey (OR 13.8 (CI 95% (3.68 to 52.2, $p < 0.001$)). In addition, Sloughing was also reduced in time by the group treated with honey in day 5 (OR 39.8 (CI 95% (5.88 to 269.5, $p < 0.001$))	2C

Table 4. Critical analysis of systematic review research

	Lindberg et al. [16]	Jull et al. [17]	Norman et al. [19]	Aziz et al. [20]
Was the main question being addressed clearly stated?	Yes	Yes	Yes	Yes
Is it unlikely that important, relevant studies were missed?	Yes	No	No	No
Were the criteria used to select articles appropriate?	Yes	Yes	Yes	Yes
Are the included studies valid enough for the type of question asked?	Yes	Yes	Yes	Yes
Were the results similar from study to study?	Yes	Yes	Yes	Yes

Table 5. Critical review of cross-sectional research

Article: Moniruzamman et al (Observational study)	
Did the study address a clearly focused question/issue?	Yes
Is the research method (study design) appropriate for answering the research question?	Yes
Is the method of selection of the subjects (employees, teams, divisions, organizations) clearly described?	Yes
Could the way the sample was obtained introduce (selection) bias?	Yes
Was the sample of subject representative with regard to the population to which the findings will be referred?	Yes
Was the sample size based on prestudy considerations of statistical power?	No
Was a satisfactory response rate achieved?	Yes
Are the measurements (questionnaires) likely to be valid and reliable?	Unclear
Was the statistical significance assessed?	Yes
Are confidence intervals given for the main results?	Yes
Could there be confounding factors that have not been accounted for?	Yes
Can the results be applied to your organization?	Yes

DISCUSSIONS

We evaluated the validity of the systematic review by Lindberg et al. [16]. However, the authors conducted literature searches exclusively in major bibliographic databases without indicating efforts to locate searches related to theses, conference proceedings, or contact experts regarding unpublished articles. Consequently, this study employed a less comprehensive search strategy. Upon examination of the inclusion criteria, randomized controlled trials (RCTs) were the sole type of research included. Therefore, the results of this systematic review can be considered reliable. The analysis also revealed a pooled risk of -20 (95% CI -0.29, -0.11, $p < 0.001$), indicating that honey is 20% more effective than silver cream in healing burns. With a heterogeneity test result of 65.65%, the difference was statistically significant ($P = 0.006$).

The systematic review by Jull et al. [17] demonstrated robust methodological quality with comprehensive search strategies. The authors used only RCT research and quasirandomized controlled trials. Therefore, the results of this study are reliable. Subgroup analysis in this study revealed that honey healed burns five days faster than silver cream did. with a weighted mean difference of -5.12, 95% CI of -9.51 – -0.73, and a heterogeneity test of 93%. Although research results vary widely, we still consider these findings to be important.

The systematic review by Norman et al. [19] has been appraised. The results of the subgroup analysis revealed that honey may be able to reduce healing time compared with silver cream, with a Hazard ratio of 2.45 (95% CI 1.71-3.52, $I^2 = 66\%$). The average healing time for honey was 3.79

days faster (95% CI -7.15 – -0.43; $I^2=96\%$). We consider these results important and reliable. A critical review was carried out on a systematic review by Aziz et al. [20]. The clinical question stated in the abstract is the effect of healing burns on honey compared with silver cream. A comprehensive literature search was conducted. They also contacted the authors and experts in the field of wound care for additional research possibilities. All RCTs comparing honey to silver cream were included in this study. The results revealed that, compared with silver cream, honey significantly reduced the wound healing time.

Moniruzamman et al. [18] conducted a prospective comparative study aimed at evaluating the effectiveness of honey compared with that of 1% SSD cream in treating burns. The results of the analysis revealed that the exudation process stopped on the third day in the honey treatment group OR 13.8, 95% CI 3.68 to 52.2, $p<0.001$), whereas the formation of slough on burn wounds with honey was significantly reduced on the fifth day OR 39.8, 95% CI 5.88 - 269.5, $p<0.001$. However, selecting samples via purposive sampling can lead to bias, and determining the sample size was not based on previous research. They explained that the number of children with burns was very limited.

Overall, we have five pieces of evidence that are valid, meaningful, and applicable for answering our clinical questions. All the results revealed similar outcomes; that is, honey can reduce the healing time of burns compared with silver cream. Several studies have evaluated the benefits of honey dressings for burns. The therapeutic superiority of honey for burn management is supported by multiple lines of evidence. A biochemical study by Nagane et al. [21] revealed that honey accelerated the healing process by reducing oxidative stress. Compared with SSD-treated wounds, honey-treated wounds presented lower levels of serum lipid peroxidation products and uric acid. These factors are associated with oxidative stress [22,23]. Additionally, honey has been correlated with a gradual increase in ceruloplasmin levels, which further indicates ongoing free radical activity.

A meta-analysis by Oryan et al. [24] elucidated the multifaceted mechanism of the therapeutic action of honey, highlighting its antimicrobial, anti-inflammatory, antioxidant, biological debridement, and tissue growth stimulation properties. Honey can facilitate wound healing by stimulating epithelialization, increasing angiogenesis, facilitating wound contraction, and increasing collagen synthesis and wound debridement.

Notably, the honey used in each of these studies was different. This is related to the type of flower or plant nectar collected by bees on honey farms [25]. However, research by Fadhila et al. [26], which evaluated the effects of local Indonesian honey on wound healing, yielded similar results. Moreover, local Indonesian honey was found to have antibacterial activity against MRSA, *S. aureus*, and *P. aeruginosa*, with a higher minimum inhibitory concentration than Manuka honey [1,23,27]. Another advantage of using honey is that it is less expensive than SSD, which ranges from IDR 60,000/250 cc to IDR. Compared with SSD, which costs an IDR of 50,000/tube (35 g) in Indonesia, it costs an IDR of 130,000/650 cc.

Kapok honey is easy to find. However, the price differences often found between western and eastern Indonesia make goods prices in the eastern region slightly more expensive. Postoperative wound care at home also contributes to improved wound healing outcomes. Wound care knowledge, attitudes, and practices involving the use of honey among patient guardians, social communities, and home care services are also supporting components for enhancing wound healing. The implementation challenges in Ende include the standardization of honey quality, storage conditions, and staff training needs. A pilot program could address these concerns while monitoring the outcomes.

Clinical implications

The use of honey as a burn wound dressing presents compelling clinical advantages in resource-limited settings. The demonstrated reduction in healing time by approximately 4–5 days compared with that of silver sulfadiazine offers significant benefits for patient outcomes and healthcare resource utilization. From an economic perspective, honey has a lower cost than SSD does (IDR 60,000–130,000/250–650 cc vs IDR 50,000/35 g), which makes honey particularly attractive for healthcare systems with budget constraints. The availability of local honey varieties

such as kapok honey in Ende further supports its practical implementation. However, successful clinical adoption requires the establishment of standardized protocols for honey quality assessment, storage conditions, and training of healthcare staff. A structured implementation program that includes monitoring systems and educational initiatives for both healthcare providers and caregivers is essential for optimal therapeutic outcomes.

Limitations

This evidence-based case review has several methodological constraints that warrant consideration. The primary limitation stems from the heterogeneity observed across the reviewed studies, with I^2 values ranging from 66% to 93%, indicating significant variability in the study methodologies and outcomes. The included studies used different honey varieties, potentially affecting the generalizability of the results. Additionally, the lack of standardization in wound assessment methods and healing time measurements across studies presents challenges for the direct comparison of outcomes. The predominant focus on superficial and partial-thickness burns limits the applicability of these findings to more severe burn cases. Furthermore, the absence of long-term follow-up data in most studies prevents a comprehensive evaluation of scarring outcomes and potential late complications.

Future research directions

Several knowledge gaps warrant further investigation to strengthen the evidence base for honey-based burn treatments. First, large-scale randomized controlled trials with standardized honey preparations and wound assessment protocols are needed to address the current heterogeneity in research methodologies. Second, studies investigating the effectiveness of specific local honey varieties, particularly those available in Indonesia, would provide valuable insights for regional implementation. Third, research examining the long-term outcomes, including scar formation and quality of life measures, would enhance our understanding of honey's comprehensive therapeutic benefits. Additionally, cost-effectiveness analyses specific to resource-limited settings and investigations into optimal storage conditions and shelf-life of honey-based dressings would support practical implementation. Finally, studies exploring potential synergistic effects of honey combined with other wound care modalities could open new therapeutic possibilities for burn management.

CONCLUSIONS

The evidence strongly supports the superiority of honey over silver sulfadiazine in treating superficial partial-thickness burns in resource-limited settings. Multiple high-quality systematic reviews and meta-analyses have consistently demonstrated accelerated healing times, with honey reducing the duration of wound healing by approximately 4–5 days compared with SSD. The biochemical mechanisms underlying the therapeutic efficacy of honey, including its anti-inflammatory, antimicrobial, and antioxidant properties, are well documented. Owing to its cost-effectiveness and availability in local settings, honey is a viable and advantageous alternative to conventional SSD treatment. However, successful implementation requires addressing standardization challenges and establishing comprehensive wound-care protocols. These findings are particularly relevant for healthcare facilities in resource-limited settings, where cost-effective and readily available treatment options are essential for optimal patient care.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as potential conflicts of interest.

AUTHOR CONTRIBUTIONS

Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing - Review and Editing, Visualization, Supervision: KAAW, SPS.

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