

Clinical outcomes of Manuka honey in burn patients: a scoping review

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Abstract

Introduction: Burns constitutes a public health problem with a high socioeconomic impact worldwide. Historically, honey has been used to treat wounds. Manuka honey stands out for its high methylglyoxal content, which gives it superior therapeutic potential. However, clinical evidence on its effectiveness in burns is heterogeneous and lacks a synthesis that evaluates clinical outcomes.

Objective: to synthesize the available evidence on the composition of dressings with Manuka honey and their outcomes in the care of burn patients in hospital settings.

Methods: Scope review was conducted according to PRISMA-SCR guidelines. The PCC (Population, Content, Context) strategy was employed. The population of interest consisted of burn patients. Treatments with Manuka honey and their outcomes, such as healing, infection, pain, exudate, patient satisfaction, costs, and others, were analyzed. Finally, the study context focused on inpatient settings.

Results: Five articles were included: three case series, one uncontrolled clinical trial, and one retrospective cohort study. The findings show that Manuka honey accelerates epithelialization, reduces bacterial load (including multidrug-resistant strains), promotes pain management, and is cost-effective.

Conclusion: Available clinical evidence suggests that Manuka honey has positive effects on wound healing, bacterial control, and pain. However, the findings are not conclusive due to the study's limitations. Therefore, more rigorous clinical trials are needed to validate these findings.

Descriptors: Manuka Honey; Burns; Pain Management; Wound Infection; Treatment Outcome (source: DeCS, BIREME).

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Resultados clínicos de la miel de Manuka en pacientes quemados: una revisión de alcance

Resumen

Introducción: las quemaduras constituyen un problema de salud pública con alto impacto socioeconómico a nivel mundial. Históricamente, la miel se ha utilizado para el tratamiento de heridas. La miel de Manuka destaca por su concentración de metilglioxal, lo que le confiere un potencial terapéutico superior. Sin embargo, la evidencia clínica sobre su efectividad en quemaduras es heterogénea y carece de una síntesis que evalúe sus desenlaces clínicos.

Objetivo: sintetizar la evidencia disponible sobre el contenido de las curaciones con miel de Manuka y sus desenlaces en el cuidado de pacientes con quemaduras en entornos intrahospitalarios.

Métodos: revisión de alcance conforme a las directrices PRISMA-SCR. Se empleó la estrategia PCC (Población, Contenido, Contexto). La población de interés fueron pacientes con quemaduras. Se analizaron las curaciones con miel de Manuka y sus desenlaces, como la cicatrización, la infección, el dolor, el exudado, la satisfacción del paciente, los costos, entre otros. Finalmente, el contexto del estudio se centró en entornos intrahospitalarios.

Resultados: se incluyeron cinco artículos: tres series de casos, un ensayo clínico no controlado y una cohorte retrospectiva. Los hallazgos muestran que la miel de Manuka acelera el proceso de epitelización, reduce la carga bacteriana (incluidas cepas multirresistentes), favorece el manejo del dolor y resulta costo-efectiva.

Conclusión: la evidencia clínica disponible sugiere que la miel de Manuka tiene efectos positivos en la cicatrización, el control bacteriano y el manejo del dolor. Sin embargo, los resultados no son concluyentes debido a las limitaciones de los estudios. Por ello, se requieren ensayos clínicos más rigurosos para validar estos hallazgos.

Descriptores: Miel de Manuka; Quemaduras; Manejo del Dolor; Infección de Heridas; Resultado del Tratamiento (fuente: DeCS, BIREME).

Resultados clínicos do mel de Manuka em pacientes queimados: uma revisão de escopo

Resumo

Introdução: Queimaduras constituem um problema de saúde pública de alto impacto socioeconômico em todo o mundo. Historicamente, o mel tem sido usado para tratar feridas. O mel de Manuka destaca-se pela sua concentração de metilglioxal, que lhe confere um potencial terapêutico superior. No entanto, as evidências clínicas

sobre a sua eficácia em queimaduras são heterogêneas e carecem de uma síntese que avalie os resultados.

Objetivo: sintetizar as evidências disponíveis sobre a composição de curativos com mel de Manuka e seus resultados no tratamento de pacientes queimados em ambiente hospitalar.

Métodos: A revisão do escopo foi conduzida conforme as diretrizes PRISMA-SCR. A estratégia PCC (População, Conteúdo, Contexto) foi empregada. A população de interesse foi composta por pacientes queimados. Os tratamentos com mel de Manuka e seus desfechos, como cicatrização, infecção, dor, exsudato, satisfação do paciente, custos e outros, foram analisados. Por fim, o contexto do estudo concentrou-se em ambientes hospitalares.

Resultados: Cinco artigos foram incluídos: três séries de casos, um ensaio clínico não controlado e um estudo de coorte retrospectivo. Os resultados mostram que o mel de Manuka acelera o processo de epitelização, reduz a carga bacteriana (incluindo cepas multirresistentes), promove o controle da dor e é economicamente viável.

Conclusão: As evidências clínicas disponíveis sugerem que o mel de Manuka tem efeitos positivos na cicatrização de feridas, no controle bacteriano e no alívio da dor. No entanto, as conclusões não são definitivas devido às limitações dos estudos. Portanto, são necessários ensaios clínicos mais rigorosos para validar esses resultados.

Descritores: Mel de Manuka; Queimaduras; Manejo da Dor; Infecção dos Ferimentos; Resultado do Tratamento (fonte: DECS, BIREME).

Introducción

Burns constitute a major public health problem worldwide, with a significant socioeconomic impact (1–3). Annually, more than 300,000 people die from burn-related injuries. This situation underscores the magnitude of the problem, as highlighted by the World Health Organization (4–6). Inadequate wound healing and its multiple complications contribute to increased morbidity, leading to prolonged hospital stays, higher healthcare costs, and long-term sequelae for patients (7–9).

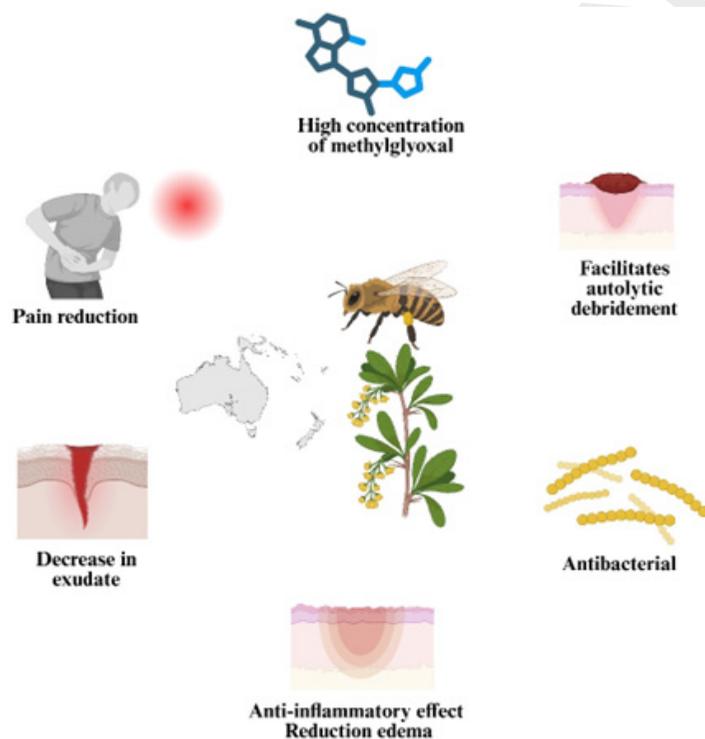
A burn is a tissue injury affecting the skin and underlying tissues, resulting from an excessive transfer of thermal energy from an external source to the human organism (10–12). These injuries result in physical alterations and trigger psychological and emotional sequelae that affect independence in activities of daily living (1, 13). Following a burn, a complex and coordinated healing process begins, involving sequential phases of inflammation, cellular migration, and proliferation, as well as the synthesis and remodeling of the extracellular matrix to restore tissue integrity (14–17).

Historically, according to the “Edwin Smith Egyptian Papyrus,” the use of honey in wound treatment dates back to 2600–2200 BC (18, 19). Currently, products of natural origin, such as medical-grade honey, have gained popularity as therapeutic alternatives for treating various skin lesions. Although most medicinal honeys contain hydrogen peroxide as the primary antimicrobial agent, Manuka honey (*Leptospermum* spp.) stands out due to its high concentration of methylglyoxal. This honey is produced by bees feeding on the pollen and nectar of the *Leptospermum* tea tree, native to Pacific coast islands such as New Zealand and Australia (20). This unique chemical composition and

specific botanical source provide it with superior bactericidal activity compared to conventional honeys, which is key in clinical practice for wound management (21–24).

Given the potential limitations of conventional burn treatments and the growing interest in adjuvant therapies that can optimize healing, Manuka honey emerges as a promising agent due to its diverse bioactive properties (25–27). These properties contribute to autolytic debridement, antibacterial control, and modulation of the inflammatory response, subsequently reducing edema, exudate, pain, and odor in colonized chronic wounds (28–35). These effects are associated with high-potency osmotic mechanisms, which generate a hydrostatic gradient that draws excess fluid from the wound to the surface, favoring autolytic debridement, decreasing local pH, and modulating matrix metalloproteinases (MMPs) (36) (Figure 1).

Figure 1. Properties of Manuka honey (*Leptospermum* spp.)



Source: BioRender premium.

To ensure biosafety and clinical reproducibility, it is necessary to differentiate medical-grade honey (MGH) from food-grade or natural honey. MGH is a pharmaceutical product sterilized by gamma irradiation, which eliminates pathogens and *Clostridium botulinum* spores without compromising its phytochemical compounds or enzymatic activity. Consequently, from a scientific standpoint, the use of honey in hospital settings should be strictly limited to MGH (14, 32).

In this regard, clinical practice in burn management has continually evolved, with the introduction of various dressings and technologies (37–40). Nevertheless, there remains a need to consolidate scientific evidence supporting the safety and efficacy of certain interventions (41). Currently,

there is no review specifically exploring the composition of Manuka honey dressings and their various outcomes—such as healing, infection, pain, exudate, patient satisfaction, costs, and other results—in the management of burn wounds within the in-hospital setting. It is crucial to highlight that Manuka honey dressing practices can be heterogeneous, involving different components and steps, which makes them less suitable for a traditional systematic review and justifies the need for a mapping approach. Therefore, the primary objective of this review is to synthesize the available evidence on the content of Manuka honey dressings and their outcomes in the wound care of burn patients in hospital settings.

Methods

A scoping review was conducted following the Joanna Briggs Institute guidelines for scoping reviews and the PRISMA Extension for Scoping Reviews (PRISMA-SCR) (42, 43). To address the research question, the PCC (Population, Concept, Context) strategy was employed. The population of interest consisted of patients with burn wounds of any age. Regarding the concept, it encompassed Manuka honey dressings and their outcomes, including healing, infection, pain, exudate, patient satisfaction, and costs, among others. Furthermore, the study context focused on in-hospital settings. The following question was formulated: What is the existing evidence on the content of Manuka honey dressings and their outcomes in the wound care of burn patients in hospital settings?

Search strategy and information sources

A comprehensive search was conducted across the PubMed, EMBASE, EBSCOhost, and LILACS-VHL databases from their inception to June 18, 2025. A highly sensitive search was prioritized, using terms adapted for each database and focusing on the population (burns) and the concept (Manuka honey). For the population, the terms “Burns [MeSH]” and “Burn wounds [Free-text]” were employed. Regarding the concept, “Honey [MeSH],” “*Leptospermum* [MeSH],” “Medihoney [Free-text],” and “Manuka [Free-text]” were used. No restrictions were applied regarding study type, language, or year of publication. The search algorithms are presented in Table 1. Additionally, the reference lists of the included studies were reviewed to identify further articles.

Table 1. Databases and search algorithms used in the scoping review

Base de datos	Algoritmo de búsqueda
PubMed	((Burns[Title/Abstract]) OR (Burn wounds[Title/Abstract])) AND (((Honey[Title/Abstract]) OR (Leptospermum[Title/Abstract])) OR (Medihoney[Title/Abstract])) OR (Manuka[Title/Abstract])
EMBASE	('burn'/mj OR 'burn' OR 'burn wound' OR 'burns') AND ('honey'/exp OR 'honey' OR 'Manuka honey'/exp OR 'leptospermum honey' OR 'leptospermum scoparium honey' OR 'Manuka (l. scoparium) honey' OR 'Manuka honey')
EBSCOHOST	XB Burns OR XB Burn wounds AND XB Honey OR XB <i>Leptospermum</i> OR XB Medihoney OR XB Manuka
LILACS-BVS	(burns) OR (burn wounds) AND (honey) OR (leptospermum) OR (medihoney) OR (Manuka) AND db:("LILACS") AND instance:"lilacsplus"

Source: Own elaboration.

Eligibility criteria

Studies were included if the population consisted of patients of any age, without restrictions on the etiology, degree, or location of the burns. Regarding the intervention, studies evaluating the topical application of Manuka honey, in any concentration or formulation, compared with or without other substances for burn treatment, were included, provided they reported the outcomes of interest. Finally, for the context, studies conducted in in-hospital settings were included. Exclusion criteria included studies involving animal or in vitro models, those evaluating other types of honey, such as food-grade honey, or those in which the purity and sterilization method were not specified. Additionally, treatments for non-relevant wounds, studies that did not provide data of interest, and conference abstracts were excluded. Given the limited information on the subject, studies of any methodological design were included.

Study selection, data extraction, and evidence synthesis

All search results from each database were managed using the Rayyan software. After removing duplicates, two authors independently screened the titles and abstracts of the identified studies. Potentially eligible studies were retrieved in full-text format and assessed against the eligibility criteria. Similarly, two authors independently extracted the data. To ensure synthesis during data collection, the extraction procedure was performed using a standardized form. In this process, variables were tabulated across four domains: identification and context (including variables such as author, year of publication, country, and setting); population (variables such as sample size, age, total body surface area (TBSA) burned, anatomical location, and burn depth); intervention (type of Manuka honey product, frequency of application, and use of comparators); and clinical outcomes (epithelialization time, bacterial load control, pain level, exudate, costs, and patient satisfaction). In all phases, discrepancies were resolved through consensus among all authors or by a third reviewer.

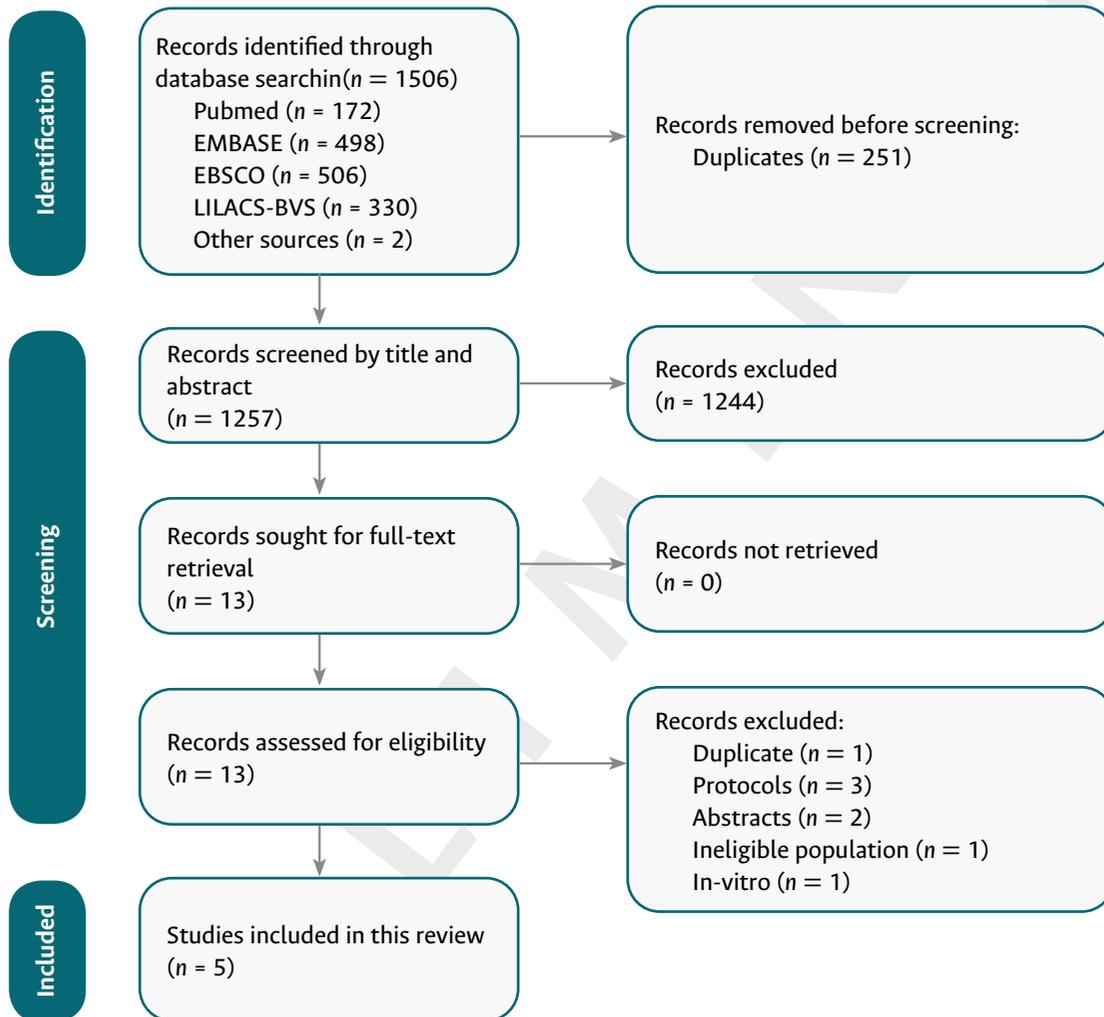
Results

A total of 1,506 articles were identified. After removing duplicates ($n = 1,257$), the selection process identified 13 articles for exhaustive full-text evaluation. Of these, studies that did not align with the review's objective were excluded, leaving 8 publications that met the inclusion and exclusion criteria. This resulted in a final sample of 5 articles (20, 44–47), as shown in Figure 2. The five included studies were conducted in the United States ($n = 2$) (20, 47), Spain ($n = 1$) (44), the United Kingdom ($n = 1$) (45), and Iran ($n = 1$) (46), with publication dates ranging from 2016 to 2024. Regarding the epidemiological design, three were case series (20, 44, 45), one was a non-controlled clinical trial (46), and one was a retrospective cohort (47) (see Table 2).

The intervention in the analyzed studies primarily consisted of the topical application of various Manuka honey formulations directly onto the burn areas. Active *Leptospermum* honey (ALH) gel or Medihoney was applied directly to the wounds, with reapplications every 6 to 8 hours (20). In some cases, honey was applied following enzymatic debridement (44). Additionally, ManukaDress IG and ManukaDress IG Max dressings were used, which are non-adherent gauze pads impregnated with Manuka honey (45).

Comparisons were made with other treatments, such as nitrofurazone ointment, silver sulfadiazine, and negative pressure wound therapy (NPWT); Manuka honey was evaluated against these conventional methods (46, 47).

Figure 2. Identification of studies via databases



Source: Own elaboration.

Table 2. Main characteristics of the included in this scoping review (n = 5)

Author/ Year of publication/ Country	Design/ Sample size/ Setting	Intervention	Comparator	Results	Conclusions
Duncan CL <i>et al.</i> 2016, United States (20)	Case series (7 patients) Burn depth: Partial thickness (second degree) Location: Facial burns Setting: Burn center in the Northeastern United States Mean age: 42.7 years (range 7 to 64 years), 4 males and 3 females, non-Hispanic white; TBSA ranged from 0.25% to 7%. Etiology: 3 thermal, 2 contact, and 2 scald	All patients' wounds were cleansed daily with soap and water and photographed, after which ALH gel (<i>Leptospermum</i>) or Medihoney was applied directly to the wounds, leaving them open to the air (open dressing technique). Patients (or their parents) and nursing staff were instructed to reapply the Medihoney gel every 6 to 8 hours, or whenever the wound surface was no longer moist, and to gently cleanse the wound between applications.	None	Wound healing and epithelialization: Healing time ranged from 3 to 14 days (mean: 8.1 days). Infection control: Wound cultures revealed normal bacterial growth at days 1 and 7 in all patients. Patients rated the ALH gel positively (57% very favorable and 21% favorable), with the most frequent complaint being stickiness in 5 patients. One patient experienced a transient burning sensation upon application, which did not lead to discontinuation of treatment. Cost analysis: The average hospital cost per patient was \$26.15.	The study suggests that ALH treatment for partial-thickness facial burns is clinically and economically advantageous. Healing time was comparable to, or even shorter than, that achieved with standard treatments, and no abnormal bacterial growth was observed in the wounds, despite the absence of antibiotics. Furthermore, patients reported overall satisfaction with the treatment.
Sampietro-de-Luis JM <i>et al.</i> , 2016, Spain (44)	Case series (10 patients) Burn depth: Superficial partial thickness (Grade II-A) and deep partial thickness (Grade II-B) Location: Facial burns involving 2 or more aesthetic subunits Setting: Burn Unit of the "Miguel Servet" University Hospital in Zaragoza, Spain Etiology: Diverse (flame, electrical flash, deflagration, scald, and chemical) Age range: 24 to 85 years (mean 47.3 years); 90% male; median TBSA 12% (Q1 = 6; Q3 = 40)	The conservative treatment protocol for facial burns included enzymatic debridement with NexoBrid® within the first 24 hours, followed by Medihoney® Wound Gel dressings every 72 hours. Gel removal was performed once the formed crust detached, indicating complete epithelialization. If detachment did not occur within 10 days, surgical removal was performed, and the dressing plan was continued.	None	Wound healing and epithelialization: Mean time for complete epithelialization was 13.88 days (range 10 to 20 days), except for one patient who died before completing epithelialization due to acute liver failure with severe coagulopathy. Infection control: No patients presented with infection or required surgery.	Preliminary results indicate the feasibility of combining NexoBrid® with Medihoney® for the conservative treatment of facial burns. However, they suggest the need for comparative studies with a larger sample size to demonstrate the superiority of this intervention over conventional management.

Author/ Year of publication/ Country	Design/ Sample size/ Setting	Intervention	Comparator	Results	Conclusions
Sack A et al., 2018, United Kingdom (45)	<p>Case series (10 patients)</p> <p>Burn depth: From superficial thickness (Grade I) to deep partial thickness and full thickness (deep Grade II and Grade III)</p> <p>Location: Face (nose), upper extremities (arms, hands), lower extremities (legs, feet), and torso</p> <p>Setting: Cases were treated across two specialized centers; initial assessment, debridement, and clinical protocol were performed at the burn unit (7 males and 3 females, aged 10 to 82 years).</p>	<p>The intervention consisted of the use of ManukaDress 1G and ManukaDress 1G Max dressings, which are non-adherent gauze impregnated with 100% Manuka honey. These dressings were used to promote autolytic debridement and reduce the risk of infection. ManukaDress 1G Max contains twice the amount of honey and features a more open-weave structure than ManukaDress 1G, making it suitable for larger, more exudative burns. The choice of dressing depended on the burn type, size, location, exudate level, and infection risk. These were applied following cleansing with saline solution.</p>	None	<p>Wound healing and epithelialization:</p> <p>Debridement and tissue repair:</p> <p>Deep-thickness burns: In Case 1 (deep partial thickness), autolytic debridement was achieved in 15 days. Case 4 (partial and full thickness) showed autolytic eschar debridement in 9 days. Case 3, involving a partial- or full-thickness burn, produced a wound bed suitable for skin grafting.</p> <p>Superficial and partial-thickness burns: Case 10 (superficial burn) healed in 7 days. Case 5 and Case 8 (superficial and partial-thickness burns) healed by day 14.</p> <p>Pain management (VAS):</p> <p>Pain, infection, and patient satisfaction:</p> <p>Pain: Pain improved in all cases.</p> <p>Infection control: None of the patients in the case series developed an infection.</p> <p>Comfort and satisfaction: Most patients found the dressings comfortable and were satisfied with the treatment.</p>	<p>The study concluded that ManukaDress 1G and ManukaDress 1G Max dressings are suitable for the treatment of superficial and partial-thickness burns. Most clinicians rated the dressing performance as “very good” or “excellent.” The dressings were successful in debriding eschar and wounds, and none of the patients developed an infection following their use. ManukaDress 1G Max is particularly suitable for larger, more exudative wounds presenting with necrotic tissue or slough.</p>

Author/ Year of publication/ Country	Design/ Sample size/ Setting	Intervention	Comparator	Results	Conclusions
Bokaiean R et al., 2018, Iran (46)	Uncontrolled clinical trial (15 patients) (30 donor sites). Split-thickness skin graft donor sites are lesions equivalent to superficial partial-thickness (Grade II) burns. Burn depth: Partial-thickness lesion (graft donor site) Location: 96.7% of donor sites were located on the thigh. Setting: Inpatient; Department of Surgery at the Iran University of Medical Sciences, Tehran	The intervention consisted of treating one of the independent donor sites with an active <i>Leptospermum</i> honey dressing (MediHoney dressing).	The control group was treated with a conventional method: the donor site was covered with nitrofurazone ointment.	Wound healing and epithelialization: Wound area, day 3: Manuka honey vs. Nitrofurazone ($1.69 \pm 2.5 \text{ cm}^2$ vs. $36.15 \pm 23.55 \text{ cm}^2$) difference -34.46 , $p = 0.001$ Wound area, day 7: Manuka honey vs. Nitrofurazone ($0.76 \pm 1.65 \text{ cm}^2$ vs. $19.1 \pm 21.89 \text{ cm}^2$), difference -18.33 , $p = 0.001$ Pain management (VAS): Pain, day 3: Manuka honey vs. Nitrofurazone (mean 3.67 ± 1.45 vs. 8 ± 1.36) difference -4.33 , $p = 0.001$ Pain, day 7: Manuka honey vs. Nitrofurazone (mean 2.67 ± 1.29 vs. 7.13 ± 1.5), difference -4.47 , $p = 0.001$ Infection control: Honey: 20% Nitrofurazone: 40%, $p = 0.064$	The study concluded that active <i>Leptospermum</i> honey dressing accelerates healing, reduces pain, and exhibits antimicrobial activity; therefore, it can be used for the care of skin graft donor sites.
Kenney C et al., 2024, United States (47)	Single-center retrospective cohort (1,348 patients from 2014 to 2019) Burn depth: Partial thickness and full thickness Location: Multiple anatomical sites Setting: Burn center; mean age 45.1 ± 17.0 years, 74.0% male, and mean TBSA of 3.5%, with injury within 48 hours. $n = 191$ Manuka honey	The study evaluated topical dressing therapies applied to burn wounds. The evaluated dressings included 5% sulfamylon solution, Manuka honey, NPWT, silver sulfadiazine, and silver nylon.	A single comparator was not used, as the study compared multiple commonly used dressings against each other to evaluate differences in pain and opioid consumption.	Pain management (VAS): Silver sulfadiazine had lower average daily pain scores than Manuka honey (mean 4.1 ± 2.1 vs. 4.5 ± 2.2 , $p = 0.04$). Regarding peak daily pain scores, silver sulfadiazine was lower compared to Manuka honey (mean 6.8 ± 2.6 vs. 7.2 ± 2.6 , $p = 0.003$). Analgesic consumption: Manuka honey resulted in lower opioid consumption compared to 5% sulfamylon solution (median 37.8 vs. 39.0, $p = 0.03$) and NPWT (median 37.8 vs. 39.0, $p = 0.02$).	The study concluded that further research utilizing additional validated pain assessment tools and clinically relevant endpoints is required to fully understand the impact of burn dressings on pain management.

Note. ALH: Active *Leptospermum* Honey; NPWT: Negative Pressure Wound Therapy; TBSA: Total Body Surface Area; VAS: Visual Analogue Scale. Source: Own elaboration.

Clinical Outcomes

Healing Process

Duncan *et al.* (20) described seven patients with partial-thickness facial burns treated with ALH gel. Dressings were initiated between days 1 and 3 post-burn and included daily cleansing with soap and water followed by the application of MediHoney gel. Healing time ranged from 3 to 14 days, with a mean of 8.1 days. To assess healing, three physicians independently rated the wounds using daily photographs and exudate tests. Strict criteria were established, whereby a wound was only considered “healed” if at least two of the three physicians rated it as such for two consecutive days. Inter-rater reliability, measured using Fleiss’ kappa statistic, ranged from slight to substantial agreement ($k = 0.10\text{--}0.64$). The study findings suggest that the healing time observed with active *Leptospermum* honey gel was consistent with, or even superior to, what is expected with standard treatments.

Likewise, Sampietro *et al.* (44) presented 10 patients with facial burns of varying etiologies. They evaluated the time to complete epithelialization following enzymatic debridement with NexoBrid® within the first 24 hours, followed by topical dressings with MediHoney® Wound Gel every 72 hours. Complete epithelialization was achieved in all patients, with a mean of 13.88 days. The time range to complete epithelialization was 10 to 20 days. One patient passed away before completing the epithelialization process due to complications unrelated to the local treatment. No patients required surgical coverage due to delayed epithelialization, and no infectious complications were identified.

Sack *et al.* (45) presented 10 clinical cases evaluating ManukaDress IG or IG Max dressings for burn management. The protocol included cleansing with 0.9% saline solution, followed by the application of secondary dressings and bandages. Although the primary indications for these dressings were debridement and infection prevention, they documented several cases in which complete epithelialization was achieved. Healing outcomes varied with burn severity. In the first case, a 70-year-old male with deep partial-thickness flame burns achieved epithelialization in 15 days. In another case, a diabetic male with full-thickness burns showed epithelialization at the edges and granulation tissue in only 9 days. In an 82-year-old patient with infected full-thickness burns, the wound bed was prepared for skin grafting within 25 days.

On the other hand, favorable results in the epithelialization process were obtained for partial and superficial burns. In one case of a partial-thickness burn, 90% epithelialization was observed at 10 days, with complete healing achieved in 14 days. In a child with partial-thickness burns, epithelialization was completed between 13 and 18 days. Finally, in three cases of superficial burns, complete epithelialization was reached between 7 and 14 days (45).

Bokaiean *et al.* (46), in their non-controlled clinical trial, evaluated the efficacy of active *Leptospermum* honey (MediHoney) compared to nitrofurazone ointment across 30 skin graft donor sites in 15 burn patients, with a mean TBSA burned of $21.00 \pm 12.10\%$. Each patient had two donor sites: one treated with active *Leptospermum* honey and the other with nitrofurazone ointment. The donor sites were primarily located on the thigh (96.7%), with the remainder on the arm. Dressings and wound cultures were performed on days 3 and 7 post-surgery. At the start of the study (day 1), the wound surface areas in the honey and nitrofurazone groups were $82.1 \pm 22.95\text{ cm}^2$ and $86.8 \pm 22.78\text{ cm}^2$, respectively, indicating initial homogeneity between the groups ($p = 0.173$).

Regarding the post-intervention findings, the results showed a significant difference in wound area reduction. By day 3, the Manuka honey group showed a significant reduction to $1.69 \pm 2.5 \text{ cm}^2$, in contrast to $36.15 \pm 23.55 \text{ cm}^2$ in the conventional group, with a mean difference of -34.46 (95 % CI: -46.99 to -21.93 , $p = 0.001$). This difference became even more pronounced by day 7, with the honey group presenting an area of $0.76 \pm 1.65 \text{ cm}^2$ compared to $19.1 \pm 21.89 \text{ cm}^2$ in the nitrofurazone group, with a mean difference of -18.33 (95 % CI: -30.48 to -6.18 , $p = 0.001$).

Pain

In the study by Duncan *et al.* (20), MediHoney gel was rated by patients as “very favorable” (maximum score) in 57 % of cases and “favorable” in 21 %. Regarding comfort, the sensation of skin protection and the speed of healing were highlighted. The primary complaint was the gel’s sticky texture. Similarly, Sack . (45) reported an absence of pain during dressing removal in cases one and seven; however, in case five, a male with a partial-thickness burn reported a pain score of 4/10 on the Visual Analogue Scale (VAS) throughout the epithelialization process, suggesting that the pain was not solely associated with the dressing change or the honey dressing itself. Crystallization of the honey was also reported in cases six and seven and was managed by moistening the wound without affecting the healing process or patient comfort (45).

Two anesthesiologists and one nurse assessed pain using the VAS in the study by Bokaiean *et al.* (46), which showed lower pain scores in patients treated with honey compared to those receiving conventional treatment. The mean pain scores for the honey group were 3.67 ± 1.45 on day 3 and 2.67 ± 1.29 on day 7, whereas the conventional group presented mean scores of 8 ± 1.36 and 7.13 ± 1.5 on the same days. The difference in pain was statistically significant on both days ($p = 0.001$).

The study by Kenney *et al.* (47) analyzed 1,348 patient records and 5,043 dressing changes, comparing the pain and opioid consumption associated with various burn dressings. The results demonstrated that silver sulfadiazine was associated with the lowest average daily pain scores (4.1 ± 2.1) compared to Manuka honey (4.5 ± 2.2), representing a statistically significant difference ($p = 0.04$). Furthermore, silver sulfadiazine was associated with lower daily pain scores than most other dressings, except silver nylon.

Nonetheless, when analyzing the use of systemic analgesia, it was observed that although Manuka honey was associated with higher pain scores, patients using it presented a significantly lower median of morphine milligram equivalents (median 34.0; 95 % CI 15.0–59.8) compared to 5 % sulfamylon solution (median 39.0; 95 % CI 15.0–79.6; $p = 0.03$) and negative pressure wound therapy (median 38.0; 95 % CI 15.0–69.0, $p = 0.02$).

Infection

Burn wound infections are the leading cause of death in burn patients; however, topical antibacterial agents have improved survival rates (48). Duncan *et al.* (20) performed burn secretion cultures on the first and seventh days of treatment to rule out infection before and during honey therapy, and reported that no wounds became infected. Regarding the case series, all reported an absence of signs of infection and successful infection control in their patients (44, 45). An exception was the clinical trial by Bokaiean *et al.*, in which bacterial infection was observed in 20 % of patients using the honey dressing and in 40 % of the conventional group ($p = 0.064$) (46).

Treatment costs

Duncan *et al.* (20) analyzed total product usage and the cost of in-hospital treatment per patient. Patients used 1 to 4 tubes (1.5 ounces each) of the product, and the average treatment cost with ALH gel was \$26.15 USD per patient, with a range of \$11.44 to \$45.76 USD. Although the actual cost of ALH was not significantly different from the estimated cost of silver sulfadiazine (\$16.49), the estimated cost of bacitracin (\$11.66) was significantly lower than that of ALH ($p = 0.02$). However, the study cautions that these comparisons were based on estimated costs for bacitracin and silver sulfadiazine, and that variations in product application by the patient or caregiver could affect the results. Although ALH costs exceeded those of bacitracin, both treatments are considered economically reasonable.

Discussion

The primary objective of this scoping review was to synthesize the existing evidence regarding the use of Manuka honey dressings and their outcomes in the wound care of burn patients within in-hospital settings. Our findings suggest that Manuka honey possesses therapeutic potential for burn treatment, showing positive effects on healing, bacterial control, and pain management. However, these results are not conclusive due to study limitations, such as methodological design and small sample sizes (20, 44, 46). Therefore, more rigorous clinical trials are required to validate these findings.

Thus, the study by Sampietro *et al.* (44) demonstrated an adequate epithelialization process in 10 patients. The initial treatment of burns is crucial for preventing necrosis and promoting healing; therefore, the chosen dressing must facilitate granulation and epithelialization, while preventing infection (44, 49). In response to this need, Manuka honey provides topical nutrition and anti-inflammatory properties, lowers wound pH, and promotes the expression of various growth factors—such as TGF- β —and angiogenesis, granulation, contraction, and wound epithelialization (22).

The work by Muñoz *et al.* (50) describes epithelialization as a process that begins with the proliferation and migration of keratinocytes; in this process, honey promotes the expression of cytokines such as IL-1 β , TNF- α , and TGF- β , which are key molecules in keratinocyte activation (50). Keratinocytes enhanced by honey express the markers K6, K16, and K17, which, during the acute phase, enable hyperproliferation and migration within the wound (29, 31, 49, 50).

Additionally, Manuka honey enhances the expression of protein kinases, such as Src, which in turn induces the expression of matrix metalloproteinases, specifically MMP-2. This enzyme degrades extracellular matrix components, facilitating keratinocyte migration during epithelialization via the ERK1/2 signaling pathway. However, throughout this process, honey regulates MMP-2 activity by modulating K6 expression, preventing excessive extracellular matrix degradation that could otherwise delay healing. Furthermore, honey reduces the formation of hypertrophic or keloid scars by regulating Src, underscoring its benefits in burns from the initial stages (29, 30, 36).

On the other hand, several studies observed more favorable epithelialization times with the use of Manuka honey. Specifically, in case series, epithelialization times of 13.88 and 14 days were reported. One of these studies even documented epithelialization within 7 days in superficial-thickness burns (20, 44, 45). These results compare favorably with conventional treatments that utilize

silver-based dressings and topical agents. A study by Malik *et al.* (51) reported that 93 % of patients treated with honey healed within 20 days, whereas those treated with silver took more than 24 days.

Similar results were reported in the study by Lusby *et al.* (52), in which 100 % of patients with partial-thickness burns treated with honey achieved epithelialization by day 21, compared with 84 % of those treated with silver. The mean healing time was 13.4 days for honey and 15.6 days for silver, showing a statistically significant difference ($p < 0.0001$). It is important to highlight that although the antimicrobial effect is the sole mechanism justifying the use of silver in burns, its chronic use can enhance pro-inflammatory cytokines, leading to impaired healing; furthermore, adverse events such as hepatic and renal toxicity, as well as leukopenia, have been reported. Additionally, the use of silver increases the frequency of dressing changes and, consequently, patient pain (53–56).

Consistent with this scoping review's findings supporting the use of Manuka honey for pain management in burn patients, existing evidence describes the physiological mechanisms by which honey alleviates pain during wound healing. Due to its osmotic effect, honey maintains a moist environment between the dressing and the wound bed, which facilitates atraumatic removal and autolytic debridement. Consequently, this prevents mechanical damage to newly formed tissue, accelerates epithelialization, and reduces the frequency of dressing changes (36).

Another mechanism through which honey reduces pain is attributed to methylglyoxal; its suppressive action on pro-inflammatory mediators, such as prostaglandins and nitric oxide, decreases edema and exudate, thereby alleviating pain. Specifically, by inhibiting prostaglandins like PGE₂—which are produced following tissue damage and activate EP nociceptors via ion channels, lowering the pain activation threshold—honey effectively raises this threshold. This process mitigates symptoms such as hyperalgesia and allodynia, which are commonly observed in burn patients (57, 58).

Regarding the reduction of bacterial load with Manuka honey, its antibacterial activity in managing burn infections manifests in several ways, as evidenced by various studies (33, 59). A preliminary analysis compared Manuka and Tualang honeys and found that Manuka honey inhibits Gram-positive bacteria more effectively. Complementing these findings, Cooper *et al.* (33) isolated 17 strains of *P. aeruginosa* from burn patients. When comparing mixed-pasture honey, Manuka honey, and an artificial honey, they found that all *Pseudomonas* spp. strains were sensitive to medical-grade honeys at minimum inhibitory concentrations (MIC) of less than 10 %. Both pasture and Manuka honeys exhibited bactericidal (rather than bacteriostatic) activity and were 2.5 and 2.8 times more effective than artificial honey, respectively.

Likewise, the study by Tirado *et al.* (60) demonstrated the efficacy of Manuka honey against antibiotic-resistant bacteria, such as multidrug-resistant (MDR) *Acinetobacter baumannii* and methicillin-resistant *Staphylococcus aureus* (MRSA). The minimum inhibitory concentration (MIC) of Manuka honey was determined to be 3.5 % for MRSA and 8.5 % for *A. baumannii*. The minimum bactericidal concentrations (MBCs) against these same pathogens were 9.5 % and 10.5 %, respectively. Furthermore, the study compared Manuka honey with supermarket-grade honeys and observed that the latter promoted the growth of bacteria and fungi. These results underscore the necessity of using medical-grade honey for the management of infectious processes to ensure the safety and efficacy observed in this research (50, 52, 61, 62).

Specifically, bacteria such as *Staphylococci* and *P. aeruginosa* are the primary infectious agents in burn patients. It has been discovered that *Staphylococci* in small-colony variants (scvs) can mod-

ify their phenotype and adapt to low pH and high osmolarity, rendering acid- and osmolar-honey categories ineffective for burn treatment. However, methylglyoxal—a key compound in Manuka honey—utilizes a different antibacterial pathway by binding to guanine residues in RNA and DNA, thereby inhibiting protein synthesis and gene replication in bacteria (62). Regarding *P. aeruginosa*, the study by Roberts *et al.* (63) demonstrated that 24 % Manuka honey concentrations inhibit the expression of flagellar regulatory genes (*fliA*, *fleN*, *fleQ*, and *fleR*), as well as the structural genes *fliC* and *flhF*. This bacterial deflagellation effect reduces virulence, leading to a marked loss of motility and a decreased capacity for initial colonization of wounds in burn patients (63).

Furthermore, the use of Manuka honey in burn patients reduces epithelialization time compared with other conventional dressings, with a direct impact on clinical indicators, such as shorter length of stay and increased bed turnover rates (20, 44, 45, 49, 52). Honey facilitates cost-effective treatment by extending the interval between dressing changes, thereby reducing consumption of hospital supplies (53, 54, 56). Additionally, its potent antimicrobial action minimizes the need for prolonged antibiotic courses, thereby decreasing the incidence of healthcare-associated infections (HAIs) and promoting the rational use of drugs (20, 33, 57, 61). This strategy is particularly relevant considering that antimicrobial resistance could cause up to 10 million deaths and result in losses exceeding \$100 trillion over the coming decades (62).

From a practice perspective, these findings have direct and preliminary implications for nursing care. Manuka honey emerges as a first-line intervention for partial-thickness (second-degree) burns and for burns infected by multidrug-resistant pathogens where conventional treatments have failed. Nevertheless, its implementation into institutional clinical practice guidelines is still hindered by a lack of standardized protocols for dressing change frequency based on exudate levels, a factor further intensified by the osmotic effect of honey.

The present scoping review features several methodological strengths that enhance its rigor. Its design was optimally adapted to mapping evidence in a field characterized by heterogeneous and limited studies. Furthermore, the search strategy was exhaustive, with no restrictions on language, study type, or year of publication, thereby minimizing the risk of selection bias in the identified literature. The findings suggest promising clinical benefits, including accelerated wound healing, effective infection control, and reduced pain in patients.

Nonetheless, it is important to acknowledge the inherent limitations of the available evidence to properly contextualize the conclusions. Most of the research included is observational; these designs do not allow for causal inference and increase the risk of selection bias and confounding. Additionally, small sample sizes reduce the statistical power and the generalizability of the findings. From an epidemiological perspective, the heterogeneity in Manuka honey formulations and in the outcome measurement methods (such as pain and epithelialization) introduces potential information bias. Finally, external validity remains limited. Most studies were conducted in highly specialized burn units, which restricts the applicability of the results to primary care settings or rural environments. Furthermore, a significant evidence gap persists regarding the use of this honey in full-thickness (third-degree) burns and in patients with severe systemic comorbidities, such as uncontrolled diabetes, where the physiological response differs substantially.

Conclusion

The clinical evidence gathered in this scoping review suggests that Manuka honey possesses therapeutic potential in the treatment of burns, demonstrating positive effects on healing, bacterial load control, and pain management. The findings indicate acceptable epithelialization times and a favorable safety profile, with a low incidence of infections.

While these results are encouraging, they remain inconclusive due to the limitations of the available evidence. Currently, the evidence is classified as very low, given that most findings are derived from case series and observational studies. This methodological weakness, coupled with the high heterogeneity in honey formulations and the lack of standardization in outcome measurement, precludes the establishment of a high-level clinical recommendation.

In terms of real clinical impact, Manuka honey shows its greatest preliminary efficacy in partial-thickness (second-degree) burns and in areas with suspected colonization by multidrug-resistant pathogens. It can be utilized as an adjuvant therapy to reduce pain during autolytic debridement and to accelerate epithelialization within the first two to three weeks of treatment. However, its use should be restricted to settings where sterile, medical-grade honey is available and where close exudate monitoring is in place, and it should be avoided in full-thickness (third-degree) burns without prior surgical evaluation.

Therefore, it is imperative to transition from case descriptions to robust evidence generation. Specific lines of research are proposed, including randomized clinical trials comparing Manuka honey with advanced silver-based technological dressings on cost-effectiveness, as well as studies evaluating standardized protocols for dressing change frequency. Only through superior methodological rigor can the role of Manuka honey be definitively validated within official clinical protocols for burn patient care.

Conflict of Interest

The authors declare no conflicts of interest.

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