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REVIEW ARTICLE

Wound Care in the Wilderness: Is There Evidence for Honey?

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Honey is one of the most ancient remedies for wound care. Current research has shown promising results for its use in wound care. This review is intended to inform readers of the physiological properties of honey and the evidence that exists to support its clinical use. When compared with evidence for current wound treatment, honey has proven to be a safe, effective, and sometimes superior treatment for various wounds. There are currently US Food and Drug Administration–approved medical-grade honey products available in the United States. Although there have been no clinical trials exploring the use of honey in wilderness environments, it may be a safe, improvisational wound treatment. More robust studies are needed for definitive conclusions of its efficacy and safety.

Key words: honey, wound, burns, topical, wound care

Introduction

Honey has been used for millennia for wound care. One of the world's oldest surgical texts, the Edwin Smith papyrus, dates back to 1600–2200 BC and describes treating a head wound with an oil-and-honey–soaked linen bandage.[1] Records from ancient Greece and Egypt, the Ayurvedics of India, Hippocrates, Aristotle, and the Qu'ran all refer to the healing effects of honey.[2–5]

In the late 19th century honey began to transition from a folk remedy to a scientific inquisition. Honey's antimicrobial qualities were first documented in 1892 by B.A. Van Ketel, a Dutch scientist, and further research in the United States and Europe noted its worth in treating infected wounds.[6] However, with the new discovery of contemporary antibiotics in mid-20th century, medical use of honey fell out of favor.[7] Honey and its role in wound care have experienced a resurgence in recent research, and particular attention has been focused on its role in treating wounds contaminated with antibiotic-resistant organisms. There is a substantial amount of modern research published to help guide honey's role in wound healing and help one to better understand its unique properties.

In 2007, the US Food and Drug Administration (FDA) approved the first honey-related wound product—a sterile, single-use wound care dressing impregnated with 95% honey, 5% sodium alginate. It was approved in the United States for use in minor traumatic or surgical cuts and burns, and on select ulcers.[8] Various dressings, gels, ointments, and hydrogel dressings have since been marketed (Table 1).[7]

We found no clinical trials exploring the use of honey in prehospital or wilderness environments; however, it may be a safe and effective provisional wound treatment, especially in situations in which antibiotics are indicated but not available. In particular, honey has been advocated as an extemporizing antibiotic strategy in high-risk animal bites for which antibiotics are indicated within an hour of injury.[9] There is in vitro evidence that honey, independent of systemic or topical antibiotics, can sterilize wounds.[10] Evidence supporting the use of topical antibiotics for minor wounds is weak, and it has been connected with antibiotic resistance and other adverse reactions (eg, allergic contact dermatitis).[11] Taking this into consideration, honey may be a useful addition to a wilderness medical kit. It can be used as an improvised treatment for multiple austere medical problems, and, if needed, provide a food source.

Methods

OVID, PubMed, MEDLINE, CINAHL, and Cochrane Database of Systemic Reviews were searched using a variety of combinations of the following terms: "honey," "wound care," "wound," and "wound healing." Titles and abstracts from the initial literature search were

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Table 1. Medical-grade honey products available

Products	*Description*
Elasto-Gel manuka wound dressing	FDA approved, sterile polymer dressing impregnated with manuka honey
MANUKAhoney, MANUKAbalm, MANUKAderm, MANUKApli, MANUKAtex	FDA approved (MANUKAtex), wound dressings, gels, ointment containing manuka honey
Medihoney dressings with active manuka honey	FDA approved, 100% manuka honey topical ointment
OTC API-MED, Medihoney Primary and Medihoney 100% honey dressings with active manuka honey	FDA approved, manuka honey impregnated dressings
L-Mesitran Hydro, L-Mesitran Border, L-Mesitran Net, L-Mesitran Active, L-Mesitran Soft	FDA approved, hydrogel dressings and wound care gel containing honey
API-MED active manuka honey absorbent dressing	FDA approved, dressings impregnated with 95% manuka honey and 5% sodium alginate
MANUKA IG	FDA approved, wound dressing containing 100% manuka honey

FDA, US Food and Drug Administration.

selected and reviewed to explore the benefits and possible negative outcomes of topical honey; references from these articles were reviewed and searched further for pertinent publications not initially found in online searches. Natural Medicines Comprehensive Database was also referenced.

Mechanism of Action

Honey is an acidic, hygroscopic, hyperosmolar sugar solution produced by honeybees from plant nectar.[12–14] It is composed of water, sucrose, glucose, fructose, amino acids, wax, pollen, pigments, minerals, and enzymes, including invertase, which converts sucrose into simpler glucose and fructose, and glucose oxidase, which oxidizes glucose and produces gluconic acid.[15] This enzymatic process contributes to the production of hydrogen peroxide. The gluconic acid lowers pH to ranges from 3.2 to 5.5, making an acidic environment inhospitable to microbe growth. The low pH also inhibits protease activity, which uninhibited will adversely affect growth factors and protein fibers essential to the healing process.[16,17] In addition to its enzymatically produced acidity and peroxide generation, honey has been described as an antimicrobial and antioxidant that produces proinflammatory cytokines, decreases biofilm formation, inhibits bacterial cell cycle production, decreases pain perception, reduces malodor, and decreases exudates (Table 2).[7] Although not all mechanisms are completely understood, every year further research illuminates honey's efficacy as a useful auxiliary in wound healing.

Free radicals from excessive and prolonged inflammation can cause tissue damage and prevent healing. Honey-exposed cells have been shown in histological studies to have higher levels of antioxidants present and decreased numbers of inflammatory cells.[18] In cell cultures, honey has been shown to stimulate B and T lymphocytes and phagocytes and release of modulator cytokines tumor necrosis factor-1 (TNF-1), interleukin 1 (IL-1), and IL-6. It also provides macrophages with the essential glucose needed for hydrogen peroxide production and energy production.[19,20] In vitro studies show honey may be able to modulate the activity of immunocompetent cells, such as monocytes.[21,22] Honey is thought to decrease edema, thereby decreasing hydrostatic pressure, allowing better wound circulation and delivery of oxygen and essential nutrients to the wound.[17]

Honey is effective in providing a protective barrier and maintaining a moist environment that is inhibitive of bacterial growth colonization, in addition to preventing adhesion of dressings to wounds.[23,24] Its viscosity and hyperosmolarity dehydrate bacteria.[25] The osmotic pressure from honey draws out lymphatic fluid from the base of wounds, which aids in removal of necrotic and devitalized tissue.[20,23] The sugary wet environment may improve local nutrition and epithelialization, and the acidity provides an optimal medium for fibroblast activity.[14] A 2010 animal study showed that honey stimulates angiogenesis at wound sites, bringing vital oxygen and nutrients necessary for healthy granulation tissue.[26]

In addition to honey's hygroscopic hyperosmotic dehydrating effects inhibiting bacterial growth, it also has been shown to have both bacteriostatic and bactericidal activities across a broad spectrum of significant wound bacteria.[27,28] Applying an occlusive dressing with 0.5 mL of standardized Dutch medical-grade honey to healthy skin for 48 hours showed reduced bacterial skin