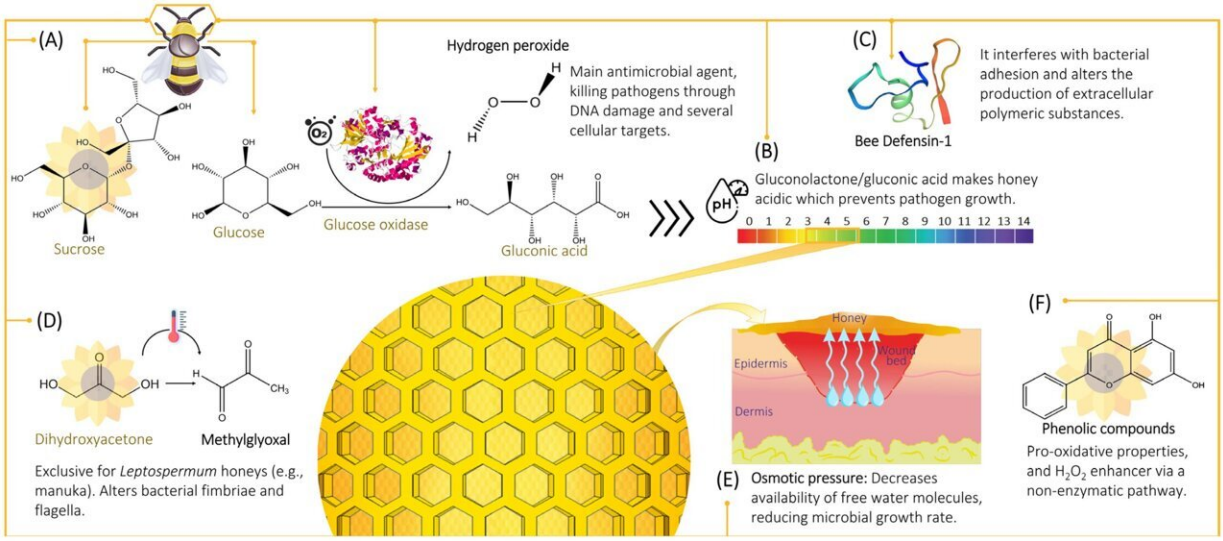
Honey has sweet potential for wound healing, scientists claim

September 20 2022, by Mike Addelman



Key antimicrobial components of honey. (A) Sucrose from flowers is broken down by the bee into glucose and fructose. The bee's hypopharyngeal glands secrete GOx. Glucose is then oxidized by the oxidized form of GOx, which results in the production of gluconolactone/gluconic acid and H_2O_2. Most of honey's antimicrobial activity comes from H_2O_2, killing pathogens through DNA damage and several cellular targets. (B) Honey is acidic with an average pH of 3.91 (ranges between 3.4 to 6.1), which makes it powerful against microbial strains with an optimum pH of growth around 7. Acidity predominantly arises from gluconolactone/gluconic acid. (C) Bee Def-1 is an antibacterial peptide originating in the bee's hypopharyngeal gland. It acts by interfering with bacterial adhesion to a surface, or in the early biofilm stage by inhibiting the growth of attached cells; and by altering the production of extracellular polymeric substances. (D) MGO is generated in honey during storage by the non-enzymatic conversion of dihydroxyacetone, a saccharide found in high concentrations in the

nectar of Leptospermum flowers. The antimicrobial activity of MGO is attributed to alterations in bacterial fimbriae and flagella, which obstruct the bacterium's adherence and motility. (E) Honey is a super-saturated solution of sugars. The strong interaction between these sugars with water molecules prevents the abundance of free water molecules (low water activity) available for microbes to grow. (F) The combination of different phenols act as an enhancer of honey's antimicrobial efficacy. In alkaline conditions (pH 7.0–8.0), polyphenols can display pro-oxidative properties, inhibiting microbial growth by accelerating hydroxyl radical formation and oxidative strand breakage in DNA. They could also support the production of considerable amounts of H_2O_2 via a non-enzymatic pathway. Credit: *Pharmaceutics* (2022). DOI: 10.3390/pharmaceutics14081663

Honey has exceptional antimicrobial and tissue-regenerative properties which should be exploited to the full to help wounds heal, say scientists from The university of Manchester.

Their review of more than 250 articles over 85 years—with the oldest article from 1937—is published in the journal *Pharmaceutics*.

The sweet substance, the researchers say, is offering an alternative to conventional antimicrobial drugs which are increasingly becoming ineffective in the face of growing resistance. However, more work, say the researchers, is needed to identify and quantify the compounds that give honey its antimicrobial and wound healing properties to make it more reliable and standardized.

Honey has been mainly used as a topical application on wounds for its antibacterial properties, resulting from its ability to generate hydrogen peroxide and the presence of other active compounds. The compounds include phenols, defensin-1, and methylglyoxal (found in manuka honey). Its acidity and low water availability also contribute to honey's healing

properties. Its stickiness also provides an effective hydrated barrier between the wound site and external environment.

A variety of wound types, the researchers report, have been treated with honey, such as burns, trauma, and chronic wounds. Mesitran, one of the first line of products to incorporate medical grade honey in the UK, was launched in 2005 in Manchester. Over the years other companies followed. In recent years, research has focused on using honey in tissue engineering applications.

Things like electrospun nanofibers, hydrogels and cryogels, foams, films, powders, cements, and bioinks have been utilized to fabricate honey-based scaffolds. And some studies have shown how antibiotic-resistant bacteria can be more susceptible to antibiotics when used in tandem with honey.

In one paper they cite, when Methicillin-resistant Staphylococcus aureus (MRSA) was exposed to manuka honey in combination with oxacillin, they acted together to desensitize the MRSA to the antibiotic. Honey's antimicrobial activity also includes the ability to kill or slow the spread of fungi and viruses.

Honey, though, used in combination with traditional wound dressings presents some limitations, such as being absorbed by the dressing, poor penetration into the wound site, and short-term antimicrobial action. However, manufacturers of impregnated dressings are attempting to improve their delivery mechanism to improve the efficacy of the substance.

Lead scientist Joel Yupanqui Mieles a postgraduate researcher from The University of Manchester says that "honey has exciting antimicrobial properties and has been used in traditional medicine to treat wounds since ancient times."

"The ancient Egyptians utilized it to treat wounds and there are direct references to honey consumption in the Bible and the Quran."

"The compounds in honey offer a bank of potential antimicrobial and regenerative agents that can be utilized to combat antibiotic resistance and aid in tissue healing."

"But though the repository of compounds within honey may have immense medical benefit, further research is required to understand more about how they work and how they can be delivered to wounds effectively and safely in a standardized way."

He added that "knowing the type and composition of honey used in different wound types will also improve the quality of research. That will allow scientists to make the most of honey's antimicrobial and healing mechanisms. It might even allow us to artificially replicate these in honey-inspired biomaterials that can be exploited with the current advances in tissue engineering technologies. That would minimize risks around processing in terms sterilization, storage, transport and determining authenticity and safety."

"One thing is certain: rising global antibiotic resistance is stimulating the development of novel therapies as alternatives to combat infections—and honey, we think, has a role to play in that. People who are worried about a wound should not treat themselves with honey without speaking to a medical profession first."

More information: Joel Yupanqui Mieles et al, Honey: An Advanced Antimicrobial and Wound Healing Biomaterial for Tissue Engineering Applications, *Pharmaceutics* (2022). DOI: 10.3390/pharmaceutics14081663