thoughts on historic infectious disease

CONTAGIONS

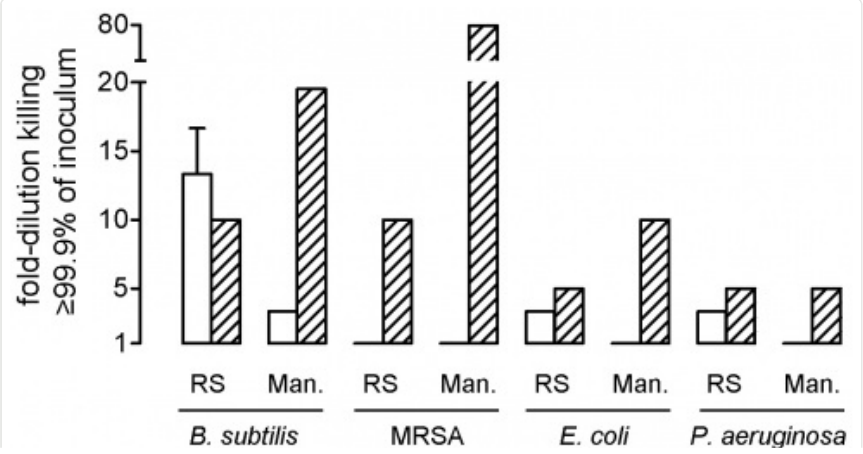
Not All Medicinal Honey is Alike

Honey has been used in medicine since antiquity. It has been used in everything from wound dressings to hot tea to sooth a colicky bowel. Modern medicine is finally beginning to investigate the basis for these folk remedies.

Honey bee (Photo: Paul Stein, Creative Commons 2.0)

This month a group from the Netherlands published a study that compares the bactericidal (bacterial killing) properties of two major medicinal honeys- RevamilH (RS) honey and medical-grade manuka honey (Kwakman et al, 2011). RS honey is a controlled environment greenhouse honey produced in the Netherlands. Manuka honey is produced from bees that feed on the manuka bush from New Zealand and Australia.

Kwakman et al (2011) chose four clinically important bacteria to test the honeys against — the wound pathogens methicillin-resistant *Staphylococcus aureas* (MRSA), *Escherichia coli* (E. coli), and *Pseudomonas aeruginosa*, and the food-spoiling *Bacillus subtilis*.



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Bacteriocidal activity of RS and manuka honey. Open bars are 2 hrs exposure, hatched bars are 24 hrs exposure. (Kwakman et al, 2011).

This experiment shows the dilution of honey that can still reduce the number of colony forming units of each bacterial species 1000 fold in 2 hours (open bars) and 24 hours (hatched bars). As you can see, only *Bacillus subtilis* was highly vulnerable to two hours exposure of RS only. Manuka honey did not have a significant effect on any of the species with the short exposure. In the 24 hour exposure, the manuka honey was more effective against the three wound pathogens.

The known anti-microbial agents in the two honeys differs considerably. The RS honey is an acidic high sugar compound with hydrogen peroxide, the peptide bee defensin-1, and methylglycol (MGO). On the other hand, Kwakman et al (2011) could not find a detectable amount of bee defensin-1 or peroxide in manuka honey, but it had 40 fold higher levels of MGO. It's not particularly surprising that levels of metabolites like MGO would differ among bees that feed on very different vegetation. Bee defensin-1 is found in royal jellies used to nurture larvae and varies between colonies (Kwakman et al, 2011).

Selectively neutralizing the activity of known anti-microbials in honey allowed them to narrow in on the likely active ingredients in each honey. Neutralizing the MGO reduced the activity of manuka honey against MRSA to the same level as honey-equivalent sugar-water alone. However, removing the activity of MGO from manuka honey did not effect its activity against *E. coli* suggesting another unknown active agent (Kwakman et al, 2011). The presence of MGO in both honeys may explain the ancient reputed effectiveness of honey against skin wounds since *Staphylococcus* is a major skin pathogen (the most common cause of boils, for example). Differing amounts and combinations of bee defensin-1, hydrogen peroxide, pH, and sugar concentrations explained the rapid (2 hr) effectiveness of RS honey.

This study highlights that our knowledge of the antimicrobial activity of honey is still at a very early stage. Medical honey won't be a predictable component of antimicrobial therapy until all of the active ingredients are not only known but tested against a wide variety of bacteria.

Kwakman PH, Te Velde AA, de Boer L, Vandenbroucke-Grauls CM, & Zaat SA (2011). Two major medicinal honeys have different mechanisms of bactericidal activity. *PloS one, 6* (3) PMID: 21394213

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