

# Medical honey and its role in paediatric patients

Anne Weissenstein, Elisabeth Luchter and Stefan Bittmann

## Abstract

**Background:** The use of complementary medical treatment in wound management has continued to grow throughout the world. There is a large body of evidence that supports the use of honey as a wound dressing for a wide range of wound types. The authors present an update of present knowledge about honey as a form of complementary medicine in paediatric wound management. **Methods:** The literature cited was found by searching the PubMed, BIOSIS and ISI Web of Science databases for the phrase 'honey and wound'. Papers where honey was used in a mixture with other therapeutic substances were excluded. Randomised controlled trials as well as case studies were taken into consideration. **Results:** This paper reviews data on the effectiveness of honey in wound healing; 80 citations or references were found that matched the criteria. Furthermore, the wound-healing properties of honey are described and the mechanism of action discussed. The authors' data show that honey induced enhanced epithelialisation, minimised scar formations and had an anti-microbiotic effect. **Conclusion:** These results should encourage the use of medical honey in the field of paediatrics. It is a safe and natural substance that induces wound healing at a greater rate than conventional methods.

**Key words:** Honey ■ Paediatric ■ Child ■ Wound ■ Infection

A variety of different unhealed wounds, burns and ulcers exist, which have a great impact on public health and economy (Molan, 1999). Numerous interventions, such as new medications and technologies, are currently being used to stimulate wound healing and to eliminate infections. In this context, the finding of an intervention that would both have a therapeutic effect and help eliminate microbes would be of immense value for children and adults with immunosuppression or resistance to antibiotic treatment.

Honey is a viscous, supersaturated sugar solution derived from nectar gathered and modified by the honeybee, *Apis mellifera*. A natural product, it has recently been introduced into modern medical practice. It has a long history of use as a medical substance. Stone Age paintings in several locations dating to 6000 BC or earlier depict honey hunting,

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documenting human use of honey for at least 8000 years. References to honey as a medicine, or rather as an ingredient carrier vehicle, are found in ancient scrolls, tablets and books (Riddle, 1985; Molan, 1992). The first mention of honey as the primary medicine for wound treatment was by the anonymous author of the Edwin Smith papyrus, an Egyptian surgical text that was written in 2600–2200 BC (Breasted, 1930). Furthermore the early Ayurvedic, Chinese and Roman medical traditions used honey in wound care (Johnson, 1992; Fu et al, 2001; Hajar, 2003).

The effective mechanisms of honey on wounds are manifold. It is postulated that honey causes significantly greater wound contraction than in controls, and enhances the epithelialisation of wounds (Hejase et al, 1996; Oladejo et al, 2003). Honey also appears to draw fluid from the underlying circulation and therefore provide a moist environment as well as topical nutrition that may enhance tissue growth, the synthesis of collagen and the development of new blood vessels in the wound bed (Bergman et al, 1983; Molan, 1999). Another very important aspect of medical honey is its antimicrobial properties, suggesting that it might be a real alternative to the use of antibiotics and other chemotherapeutic agents for the treatment of wound infections. The antibacterial activity of honey was first reported in 1882 (Cooper, 2005). It was subsequently found that hydrogen peroxide might be an important factor, as the antimicrobial activity increased when honey was diluted with water.

Over the past decade, the interest in using honey for wound treatments in paediatrics has grown considerably. That is why it is important to analyse the current data in order to assess in detail how the honey works, whether there are side-effects and, most importantly, whether honey has the proposed effects in wound healing.

## Methods

The authors report an update on historical and general aspects of honey, and review the few published data concerning honey as a form of complementary and alternative medicine (CAM) used in paediatric wound management. The literature cited was found by searching the PubMed, BIOSIS and ISI Web of Science databases for the term 'honey and wound'. Excluded were papers where honey was used in a mixture with other therapeutic substances. Randomised controlled trials as well as case studies were taken into consideration.

## Results

Eighty citations or references were found that matched the criteria. In several studies, honey was used to dress wounds

(burn wounds, wounds infected with *Methicillin-resistant Staphylococcus aureus* (MRSA), postoperative wounds). The results showed an increase in healing, a prompt successful graft, increased debridement and a removal of dry crust. Furthermore, the wounds were deodorised and cleansed (Keast-Butler, 1980; Ndayisaba et al, 1992; Subrahmanyam, 1994; Osato et al, 1999; Baghel et al, 2009). In addition, it was found that honey is effective in treating infected wounds, as it has antibacterial activity against different types of bacteria and viruses (Cooper et al, 1999; 2002; Osato et al, 1999; Taormina et al, 2001). Several clinical case studies and randomised trials report that wounds that were treated with honey have a significant lower bacterial colonisation in 3–10 days (Mossel, 1980; Tovey, 1991).

A number of characteristics found in honey are essential for wound healing: nitric oxide (NO), prostaglandins, osmolarity, hydrogen peroxide, and increased lymphocytic and phagocytic activity. Honey has the ability to increase NO production in the tissue (Al-Waili et al, 2004). NO is important for the reduction of bacteria, viral inhibition and healing (Efron et al, 2000; Childress and Stechmiller, 2002) and is therefore an important factor in the increased wound healing in honey. Moreover, NO has been shown to play a role in the host defence against various bacterial and viral infections (Schwentker et al, 2002), which would explain the antibacterial activity of honey.

Honey also has the ability to decrease the synthesis of prostaglandins (Al-Waili, 2005). As they are the mediators of

inflammation and commonly regarded as immunosuppressive (Phipps et al, 1991), their reduction could explain honey's therapeutic effects. Furthermore, it is known that bacteria, in order to grow, need sufficient water (Chirifé et al, 1982). Honey, because of its high osmolarity, is able to draw water from wounds, preventing the growth of bacteria and inducing healing (Archer et al, 1990). Further, the effect of honey on wound healing may be partially related to the stimulation of inflammatory cytokines from monocytic cells, which are known to be an important factor for healing and tissue repair (Tonks et al, 2003). A UK study analysed the effect of three honeys (manuka, pasture and jelly bush) on the release of inflammatory cytokines from MM6 cells. Together with a sugar-syrup control, these honey were incubated with MM6 cells. The results proved that natural honey is able to significantly increase the TNF-alpha, IL-1 alpha and IL-6 release from MM6 cells, as well as human monocytes; the so-called proinflammatory inhibitors.

Numerous early studies have also described the antimicrobial activity of honey (Molan, 1992). The most effective honey type is leptospermum (manuka). Different studies have shown that it inhibits the growth of antibiotic-resistant strains of microorganisms both in vivo (Blaser et al, 2007) and vitro (Cooper et al, 1999). In in-vitro studies, manuka honey minimised bacterial colonisation on agar plates.

Another important mechanism of honey on wound healing is that honey is easy to apply and remove (Efem, 1993) and does not stick to the underlying wound tissues.

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However, there are numerous potential risks for honey therapy: mad honey poisoning, allergy to honey, infant botulism and pain are the most known complications after honey intake.

### Mad honey poisoning

In cases of mad honey poisoning, cardiac rhythm disturbances like bradycardia or atrioventricular block have been known, as have convulsions, vomiting, sweating, blurred vision, chills and cyanosis (Dilber et al, 2002; Akinici et al, 2008). Honey from the Black Sea region in particular contains grayanotoxin I, which is responsible for honey poisoning. Different forms of grayanotoxins have been isolated from the leaves and flowers of the rhododendron and some other plants (Dilber et al, 2002).

### Allergy to honey

Honey allergy is extremely rare, but can result in anaphylaxis. Allergy may be due to plant and bee proteins, and pollen found in the honey (Tuncel et al, 2011). Only case reports and case series of honey allergy with limited number of patients have been reported in adults. Tuncel et al (2011) described one case of anaphylaxis caused by honey, which to the authors' knowledge is the first.

### Infant botulism

Infant botulism is a rare condition caused by contamination of honey with clostridia spores. It occurs mainly in infants younger than 12 months of age; nearly 95% of cases occur in the first 6 months of life (Molan, 1999). In the literature, no cases of topical medical honey application were found to induce infant botulism. Germinating clostridia spores are colonised in the gut of the infant after oral intake, leading to constipation as the first sign of botulism. Concerns about wound infection from clostridia spores seem to be unfounded, as no such complication has been described in more than 500 reports (Molan and Betts, 2004).

### Pain

Some patients experience pain on application of honey. In these cases, higher concentrations of honey seem to induce higher levels of pain (Ozlugedik et al, 2006; Mphande et al, 2007), whereas the high osmotic potential (drawing pain) and/or low pH may be the cause. Nevertheless, pain does not appear to exert a negative effect on healing rates, but it can influence patients' quality of life, depending on their tolerance. In a study comparing aciclovir and honey in treating labial herpes, significant lower pain duration was found in the honey group (Al-Waili, 2004). These findings were found in an adult population, but to date there have been no child studies.

Several studies compared the effect of honey on wound healing against the standard therapy. In a randomised clinical trial, Robson et al (2009) compared the effect of honey versus conventional wound dressing in a sample of 105 adult patients. The median time to healing in the honey group was 100 days compared with 140 days in the control group. Jull et al (2008) compared the healing rates of venous leg ulcers dressed with calcium alginate dressings impregnated with manuka honey

## KEY POINTS

- There is substantial scientific evidence supporting the use of honey in pediatric wound management
- Honey appears to be an effective alternative to wound management in children and adults
- Because of the irradiation of medical honey the risk of side effects in children is very low

with standard treatment (non-adherent, alginate, hydrogel, hydrocolloid, silver dressing) in 368 patients. These patients were randomised and, after 12 weeks, there was a 5.9% increase in healing in favour of honey, although this did not reach statistical significance.

Other authors have reviewed the use of honey as a wound dressing and concluded that there is a lack of high-quality comparative evidence for both conventional and unconventional treatments such as honey (Lusby, 2002; Gethin, 2004). In a systematic review, Gethin (2004) concluded that the evidence available from seven comparative studies on 264 patients was limited by lack of blinding, poor reporting and poor validity.

## Discussion

Wound management in the paediatric field is difficult, as it is often time-consuming, expensive and may not lead to satisfying results. Many different dressing products exist, but few of them have undergone the analysis of randomised controlled trials.

Other authors argue that there are not enough high-level studies on the use of honey as a wound treatment, meaning a definite recommendation cannot be made and a first-choice treatment for wounds still has not been found. Machin and Campbell (2005) have argued that the strongest evidence is derived from double-blind randomised controlled trials, followed by single-blind randomised controlled trials, open randomised controlled trials, non-randomised studies, case-control studies and finally case series. On the other hand, controlled studies and good case studies often have a message that may be useful for further research in this interesting field.

The scientific evidence for using conventional wound-care products, especially in paediatric patients, is poor. No prospective randomised studies have been done in this particular age group. The results of Simon et al (2006), dealing with wound care with antibacterial honey (Medihoney) in paediatric haematology-oncology, are promising. Simon reported that an immunocompromised paediatric patient with acute myeloid leukaemia and wound infection with methicillin-resistant coagulase-negative *staphylococci* and vancomycin-resistant *enterococci* received a topical medical honey application, which led to a successful healing without local or systemic complications. Simon et al (2006) also reported that 15 paediatric oncology patients with different oncologic diseases were successfully treated with topical,  $\gamma$ -irradiated Medihoney™.

Extensive randomised controlled trials are needed to develop clear guidelines for paediatric wound management, particularly in children. Taking into account all data published so far, it is not yet possible to introduce clear guidelines.

## Conclusion

In microbiological and clinical tests, honey offers many advantages in controlling bacterial growth, and also in the treatment of certain health problems such as gastric ulcers, burn wounds, leg ulcers and wounds in adults. The antibacterial, anti-inflammatory, antioxidant and physical properties of honey make it a logical and accepted natural agent for wound dressing in paediatrics. In both industrialised and developing countries, honey offers a cost-effective therapy to treat paediatric wound infections (Tovey, 1991).

In children, topical honey application may lead to allergic reactions and pain episodes. Nevertheless, it has great potential. To formulate clear guidelines for paediatric wound treatment, further intensive research is needed. BJN

*Conflict of interest: none*

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