



Honey in Medicine

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SHORT HISTORY OF HONEY IN MEDICINE



Pabasa tombs, 26th Dynasty, 760-656 BC



Preparation of honey medicine from Materia Medica, Dioscorides, Arab translation 1224

Wound healing was probably the first use of honey for human health. In the oldest human scriptures from Sumer, dating back about 2000 BC a prescription for treating wounds states: *Grind to a powder river dust and (words missing) then knead it in water and honey and let plain oil and hot cedar oil be spread over it*⁴⁸

According to the Ebers papyrus (1550 BC) honey is included in 147 prescriptions in external applications: *“Mix honey, red ochre, powdered alabaster to cure spotted baldness”* or includes honey after surgery, as suppository and to reduce inflammation.⁴⁸

According to the Smith papyrus (1700 BC) it was used in wound healing: *“Thou shouldst bind [the wound] with fresh meat the first day [and] treat afterwards with grease, honey [and] lint every day until he recovers.”*⁴⁸

In the first compendium of ancient Chinese Medicine Shen Nang, compiled many years BC, and mentioned in a written form for the first time around 200 AD there are many prescriptions and medical indications which contain honey⁸⁷.

In ancient India ayurvedic medicine uses honey for many purposes. According to the Ayurveda classic Ashtanga Hridaya, written about 500 AD honey can be used against many diseases, e.g. healing and cleaning wounds, against different internal and external infections⁵²

The ancient Greeks considered honey as medicine and believed that if bee honey is taken regularly human life could be prolonged. Early thinkers such as Homer, Pythagoras, Ovid, Democritus, Hippocrates and Aristotle mentioned that people should eat honey to preserve their health and vigour. Dioscorides, in the first century AD (see picture to the left) used honey for treating wounds⁵⁵

Honey was the most useful substance used in old Roman pharmacopoeia. Pliny writes that it is good for afflictions of the mouth, pneumonia, pleurisy and snake bites⁴⁸

The wise Solomon praises the virtues of honey in the old testament. The Koran says” thy Lord taught the bee to build its cells in hills, on trees and in (men's) habitations..... there issues from within their bodies a drink of varying colours, wherein is healing for mankind (Quran 16:68-69).

The ancient Maya civilisations used Melipona (stingless bee) honey in the treatment of cataracts⁴⁸

Today the knowledge on the healing virtues of honey and the other bee product is called apitherapy is compiled in many books or on the Internet www.apitherapy.com, www.apitherapy.org

HONEY AND WOUND CARE: AN OVERVIEW

By Keith Cutting

Reprint with permission from Ostomy Wound Management³⁰.

History

Until the first part of the 20th century, honey dressings were part of everyday wound care practice. With the advent of antibiotics in the 1930s and 1940s, views changed and honey was consigned to items of historical interest. Misuse of antibiotics, the emergence of resistant bacteria, and increasing interest in therapeutic honey have provided an opportunity for honey to be re-established as a broad-spectrum, antibacterial agent that is non-toxic to human tissue.

Despite lack of promotional support from large corporations, interest in the use of honey in wound management has increased in recent years. However, a clinical profile in wound care commensurate with other modalities has not been achieved despite offering similar indications of use and an increase in research activity and clinical reports. It is observed that “The therapeutic potential of uncontaminated, pure honey is grossly underutilized”¹⁰⁷

Clinicians need reassurance that any health-related agent is safe and meets its stated therapeutic purpose. Therefore, it is important to emphasize that although natural in origin, the honey used in wound care should be of medical-grade standard and not sourced from honey destined for the supermarket shelf. Medical grade honey is filtered, gamma-irradiated, and produced under carefully controlled standards of hygiene to ensure that a standardized honey is produced¹⁰²

Therapeutic benefit of honey in wound care

The therapeutic properties of honey are variable and depend on the type of honey used⁶⁰. Manuka (the Maori name for the New Zealand tea tree/bush *Leptospermum scoparium*) or *Leptospermum* is honey derived from the tea tree; the former is the more widely used term. In a review of the literature, Moore showed that Manuka honey has “very special healing properties” and described it as “the best natural antibiotic in the world.”⁶⁶

Medical grade Manuka honey is prepared purely for medical use and controlled by a rigorous set of systems and standards. These exacting standards apply to the *leptospermum* honey distributed in US (Medihoney™, Derma Sciences, Princeton, NJ). This product is a blend of *L. scoparium* (Manuka) and *L. polygalifolium* know as Jelly Bush.

A systematic review⁶⁶ of honey as a wound dressing noting the dearth of good evidence on topical wound agents contradicts Molan’s literature review⁶² of the evidence (17 randomized, controlled trials involving 1,965 participants and five clinical trials involving 97 participants, plus numerous case studies) — supports the use of honey as a wound dressing and underscores clinician failure to recognize that evidence. Molan’s research reviews also addressed the range of honey’s therapeutic activities⁶⁴ :

Bioactivity of honey	Suggested Rationale
Prevention of cross-contamination	Viscosity of honey provides a protective barrier
Provides a moist wound healing environment	Osmolarity draws fluid from underlying tissues
Dressings do not adhere to wound surface. Tissue does not grow into dressings	The viscous nature of honey provides an interface between wound bed and dressing
Promotes drainage from wound	Osmotic outflow sluices the wound bed
Removes malodor	Bacterial preference for sugar instead of protein (amino acids) means lactic acid is produced in place of malodorous compounds
Promotes autolytic debridement	Bacterial preference for sugar instead of protein (amino acids) means lactic acid is produced in place of malodorous compounds
Stimulates healing	Bio-active effect of honey
Anti-inflammatory	Number of inflammatory cells reduced in honey-treated wounds
Managing infection	Antiseptic properties found to be effective against a range of microbes including multi-resistant strains

Wound bed preparation

Wound bed preparation may be viewed as management of the wound in order to accelerate endogenous healing⁶⁴. The bio-activity of honey aligns closely with the concept of wound bed preparation. The physiology of healing in acute wounds is a carefully controlled series of events that ensures healing progresses in a timely fashion. However, in chronic wounds this orderly sequence is disrupted and the repair process is delayed. If wound bed preparation is to be successful, the impediments to healing must be recognized and addressed, implying appropriate management of exudate, devitalized tissue, and associated bioburden. The appropriate application of honey dressings offers a way forward in managing potential wound-related barriers to healing.

Exudate

A clinical study by Al-Waili and Saloom⁵ compared honey with topical antiseptics in 50 patients with postoperative abdominal wound infections; Ahmed et al's² non-randomized study of 60 patients with chronic surgical or trauma wounds; and Betts and Molan's¹⁹ in vivo pilot study reported that honey helps reduce the amount of wound exudate. This is most likely a consequence of honey's anti-inflammatory properties. Inflammation — increased vessel permeability increases fluid movement into soft tissue, subsequently increasing surface exudate. A decrease in inflammatory cells has been found (histologically) in animal models following application of honey in full-thickness burns. Similar findings⁸⁰ have been reported in animal studies comparing ampicillin and nitrofurazone in treating infection of full-thickness wounds^{53, 73}. The anti-inflammatory activity of honey also has been documented in clinical studies of human burn wounds and in "in vitro studies"⁹⁴⁻⁹⁶. The potential consequences of effectively managing inflammation include rapid reduction of pain, edema, and exudate; additionally, hypertrophic scarring is minimized by avoiding protracted inflammation that may result in fibrosis⁶⁵. It follows that reducing inflammation lessens exudate production and dressing change frequency, which may conserve resources in terms of dressings used, staff time, and unnecessary disturbance of the patient and the wound bed.

Devitalized tissue

It has been established that dressings that create the type of moist wound environment that honey provides facilitate the process of autolytic debridement. The osmotic pull of honey draws lymph from the deeper tissues and constantly bathes the wound bed. Lymph fluid contains proteases that contribute to the debriding activity of honey. In addition, the constant sluicing of the wound bed is believed to help remove foreign body (e.g., dirt and grit) contamination⁶⁵. Molan⁶¹ has suggested the most likely explanation for honey's debriding activity involves the conversion of inactive plasminogen to plasmin, an enzyme that breaks down the fibrin that tethers slough and eschar to the wound bed. Stephen-Haynes⁹³ who presented the results of three patient case studies and an additional five patients who benefited from management of wound malodor, attests to the clinical impact of honey in debridement. Malodor is known to occur in a variety of wounds in conjunction with slough and necrotic tissue; it is a particular concern when managing fungating lesions. Malodorous substances such as ammonia and sulphur compounds are produced when bacteria metabolize protein. Because honey provides bacteria an alternative source of energy (glucose), these noxious compounds are no longer produced and wound malodor is avoided.

Maceration

Macerated periwound skin can be a problem in some wounds and is often related to the dressing used²⁹. The osmotic action of honey, previously mentioned, has been shown in previous reviews of the literature to reduce the risk of maceration — honey draws moisture rather than donates it⁶⁵. Thus, periwound skin is protected from overhydration.

Bioburden

Honey has been shown in clinical observations to have the ability to manage wound infection in situations where conventional antimicrobial (antibiotics/antiseptics) have failed^{35, 37, 103}. Honey also has been found to be effective in vitro against a range of multiresistant organisms including methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant Enterococci (VRE), and other multiresistant Gram-negative organisms including *Pseudomonas aeruginosa*⁴⁰. Other in vitro studies involving different microorganisms also have demonstrated honey's effectiveness against antibiotic-resistant bacteria^{27, 50}. George and Cutting specifically identified honey's antibacterial activity⁴⁰. The binding of water can be added to these antibacterial properties:

- The high sugar content/low water activity provides osmotic action
- Acidic pH (3.2 to 4.5) inhibits bacterial growth
- Glucose oxidase enzyme helps produce hydrogen peroxide
- Plant-derived factors (present in some honeys and not specifically identified).

The antibacterial action most likely reaches below the wound surface. Although topical honey manages superficial bacteria (bactericidal in action rather than bacteriostatic)^{27, 99} it also has been shown in vitro to provide prompt clearance of deep-seated infection and boils with unbroken skin, suggesting that honey's antibacterial activity may diffuse through the skin to deeper tissues. Cooper et al²⁷ performed sensitivity testing of 17 strains of *P. aeruginosa* isolated from infected burns using two honeys with different types of antibacterial activity; Wahdan⁹⁹ compared the antibacterial activity of a sugar solution and honey on 21 types of bacteria and two types of fungi.

Some commercial honey preparations used in wound healing



Medihoney for wound care



Antibacterial wound gel



Moistering cream against eczemas



Medihoney wound gauze



Wound-healing creams



Wound dressing with Medihoney gauze

Biofilms

In recent years, attention has turned to the potential role of biofilms in wound infection. A biofilm may be described as a bacterial community living within a self-produced extracellular polysaccharide (EPS) matrix. The EPS protects the bacterial community from antimicrobial and phagocytic onslaught. Lately, in vitro evidence has indicated that honey is an effective agent for preventing biofilm formation. In an in vitro study it was found that laboratory-grown Pseudomonas biofilms were disrupted following application of Manuka honey⁴⁷. These findings are particularly encouraging when considering the emergence of antimicrobial-resistant bacteria. No evidence has yet been presented that bacterial resistance to honey has occurred — it is highly unlikely that bacteria will select for resistance to honey because bacteria rely on sugar as a source of food.

Cross-contamination

Use of honey dressings may help prevent cross contamination. This is and will remain an important issue in healthcare. The viscous nature of honey is believed to provide a physical barrier that helps safeguard patients by preventing cross contamination.

Dressing wounds with honey

All dressings must be used in accordance with the manufacturer's instructions. This helps endorse the maxim do no harm and ensure that the full benefit of the product is realized.

Because of its fluid and viscous nature, honey can be difficult to apply. This is particularly true when profuse exudate is present, diluting the honey. Experience has shown that use of the appropriate honey vehicle, including a secondary dressing, can sometimes circumvent this problem:

- **Honey liquid or gel dispensed from a tube:** Applied directly onto wound or onto appropriate dressing before application
- **Absorbent alginate dressing with honey:** Can be applied to most acute/chronic wounds including infected or sloughy wounds
- **Honey in a hydrocolloid-like sheet:** Should be selected according to the exudate level of the wound

Allergy

Before honey is applied to a wound, the patient should be asked routinely if he/she is allergic to honey or bee products, including bee stings. It is advisable not to proceed with a honey-containing dressing if the answer is affirmative.

Discomfort

Occasionally, some patients report transient stinging on application of honey. The discomfort often disappears in a short period of time or after the first few applications. Analgesia is required only in those rare circumstances when pain may persist. In a review paper, Molan⁵ noted that patient response to honey applied to open wounds was reported as soothing, pain-relieving, and non-irritating, and demonstrated no adverse effects⁶²

Conclusion

The resurgence of interest in honey as a modern wound dressing offers opportunities for both patients and clinicians. Recent additions to the honey product range of dressings indicate commercial confidence in the future of therapeutic honey. The wheel has turned full circle and honey is being re-established as a valuable agent in modern wound care management. Its advantages — providing a moist environment, debriding, deodorizing, antibacterial, anti-inflammatory capabilities — are factors that have been shown to facilitate healing. These advantages have been experienced by patients and clinicians in Europe and Australia and are now available to patients in North America. Use of any medical device must be based on clinical justification and available evidence about product safety and effectiveness. Continued research is needed to increase our understanding about the role of honey in a variety of wounds and its effect on healing compared to other treatment modalities.

HONEY FOR WOUND HEALING UNDER HOME CONDITIONS

Besides scientifically based use of honey in wound care in hospitals (see next section), honey can also be used under home conditions, as it was used for many centuries. Although sterilised honey is only used in hospitals, raw honey can also be used under home conditions without any risk, as no adverse effects have been reported. Indeed, Prof. Descotte lectured in several Apitherapy conferences that his team has used raw honey routinely for wound care in hundreds of cases in the hospital of Limoge, France³³

Honey applied in wound healing in a Swiss hospital



Wound at the treatment beginning

A painful and infected wound on the left leg. The fracture was stabilised with plates and screws. After several operations the blood circulation of the leg was diminished and sores were built because of the prolonged bed lying.

The wound treatment with conventional means was not successful. The patient agreed to make a honey treatment.



After only 5 days of treatment the wound condition was significantly improved. New tissues were built and the bacterial inflammation has diminished significantly



After two months the wound was completely closed. The cicatrise is almost invisible and he skin is healthy, tender and elastic at the same time.

photos and comment by Kathrin Rieder, Switzerland, application see below.

Application of honey for wound healing under home conditions, after²¹

It is not necessary to disinfect wound because honey will disinfect it

1. Apply honey as much honey on a gauze or clean cotton cloth as it is necessary to cover wound fully. Gauze and cloth need not be sterile.
2. Abscesses, cavity or deep wounds need more honey to adequately penetrate deep into the wound tissues. The wound bed should be filled with honey before applying the honey dressing pad.
3. Change bandage once a day. When doing it, wound need not be cleaned from honey. Honey is „dissolved“ in the wound or sticks to the gauze.
4. When changing the bandage remove hornification at the border of the wound with a pincette. This can be done under running water or with a soft tooth brush. Cell debris, which were not removed will not disturb healing process.
5. After cleaning, wound should be padded with as much gauze as is needed for drawing the wound liquid.
6. If wound is infected by yeast or it heals badly, a mixture of honey-betadine 1:1 can be used.

HONEY FOR DIFFERENT EXTERNAL APPLICATIONS

Honey against eye diseases

Since ancient times honey has been used for the treatment of eye disorders. This topic is reviewed by Molan, 2001, see there the original references⁶⁴ : Aristotle has written in his Historia Animalium that *“honey is good as a salve for sore eyes”*. It has also been used by traditional Indian medicine and in Mali. In the Rangarya Medical College of India it has been used to treat corneal eye ulcers, treatments of plepharitis (inflammation of he eye-lids) catarrhal conjunctivitis and keratitits. Honey is also successful in various ailments of the cornea. The use of honey in Russia has been reviewed: undiluted or 20-50 % water solutions being being applied to the eye under the lower eye lid against chemical and thermal burns of the eye, conjunctivitis and infections of the cornea. The healing effect of honey is explained by its anti-inflammatory, antibacterial and antifungal actions of honey.

There are reports on the successful treatment by honey of keratitis, conjunctivitis and blepharitis in Egypt³⁸.

The positive effect in keratitis to reducing the levels of angiogenic factors (VEGF and TGF-beta), inflammatory cytokines (IL-12) and chemokines (CC chemokine receptor 5(CCR-5))⁹⁸

Another explanation of the healing effect of honey in eye diseases is a irritation effect, triggering healing processes of the eye¹⁹. Stingless bee honey has been traditionally used by the Mayas against cataract¹⁰⁸.

Oral health



There is much debate whether honey is harmful to teeth. Some reports show a cariogenic effect of honey^{22, 86}, while others claim that the effect of honey is less cariogenic effect that sucrose^{32 38}. Due to its antibacterial activity honey ingestion inhibits the growth of bacteria, that cause caries^{63, 92} and might have a carioprotective effect^{36, 85}. It was also shown that Manuca honey, a very potent antimicrobial honey, has a positive effect against dental plaque development and gingivitis and thus can be used in the place of refined sugar

in the manufacture of candy⁶³.

According to electron microscopic studies ingestion of honey does not cause erosion of tooth enamel as observed after drinking of fruit juice (pH 3.5). Ten minutes after consumption of fruit juice tooth erosion was seen, while 30 minutes after honey ingestion the erosion was only very weak. This effect can be explained only partially by the calcium, phosphorous and fluoride levels of honey, other colloidal honey components have to be also responsible⁴².

Summarising the different findings, it can be concluded that honey is probably not as cariogenic as other sugars and in some cases can be also carioprotective, especially when strong antibacterial honey is ingested. However, for safety reasons, after consumption of honey it is advised to clean the teeth.

Other external applications

Besides the application in wounds and burns honey has also other external applications:

Against virus action on lips and genitals⁸:

Apply honey on gauze auf critical point and change once a day

Against boils and furuncles

Mix liquid honey and flour 1:1, add a little water and brush with it affected area. Cover with gauze and leave it overnight.

Against muscle cramps

Cover affected area with honey, cover with gauze or cloth and fix it with adhesive plaster. Ev. cover with a warm wool cloth. Leave at least 2 hours.

Against bruises and contusions

Mix honey and olive oil 1:1 and cover with mixture affected area. Cover with gauze and leave for 4-6 hours.

Honey massage



Honey massage was developed in Tibet and Russia and is extensively described elsewhere^{44, 97}

Both liquid and crystalline honeys can be used.

1-2 tea spoons of liquid honey are applied on the back. Massagist puts hands onto this area and unglues the palms. Easy at first, "ungluing" the hands becomes more difficult with every move because the tension force increases. Massage lasts until the palms no longer stick to the massaged area, and the honey disappears from it. The actual duration depends on the type and quality of honey. Generally, honey massage lasts from 30 minutes.

CANCER

Most of the cancer research has been done in animal models (see chapter 7). The use of honey in clinical cancer treatments has been reviewed in 2008 by Bardy¹⁷ and in 2009 by Orsolich⁷²

Urogenital carcinoms

The first reported use of honey in oncology patients was the topical application of 'household' honey to 12 patients with wound breakdown following radical excision of vulval carcinoma. Clearance of infection was observed within 3-6 days, and improved healing rates were recorded²⁴. In a report from the Russian Academy of Medical Science, patients with uterine cancer undergoing radiotherapy and treated with 'honey laminolact' showed a significant decrease in the severity of radiation-induced intestinal morbidity⁹¹

Honey treatment for prevention of oral mucositis

This topic has been reviewed in 2008 by Bardy. It has been pointed out that honey may be used for radiation-induced mucositis, radiotherapy-induced skin reactions, hand and foot skin reactions in chemotherapy patients and for oral cavity and external surgical wounds¹⁷.

Patients with head and neck cancer treated with radiation therapy were given honey. There was a significant reduction in the symptomatic grade 3/4 mucositis among honey-treated patients compared to controls; i.e. 20 versus 75%. The compliance of honey-treated group of patients was better than controls. Fifty-five percent of patients treated with topical honey showed no change or a positive gain in body weight compared to 25% in the control arm, the majority of whom lost weight²⁰.

Febrile neutropenia is a serious side effect of chemotherapy. Honey was administered to chemotherapy patients with neutropenia and was found that it reduced the need for colony-stimulating factors¹⁰⁶.

Pediatric oncology

In paediatric oncology patients, the immune system is often suppressed by cytotoxic antineoplastic agents or radiation therapy and wound healing is impaired. In the Department of Paediatric Oncology at the Children's Hospital in the University of Bonn, Medihoney™ has become a readily accepted treatment with a positive impact on patient and parent satisfaction⁸⁸.

Honey and chemotherapeutic drugs in combined supportive therapy

This use of honey has been reviewed⁸¹. Honey has been used to support chemotherapeutic action and reduce its side effects in myelosuppression, neutropenia etc.

The antitumor activity of honey can be explained by the antibacterial, antiinflammatory, immunomodulating, antioxidant and probiotic effects of honey.

HONEY IN GASTROENTEROLOGY

According to the Muslim holy book "The Holy Hadith", dating back to the 8th century AD the prophet Mohamed recommended honey against diarrhoea⁶. Also, the Roman physician Celsus (ca. 25 AD) used honey as a cure for diarrhoea²⁵. The use of honey for prevention and treatments of gastro-intestinal disorders such as peptic ulcers, gastritis, gastroenteritis has been reported in various books and publications from Eastern Europe^{51, 56, 59, 90} and from Arab countries⁸⁴.

Ulcers and Gastritis

Honey is a potent inhibitor of the causing agent of peptic ulcers and gastritis, *Helicobacter pylori*^{3, 14, 57, 74}. In rats honey acted against experimentally induced gastric ulcers^{11, 13, 41, 49}.

Honey is not involved on prostaglandin production, but has a stimulatory effect on the sensory nerves in the stomach that respond to capsaicin^{4, 9}. As a second mechanism of action has been postulated that this effect is due to the antioxidant properties of honey. Honey intake in rats prevented indomethacin-induced gastric lesions in rats by reducing the ulcer index, microvascular permeability and myeloperoxidase activity of the stomach⁶⁹. In addition, honey has been found to maintain the level of non-protein sulfhydryl compounds (e.g. glutathione) in gastric tissue subjected to factors inducing ulceration^{4, 9, 12}. A third mechanism of the gastroprotective effect of honey has been suggested by Beretta et al. It involves the salivary reduction of nitrate (NO₃⁻) to nitrite (NO₂⁻) and the intragastric formation of nitric oxide (NO), the latter involved in the preservation of the gastric mucosa capillaries and in boosting mucous production. Honeys contained NO₂ and NO₃, the concentration in honeydew honeys being higher than that of blossom honeys¹⁸.

Ingestion of dandelion honey was shown to reduce gastric juice acidity by 56%¹⁶. The gastric emptying of saccharides after ingestion of honey was slower than that of a mixture of glucose and fructose⁷⁹.

The effect of honey under clinical condition on more than 40 gastric ulcer patients was studied in a Russian hospital. Control treatments were with water. It was found that ingestion of 120 ml of 33 % honey solution by gastric ulcer patients improves the micro capillary blood circulation, which can beneficially influence the gastric ulcers. Ingestion of 120 ml of 33 % honey warm honey solution decreases the acidity of the gastric juice, while the ingestion of the same amount and concentration of a cold honey solution increased the acidity of the gastric juice. The sleep of the gastric ulcer patients was also improved by ingestion of 50 g honey before sleep. In order to decrease gastric juice acidity the author recommends the intake of warm honey solution 40 to 60 minutes before eating. The function of the gall bladder is improved by the ingestion of cool solution of 100 ml 50 % honey (13-15 °C). The author concludes that ingestion of warm honey ev. in combination with propolis ingestion, is a good way to treat gastric ulcers³⁴.

There are reports on healing of patients of suffering from gastritis, duodenitis and duodenal ulcers by intake of 30 ml of honey⁸⁴.

A clinical study of honey treatment in infantile gastroenteritis was reported by Haffejee and Moosa (27). They found that by replacing the glucose (111 mmol/l) in the standard electrolyte-containing oral rehydration solution recommended by the World Health Organisation/UNICEF as well as the solution of electrolyte composition 48 mmol/l sodium, 28 mmol/l potassium, 76 mmol/l chloride ions, with 50 ml/l honey (29), the mean recovery times of patients (aged 8 days to 11 years) were significantly reduced. Honey

was found to shorten the duration of diarrhoea in patients with bacterial gastroenteritis caused by organisms such as Salmonella, Shigella and E. coli. They recommended that honey was a safe substitute for glucose as long as it provided 111 mmol/l each of glucose and fructose. The high sugar content of honey means that it could be used to promote sodium and water absorption from the bowel⁴³.

Clinical and animal studies have shown that honey reduces the secretion of gastric acid. Additionally, gastric ulcers have been successfully treated by the use of honey as a dietary supplement. An 80% recovery rate of 600 gastric ulcer patients treated with oral administration of honey has been reported. Radiological examination showed that ulcers disappeared in 59% of patients receiving honey⁴⁹.

Animal experiments have shown that the administration of a honey solution via a tube in the stomach of rabbits prior to them being administered with 0.5 g ethanol per kg body weight, accelerated alcoholic oxidation. Honey administered subcutaneously or orally before oral administration of ethanol affords protection against gastric damage and reverses changes in pH induced by ethanol¹⁰.

A controlled clinical trial demonstrated the use of fructose in the treatment of acute alcoholic intoxication. A small but significant increase occurred in the rate of fall of blood-ethanol levels and it was concluded that fructose may be beneficial in shortening the duration of alcoholic intoxication²³.

In certain cases, consumption of relatively large amounts of honey (50 to 100 g) can lead to a mild laxative effect in individual with insufficient absorption of honey fructose⁵⁴. Fructose is less readily absorbed in the intestinal tract than fructose together with glucose⁸³. The mild laxative properties of honey are used for the treatment of constipation in Eastern Europe, China and the Near East. *However one should not give honey against constipation of infants younger than 1 year old because of the children botulism risk.*

Supplementation of honey in concentration of 2, 4, 6 and 8 g/100 g to protein fed to rats improved the protein and lipid digestibility⁸⁹.

The anti gastric ulcer and anti-gastritis effect of honey can be explained by its antibacterial and anti-inflammatory action, as well as with its inhibitory effect on the acidity of the gastric juice. The positive effect of honey on nutrition function is also due to its prebiotic effect.

CARDIOVASCULAR HEALTH

The effects of ingestion of 75 g of natural honey by humans compared to the same amount of artificial honey (fructose plus glucose) or glucose on plasma glucose, plasma insulin, cholesterol, triglycerides (TG), blood lipids, C-reactive proteins and homocysteine, most of them being risk factors for cardiovascular diseases were studied in humans. Elevation of insulin and C-reactive protein was significantly higher after dextrose than after honey.

Dextrose reduced cholesterol and low-density lipoprotein-cholesterol (LDL-C). Artificial honey slightly decreased cholesterol and LDL-C and elevated TG. Honey reduced cholesterol, LDL-C, and TG and slightly elevated high-density lipoprotein-cholesterol (HDL-C). In patients with hyperlipidemia, artificial honey increased LDL-C, while honey decreased LDL-C⁷.

A similar study has been recently carried out in normal and overweight persons carrying a higher risk for a cardiovascular disease. These patients were given 70 g honey for 30 days. Results showed that honey caused a mild reduction in body weight (1.3%) and body fat (1.1%). Honey reduced total cholesterol (3%), LDL-C (5.8), triacylglycerole (11%), FBG (4.2%), and CRP (3.2%), and increased HDL-C (3.3%) in subjects with normal values, while in patients with elevated variables, honey caused reduction in total cholesterol by 3.3%, LDL-C by 4.3%, triacylglycerole by 19%, and CRP by 3.3% ($p < 0.05$). The conclusion of the authors is that consumption of natural honey reduces cardiovascular risk factors, particularly in subjects with elevated risk factors, and it does not increase body weight in overweight or obese subjects¹⁰⁴. Honey decreases also platelet aggregation and blood coagulation¹

The above cited studies suggest small effects of honey on arteriosclerosis risk factors such as cholesterol, LDL-c and TG, the first studies being carried out with only 9 patients.

In a study with 30 persons and 30 controls it was shown that no significant decrease of cholesterol HDL and TG was encountered after ingestion of 75 g honey daily for a period of 14 days. While there were no effects in men, in women HDL values were increased in the controls having ingested sucrose, while in the honey group no increase was encountered, pointing out that honey has a positive effects in women⁶⁸

The effect of honey intake on the blood risk factors was tested in diabetes 2 patients (controls with no intake). Body weight, total cholesterol, low-density lipoprotein-cholesterol and triglyceride decreased, while and high-density lipoprotein-cholesterol ratio increased significantly¹⁵.

Honey can contain nitric oxide (NO) metabolites which are known cardiovascular disease risk indicators. Increased levels of nitric oxides in honey could have a protecting function in cardiovascular diseases. Total nitrite concentration in different biological fluids from humans, including saliva, plasma, and urine was measured after ingestion by humans of 80 g of honey. Salivary, plasma and urinary NO metabolites concentrations showed a tendency to increase^{11, 13}. Different honey types contained various concentrations of NO metabolites, darker or fresh honeys containing more NO metabolites than light or stored honey. After heating, NO metabolites decreased in all the kinds of honey^{11, 13}.

The cardiovascular effects of honey can be explained by its antioxidant and anti-inflammatory effects.

HONEY AGAINST COUGH

Small doses of honey, 1 to 2 tablespoons intake has been found to influence favourably cough^{31, 46, 100, 101} and also sleep¹⁰¹ of children.

The dose of honey used was ½ tsp for 2-5 year olds, 1 teaspoon for the 6 to 11 year-olds and 2 tsp for 12 to 18 year-olds. Buckwheat honey was chosen in this study because of its high antioxidant properties. The same study shows that honey is more effective than a chemical anti cough syrup⁷⁵

HONEY IMPROVES SLEEP

It has been claimed for a long time that honey influences beneficially human sleep, but there were no experiments to prove the claims.

Ingestion of one to two table spoons of buckwheat honey (10-20 g) by children of 6 to 18 years (6-11 years old- one table spoon, 12-18 years old 2 table spoons) improved also the sleep of coughing children^{75, 101}.

According to a theoretical model for the influence of honey on sleep honey stabilizes blood sugar levels and contributes to the release of melatonin, the hormone required for recovery and rebuilding of body tissues during rest⁵⁸

THE EXPERIENCE IN RUSSIA

Ludyansky, a chief doctor in a big Russian hospital, with life-long practice in apitherapy, has summarised the apitherapy knowledge in his monograph “Apitherapia” (in Russian)⁵⁶

Ludyanski summarises the medical uses of honey in his hospital in the following table:

Treated disease	Very good and good improvement	No improvement
Alopecia	11	5
Geriatry	59	-
Impotency	21	6
Inflammation of the vagina	21	5
Neurasthenia	60	-
Pediatrics	47	12
Prostatitis	24	5
Radiculitis	47	15
Stomatology	43	16

OTHER HEALTH ENHANCING EFFECTS

Influenza and common cold

An Iranian study claims that intake of 50 g of honey daily reduces the length of the common cold by two days⁸¹.

The Ukrainian doctors Frolov and Peresadin reported on a unique long term honey intake experiment. Frolov is the chair of the department of infectious diseases in the medical university of Luganska. All members of the department took 3 times a day, a total of 40-45 g of honey added to lukewarm tea. In the whole experiment 26 people took part in this unique experiment (n and number of years): n 5 for 20 y; n 6 for 15 y; n 8 for 10 y; n 5 for 5 to 10 y. During the whole experiment no other prophylactic was used. During the last 8 years of the experiment the department was in close contact with 40-60 patients with influenza and inflammation of the upper respiratory organs or with other infectious diseases like virus hepatitis, dysentery and even cholera. During the 20 year duration of the experiment no department member had any of the described diseases. In the immunological blood test it was found that the skin and the blood had an increased bactericidal activity, combined with very low microbial counts on the skin, while there were no pathogens in the whole area of the upper respiratory organs. And there was a control group to this experiment: a medical department, which was in close proximity of Frolov's test group, which had influenza or sore throat 3 to 4 times a year. This shows that a long term honey intake increases the anti-infectious immunity³⁹.

Hay fever

Another controversial possible application of honey is its use for preventing hay fever. Beekeepers claim that eating honey in the pre-vegetation season (i.e. during winter) will prevent or weaken hay fever symptoms. A report by Croft presented evidence that daily ingestion during winter time of 10-20 g of honey resulted in improvements of hay fever symptoms in 16 out of 21 patients²⁸. Münstedt and Kalder found a positive effect of honey ingestion by means of questionnaire filled out by 29 beekeepers⁶⁷.

A 2002 clinical trial did not confirm the positive effects of honey ingestions, but honey was taken during the hay fever season and not before it⁸².

As hay fever is increasing in developed countries this issue should be faced with more clinical trials, carried out in a correct way. More research is necessary to clarify this possible effect of honey.

Infertility

In a preliminary announcement at the 2nd International Conference on the Medicinal Use of Honey in 2010 there is a preliminary announcement that intracervical injection of honey in women with chronic endocervitis was of positive therapeutic value both in terms of clinical cure and fertility enhancement¹. At the same conference it was reported that honey has positive effect on the mechanical properties of the fetal membranes, may be through "collagen promoting action"².

Against alcohol abuse

Positive effects of honey on ethanol intoxication such as disappearance in blood increase and of ethanol elimination rate has also been confirmed in studies with humans^{70,71}.

Ingestion of both honey (2 g/kg body weight) and fructose, prevented the ethanol-induced transformation of erythrocytes of mice¹⁰⁵.

Hepatitis

A positive effect of honey on hepatitis A patients was found after ingestion of clover and rape honey, causing a decrease of alanine aminotransferase activity (by 9 to 13 times) and of bilirubin production by 2.1 to 2.6 times¹⁶.

Anaemia

Remy Chauvin reviews different early works carried out on 4-8 old infants. The dose given was one tea to one soup spoon in warm milk per day. The increase of blood haemoglobin was seen after one week of intake²⁶.

These clinical results are confirmed by experiments by Haydak et al. with rats, placed on a diet with milk and poor in iron. Only dark honeys, e.g. calluna, were capable of bringing blood haemoglobin values back to normal, while light honeys failed to do so⁴⁵

SPECIFIC HEALTH EFFECTS OF UNIFLORAL HONEYS



Due to different proportions of the possible sources, nectar and/or honeydew coming from a great variety of plants, no honey is completely the same as another one. This variability could be a handicap, given the market requirement for a consistent product, but when properly managed, it also could represent an opportunity for enhancing honey by offering to the consumer a number of typical products with special characteristics, according to the

particular botanical origin. Indeed, unifloral honeys are regarded as a more valuable class of honey, and botanical denominations are widely employed on the European market, often achieving higher prices than honey blends. Unifloral honeys have higher prices than blend honeys. In countries like France, Italy and Spain 30 to 50 % of the marketed honey is unifloral. In non-European countries, with the exception of the Manuka New Zealand honey, unifloral honeys have a smaller importance.

Information on European honeys is compiled in the special Apidologie Issue 35 from 2004. In Europe there are more than 100 plant species that can give origin to unifloral honey, most of them having only a local importance⁷⁶⁻⁷⁸

Most biological and clinical studies reviewed above have been made with undetermined types of honeys and there are very few studies where comparisons have been done with different unifloral honeys. Here the fields will be reviewed where such studies have been carried out.

Unifloral honey in folk medicine

Unifloral honey in practical apitherapy after²¹

Honey type	Applications
<i>Acacia</i> , liquid and mild;	Sweetener for people with Diabetes Type II. Improved digestions. Applied at diseases of stomach, intestines, liver and kidney
<i>Buckwheat</i> , dark and strong	High antioxidant activity, improves digestions, to be taken by pregnant women and when nursing
<i>Eucalyptus</i> , dark and strong	Against infections and diseases of respiratory organs and urinary passages. Increases immunity
<i>Calluna</i> , dark and strong	High antioxidant activity. Invigorating at fatigue and convalescence; against problems with kidney urinary bladder
<i>Chestnut</i> , dark and strong	Improves blood circulation; against anemia and infactions of kidney urinary bladder
<i>Clover</i> , light und mild	sedative
<i>Lavendel</i> , aromatic	Treatment of wounds, burns, insect stings, infections or respiratory organs and depressions
<i>Linden</i> , strong, aromatic	Diaphoretic, diuretic, palliative, apetising; against cold, flu, cough, sinusitis, headache, sleeplessness and anxiety.
<i>Manuka</i> , Dark and strong	High antibacterial activity, against infections and for wound healing
<i>Dandelion</i> , aromatic	Hemo-protective, against gastric, intestine, liver, kidney and gall bladder diseases
<i>Citrus</i> , light and mild	Against indigestion and sleeplessness
<i>Rape</i> , mild	Sedative, relaxing
<i>Rosmarine</i> , mild	Hemo-protective; against gastric, intestine, liver diseases
<i>Sunflower</i> , mild	spasmolytic in asthma cases, gastric, intestine colic
<i>Fir, honeydew</i> , dark and strong	High antioxidant activity. Against infections of respiratory organs
<i>Thyme</i> . dark and strong	Against infections of respiratory organs; wound treatment

Unifloral honeys are used in folk medicine for different purposes. The applications given in the table below remain to be confirmed by experimental science. Indeed, in most scientifically conducted clinical studies the botanical origin of the honey was not determined. On the other hand, the antibacterial and the antioxidant activity of honey depends strongly on the botanical origin. Health enhancing effects of different unifloral honey have been claimed in different practical apitherapy books, e.g. ^{32, 89, 100}. The table below has been compiled from them. At present there is no scientific explanation of many of the claimed effects.

HOW TO EXPLAIN THE USE OF HONEY IN MEDICINE

Therapeutic and health enhancing use	Biological rationale
Therapy of digestive diseases like peptic ulcers and gastritis	Antibacterial and anti-inflammatory effects
Against children diarrhoea	Antibacterial and anti-inflammatory effects
Improvement of gut microbial health and of digestion	Prebiotic effect
Improvement of immune reaction of the body	Immunoactivating effect
Regular intake improves cardiovascular health	Lowering of blood risk factors and specific heart conditions as extracystoles, arrhythmia and tachicardia
Long term ingestion of honey can reduce the risk of human cancer	Anticancerogenic effects
Positive glycemic nutritional effect. Can be used as a sweetener of people with diabetes type II and also probably type I	Some honeys have a low glycemic index: e.g. acacia honey. Other fructose rich honeys such as thyme, chestnut, heather and tupelo are good alternatives.
Use for the treatment of radiation-induced mucositis	Antibacterial and anti-inflammatory effects
Positive effect of honey ingestion on hepatitis A patients	Anti-inflammatory effect
Improvement of cough in children	Contact soothing effect, sweet substances, as a sweetener honey causes reflex salivation and increases airway secretions which may lubricate the airway and remove the trigger that causes a dry, nonproductive cough.

EVENTUAL HEALTH HAZARDS

See Chapter 8, Honey as nutrient and functional food.

QUANTITY AND TIME OF HONEY INGESTION

The health enhancing effects in human adults, described in this report were mostly achieved after ingestion of 50 to 80 g of honey per day.

The health claims of honey which are reported below are valid for intakes of following amounts of honey:

- *Adults: after ingestion of 50 to 80 g per day by adults,*
- *General (adults or infants): 0.8 g to 1.2 g honey per g human weight*

The duration of honey ingestion for increase of physical performance and fitness

is very fast, and takes place already 1 to 4 hours after intake.

The health effects reported in the different publications reported above were measured mostly after 2 to 3 weeks of daily honey ingestion. Practical apitherapists suggest for health enhancing effects a daily honey ingestion for 1.5 to 2 months ^{65, 89}.

The normal daily allowance for carbohydrate sweeteners is 25 grams. Considering that the recommended amount of honey is quite high, intake of other sweeteners should be avoided. A normal intake of about 20-25 g per day will rather have a long term health enhancing effect.

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