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# Medicinal Properties of Honey: A Review

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## ABSTRACT

*Honey has a long history of human consumption, and is used in various foods and beverages as a sweetener and flavoring. It also has a role in religion and symbolism. Flavors of honey vary based on the nectar source, and various types and grades of honey are available. It is also used in various medicinal traditions to treat ailments. The health effects of honey have long been noted by humans. The nutritional and medicinal qualities of honey have been documented in Vedic, Greek, Roman, Christian, Islamic and other texts. Physicians of ancient times, such as Aristotle (384–322 BC), Aristoxenus (320 BC) Hippocrates, Porphyry, Cornelius Celsus (early first century AD) and Dioscorides (c. 50 AD), and Arab physicians have referred to the healing qualities of honey. Honey contains powerful antioxidants with antiseptic and antibacterial properties.*

***Key words:*** *Honey, Anti-microbial, Antibacterial, Wound healing.*

## INTRODUCTION

Honey is a sweet food made by bees using nectar from flowers. Honey bees transform nectar into honey by a process of regurgitation and evaporation. They store it as a primary food source in wax honeycombs inside the beehive. Honey gets its sweetness from the monosaccharide's, fructose, and glucose, and has approximately the same relative sweetness as that of granulated sugar. It has attractive chemical properties for baking, and a distinctive flavor that leads some people to prefer it over sugar and other sweeteners. Honey has a long history of human consumption, and is used in various foods and beverages as a sweetener and flavoring. It also has a role in religion and symbolism. Flavors of honey vary based on the nectar source, and various types and grades of honey are available. It is also used in various medicinal traditions to treat ailments. The health effects of honey have long been noted by humans. The nutritional and medicinal qualities of honey have been documented in Vedic, Greek, Roman, Christian, Islamic and other texts. Physicians of ancient times, such as Aristotle (384–322 BC), Aristoxenus (320 BC) Hippocrates, Porphyry, Cornelius Celsus (early first century AD) and Dioscorides (c. 50 AD), and Arab physicians have referred to the healing qualities of honey. Honey contains powerful antioxidants with antiseptic and antibacterial properties.

In the earliest Hindu Vedic texts, honey and its evolution are described elaborately. It is used as a metaphor to describe the Sun as honeycomb. The honeybees incubate in the cells to form honey, which is called "the nectar of the Sun" [1].

Another metaphor states that the four Vedas, the Hindu scriptures, are represented by the honeycomb which is stated to be "sweet, beautiful, golden like the Sun". It is also described as a "blend of all the Nectars of many flowers." The knowledge of honey represents "oneness of everything." In Hindu rituals, honey is one of the five ingredients of Panchamrit "the five Nectars", the other four are the ghee, milk, sugar and buttermilk[2].

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Honey has been used in Ayurveda medicine in India for at least 4000 years and is considered to affect positively in all three primitive material imbalances of the body. In the Ayurvedic system of medicine, within specific bee species, curative honey is categorized under eight distinct types. Overall, more than 634 remedies with honey as an ingredient have been propounded to tackle a wide range of health problems and many of them are said to be of complex formulation.

Honey has also been used by humans since pre-Ancient Egyptian timesto treat a variety of ailments through topical application, but only recently have the antiseptic and antibacterial properties of honey been chemically explained. Ancient Egyptian physicians used honey in medicinal compounds 5,000 years ago and the ancient Greeks believed that honey could promote virility and longevity. Honey has been used in Traditional Chinese Medicine for thousands of years and is still important today. Ancient Russian manuscripts attributed great importance to honey as a medicine.

In ancient Islamic literature, honey bees have been extolled for their "intelligence, industry and creativity." The Quran mentions it as medicine to cure human illness. It says "And thy Lord taught the Bee to build its cells in hills, on trees, and in (men's) habitations; Then to eat of all the produce (of the earth), and find with skill the spacious paths of its Lord: there issues from within their bodies a drink of varying colors, wherein is healing for men: verily in this is a Sign for those who give thought" [Al-Quran 16:68-69]. Prophet Mohammad himself spoke of the healing power of honey as a cure for all mental illness.In the later part of the 12th century, a Muslim physician described the healing powers of honey to disperse body fluids, soothing the bowels, curing dropsy, checking facial twitches, improving appetite, preventing the breakdown of muscles and preserving them. In 1000 BC, it was a Saxonherbal treatment for wounds, sties and amputated limbs. In 1446, it was used as a therapeutic drug, in combination with alum, to treat ulcers. And in 1623, it was used as an antiseptic and a mouthwash. The use of honey as a therapeutic cure in various combinations was popularized in Medieval Europe, in particularly in England, Germany, Finland, and Ireland. It was also extended to Ghana, USA, Nepal, Nigeria, Russia, and Brazil.

It was a gourmet medicine during the Second Balkan War in 1913, healing the wounds of soldiers. Honey from several species of sting-less bees was consumed to cure flu, to cure cataract, glaucoma and cough. In modern times, its use as a healing agent is equally popular. In 2007, in the *Manchester Evening News* in England, the use of “manuka honey” in a large hospital in New Zealand to control methicillin-resistant *Staphylococcus aureus* (MRSA) and other bacterial infections was noted; its antibacterial property to kill or inhibit is supported by many scientific studies in recent years[3].

**Medicinal Properties of Honey**

Scientists have revealed that honey has powerful anti-bacterial properties on at least sixty species of bacteria, and unlike antibiotics, which are often useless against certain types of bacteria, honey is non-toxic and has strong effects.The benefits of honey have been extolled since ancient times by many religious faiths and recorded in ancient scriptures.

The composition of honey includes sugars such as glucose and fructose and also minerals such as magnesium, potassium, calcium, sodium chlorine, sulphur, iron and phosphate. Depending on the quality of the nectar and pollen, the vitamins contained in honey are B1, B2, C, B6, B5 and B3. The pH of honey is commonly between 3.2 and 4.5. This relatively acidic pH level prevents the growth of many bacteria.

Honey is primarily a saturated mixture of two monosaccharides. This mixture has a low water activity. Most of the water molecules are associated with the sugars and few remain available for microorganisms, so it is a poor environment for their growth. If water is mixed with honey, it loses its low water activity, and therefore, no longer possesses this antimicrobial property.

Medicinal benefits are broadly categorized under the following headings.

1. **Antimicrobial activity of honey**

**A. Mechanism of action**

Honey has been demonstrated in many studies to have antibacterial effects, attributed to its high osmolarity, low pH, hydrogen peroxide content and content of other, uncharacterized compounds.

The low water activity of honey is inhibitory to the growth of the majority of bacteria, many yeasts and moulds. When applied topically to wounds, osmosis would be expected to draw water from the wound into the honey, helping to dry the infected tissue and reduce bacterial growth. Even when diluted with water absorbed from wounds, honeys would be likely to retain a water activity sufficiently low to inhibit growth of most bacteria.

*Staphylococcus aureus*is one bacterium that is tolerant of low water activities, being observed to grow when water activity is as low as 0.86. It has been found to survive treatment on infected skin treated with concentrated solutions of pure sugars, but to be sensitive to the other antibacterial components of honey of the same water activity[4].

Honey is mildly acidic, with a pH between 3.2 and 4.5. Gluconic acid is formed in honey when bees secrete the enzyme glucose oxidase, which catalyses the oxidation of glucose to gluconic acid. The low pH alone is inhibitory to many pathogenic bacteria and, in topical applications at least, could be sufficient to exert an inhibitory effect. When consumed orally, the honey would be so diluted by body fluids that any effect of low pH is likely to be lost[5].

Hydrogen peroxide was identified as the major source of antibacterial activity in honey in 1963 by White, Hubers & Schepartz. Hydrogen peroxide is produced by the action of glucose oxidase on glucose, also producing gluconic acid. Glucose oxidase operates most effectively when honey is diluted. When honey is undiluted, the gluconic acid produced lowers the pH to a point where it inhibits further enzymatic activity, and hence further peroxide production. Excessive heat (>50$^{o}$C) may also reduce glucose oxidase activity[6].

There are a range of other, largely uncharacterized, substances present in some honeys that have antibacterial effects. Some compounds that have been identified include syringic acid (3.5-dimethoxy-4-hydroxybenzoic acid), methyl syringate, 3,4,5-trimethoxybenzoic acid, 2- hydroxy-3-phenylpropionic acid and the flavonoid pinocembrin. Wootton et al identified a range of volatile substances in Australian honeys although their report does not note whether or not these substances are believed to contribute to honey's antibacterial activity. Volatiles identified included acetoin, acetone, acetic acid, furfural, valeric acid, ethyl salicylate, benzyl alcohol and hydroxymethyl furfural[7].

Tan et al demonstrated by gas chromatography that manuka honey contained an array of acidic and phenolic substances, the most dominant being 2-hydroxy-3-phenylpropionic acid[8].

### B. Measurement of antimicrobial activity

The antimicrobial activity of honey has been measured most commonly by the use of agar well diffusion techniques. This technique takes large plates of agar mixed with cultures of particular bacteria, *Staphylococcus aureus* being the most commonly used. Wells are cut into the agar and solutions of the test material applied. Solutions of varying concentrations of known antibacterial agents, commonly phenol, can be used for comparison. The diameter of the zone of bacterial growth inhibition is measured after incubation of the plates.

### C. *In vitro* studies of antimicrobial activity

Allen, Molan & Reid conducted a major study of the antibacterial activity of NewZealand honeys, categorized according to their floral source. The mean antibacterial activity of undiluted honey was found to be equivalent to a 14% solution of phenol in water. There was a tremendous range of activities observed, however, depending on the floral source. Some honeys had no detectable antibacterial activity, while others had activities up to the equivalent of 42% phenol. For most honeys tested, destruction of peroxide-generating ability by the use of catalase was associated with loss of antibacterial activity. Honey derived from manuka (*Leptospermum scoparium*) and vipers bugloss (*Echiumvulgare*) were the only honeys tested that retained significant antibacterial activity.[2]

Further *in vitro* research on manuka honey by the group of NZ workers highlighted the pathogen-specific effects of different types of honey. Differentconcentrations of honeys were incubated aerobically with a range of pathogens to determinethe minimum concentration required for 100% growth inhibition over an 8 hour period at 37 $^{o}$C. For some pathogens (eg *S. aureus, E. coli*), manuka honey was considerably

moreeffective at inhibiting growth than other honeys. Complete inhibition of growth of *S. aureus* was achieved at a manuka honey concentration of 1.8% v/v compared to 4.9% for other honeys. The opposite finding was observed for complete inhibition of *Proteus mirabilis*, where a concentration of 7.3% v/v manuka honey was required, compared to 3.3% for other honeys. Despite the differences observed with different pathogens and honey types, the study demonstrated that a range of honeys have bacteriostatic effects at concentrations likely to beachieved when honey is applied topically to wounds[9].

The same group of researchers has also studied the inhibitory action, *in vitro*, of manukahoney against *Helicobacter pylori*, the bacterium believed causative of human gastric ulcers.

Using techniques described previously, Somal et al found that the growth of a range ofisolates of *H. pylori* was inhibited by a 5% v/v concentration of manuka honey[10].

Ali et al also studied *in vitro* inhibition of *H. pylori* growth in the presence of honey ofunstated origin. They found that a honey concentration of 20% was sufficient to inhibitgrowth of a range of clinical isolates[1].

The antibacterial effect of a number of Sudanese honeys was studied by Farouk et al and compared to that of five antibiotics (30g/ml) ampicillin, cephradine, chloramphenicol, gentamicin and oxytetracycline. Undiluted honey (0.2 ml) was testedagainst the pathogens *Bacillus subtilis, S. aureus, E. coli, Klebsiella aerogenes* and *Pseudomonas aeruginosa*. All honeys tested were inhibitory against all these bacteria butgentamicin was the only antibiotic effective against *P.aeruginosa*. The other antibiotics weremore effective at inhibiting bacterial growth than were the honeys, measured in terms of thezone of inhibition on agar plates. For example, antibiotics had a zone of inhibition against*B. subtilis* of 16.8 – 26.5 mm compared to a range of 14.7 – 19.0 mm for honeys[11].

Enteropathogens common in Nigeria were tested for *in vitro* sensitivity to honey in research by Obi et al Filter paper disks impregnated with honey of varying concentrationswere placed on agar plate'sinoculated with clinically-isolated strains of a range of pathogens including *Salmonella typhi, Vibrio cholera* and *Yersinia enterocolitica*. The diameter of the zone of inhibition was measured. Honey concentrations of 40% and above reduced bacterialgrowth, with undiluted honey having the greatest effect. Concentrations of 30% and lowerdid not inhibit pathogen growth[12].

**2. Efficacy studies - animals**

**A. Animal studies of honey and surface wound healing**

Twenty-four male mice underwent skin excision (10x10 mm) from the nape of the neck, tothe depth immediately above the first layer of muscle, in a study by Bergman et al.Half the animals had pure honey applied in a thin layer to the wounds, twice daily, while thecontrol group had saline applied at the same frequency and time of day. Four animals from10each group was killed at 3, 6 and 9 days after wounding and the damaged tissue excisedcompletely. Depth and quality of granulation tissue was determined microscopically and thedegree of epithelisation measured as the distance from the skin border to the wound centre.

The honey-treated tissue underwent more rapid and more extensive epithelisation than did thesaline-treated control. After 3 days, the honey-treated tissue had 58% more skin growth($P<0.001$), after 6 days it had 114% more ($P<0.001$) and after 9 days, 12% more ($P<0.01$)than the controls. Honey-treated mice had a greater thickness of granulation tissue in the Centre of the wounds ($P<0.001$) compared to the control mice. No bacterial infections weredetected in any of the wounds, which may reflect hygienic standards in the original surgicalprocedure. This experimental model therefore may not be representative of wound healing ininfected tissue[13].

Gupta studied the effect of topical natural honey on the healing of infected skinwounds in buffalo calves, and compared this effectiveness to that of ampicillin ointment, andampicillin mixed with honey. Wound production being well-defined, a large number of wounds being studied (90) and histological observation being undertaken, the report suffers from a major defect in that no tabulatedresults are provided. The authors present only three photographs as evidence in support oftheir conclusions. The authors claim that honey was significantly more effective than ampicillin (2.5% ampicillin sodium in petroleum jelly) or

2.5% ampicillin sodium in honey inaccelerating wound healing. The amount of ointments applied was not stated. The authorsreport that honey-treated wounds showed less neutrophilic infiltration and more formation of angioblasts and fibroblasts. Without presentation of numerical results it is difficult to assignmuch weight to this paper, beyond the anecdotal[14].

Deep skin burns were applied in twelve places on the flanks of three pigs in a study by Postmes that compared the efficacy of honey to sugar solutions, both of very similar carbohydrate composition and concentration, and silver sulfadiazine (1% cream) inhealing burn tissue. Burn tissue was examined histologically on days 7, 14, 21, 28, 35 and 42 post-burn. Honey and sugar both produced more rapid healing than did silver sulfadiazine,with wounds closing within 21 days for honey and sugar, but requiring 28-35 days for silversulfadiazine. Burns treated with sugar solution produced thicker new skin (mean 7.1 mmafter 28 days), with evidence of inflammation, than was found on the burns treated withhoney, which showed little inflammation (mean dermal thickness after 28 days: 5.1 mm).

The mechanism by which honey produced a more rapid and effective healing than eithersugar or silver sulfadiazine was not identified, although tissue treated with sugar showed more myofibroblasts than did the honey-treated tissue[15].

**B. Honey and gastric ulcers**

Acetyl salicylic acid (50 mg/kg body weight) was used to induce gastric ulcers in 60 rats in a study by Kandil et al. Twenty four hours after administration of acetyl salicylic acid,0.5 ml of either floral honey, honey produced by bees feeding on sugar, or saline wasadministered to each rat for 3 days. The dose of test substance would be approximately equalto 4 g/kg bodyweight. Rats were then sacrificed and the number of gastric ulcers estimated.80% of rats consuming floral honey were classed as healed, compared to only 47% of ratsconsuming sugar honey. This study had some major deficiencies, such as failure to describethe effect of honey consumption on other food intake, the absence of a definition of “healed”and poor data reporting (eg the results reporting only the number of ulcers rather than the sizeof ulcers)[16].

**3. Efficacy studies – human**

**A. Traditional medicinal uses**

Honey has a long history of use as a medicinal substance. It was used by the ancient Greeks and Sumerians. In ancient Egypt it was used as a wound treatment, mixed with grease and fibre, and for gut conditions. Hippocrates recommended honey and vinegar forpain, water and honey for thirst and a mixture of honey, water and other substances to treat acute fevers, as well as recomending its use to treat ulcers. The Bible mentions the use of honey in eye problems.

Its use is referred to in the Koran, which specifically refers to its role intreating diarrhea.

In Ayurvedic medicine, honey is described as thenectar of life and its use is recommended for various conditions. Russian soldiers in World War 1 used it, apparently successfully, for wound healing purposes. Honey, lime leaves and palm kernel are traditional medicines forwound healing in Ghana and among the Bambara of Mali, honey is atraditional treatment for measles, both via the oral route and as an eye ointment.

Beck & Smedley summarized the traditional uses of honey as follows: “… its mainemployment was as a helpful remedy for gastric and intestinal disorders, especially as apleasant laxative. Respiratory troubles were next in order. The sedative and soporific powerof honey is often emphasized. The diuretic effect of honey was well known and it was a favored remedy for all kinds of inflammation of the kidneys, for gravel and for stones. The antiseptic property of honey made it a desirable gargle, expectorant and valuable adjunct inmouth hygiene. In inflammation of the eyes and eyelids honey was extensively used. Insurgical dressings and skin diseases it was a remedy of first choice. The smallpox patients were anointed with honey. It was also employed as a vehicle for nauseous or bitter medicines”[17].

**B. Clinical trials - wound healing**

The Indian researcher Subrahmanyam conducted a number of studies of the topical use ofhoney to treat burns. In all studies, patients had partial thickness burns to less than 40% oftheir body surface area. In 1991, he reported on a trial comparing honey with silversulfadiazine (SSD) with a total of 104 patients

randomly allocated to receive one of the two treatments. After the burns were washed with saline, half the patients were treated with 15 –30 ml honey spread over the wound each day, the amount applied depending on the size ofthe burn. The burn was then covered with dry, sterile gauze. Remaining patients were treated with gauze impregnated with SSD, the gauze being replaced daily. Age, sex andinjury characteristics of both groups were similar. Among patients treated with honey, healthy granulation tissue appeared at a mean of 7.4 days, compared to 13.4 days for SSDpatients. Wounds healed more rapidly in the honey group (33/52 patients within 10 days andall within 40 days) compared to the SSD group (35/52 patients within 30 days and all within60 days). Four honey-treated patients showed infection at the burn site after 7 days oftreatment, compared to 38 of the SSD patients[18].

Amniotic membrane, prepared from fresh caesarian or vaginal deliveries, was used in another of Subrahmanyam's trials of the use of topical honey to treat partial thickness burns. Sixtyfour patients were randomized to receive either honey-impregnated gauze every 2 days untilhealed (40 patients), or to have their burn covered with amniotic membrane (24 patients).Patient characteristics were similar in the two groups. The burns treated with honey healedfaster compared to those treated with amniotic membrane (9.4 vs 17.5 days, $P<0.001$) with less scarring (8% vs 17%, $P<0.001$)[19].

The same author Subrahmanyam conducted a similar trial comparing honey to boiled potato peel for the treatment of partial thickness burns. According to the author, potato peelsare commonly used as burn dressings in developing countries. Fifty patients were randomly allocated to each treatment group, within 6 hours of the occurrence of the burn and afterwashing the burn with normal saline. Depending on the burn size, between 15 – 30 mlhoney was applied every 2 days and the wound covered with sterile dry gauze. All woundswere observed until healing was complete. The characteristics of the two groups werereported and did not differ substantially in age, mechanism of injury or burn area. Burnshealed more quickly in the honey-treated group (mean 10.4 days vs 16.2 days) ($P<0.001$) andgranulation tissue appeared sooner (mean 6.8 days vs 9.2 days). Among honey-treatedpatients, only 4 had pathogens in the wound after 7 days compared to 42 in the potato peelgroup[20].

Subrahmanyam reported another study comparing topical honey with topical SSD inthe treatment of burns. After saline washing within 6 hours of the burn occurring, 50 patientsreceived either 16-30 ml unprocessed honey every 2 days or a covering of gauzeimpregnated with SSD, replaced daily. Characteristics of the treatment groups did not differsubstantially and patients had a mean burn area of 15% of the body surface. Satisfactoryepithelisation was achieved within 7 days in 84% for honey-treated patients and within 10days for all, compared to 72% and 84% respectively for SSD. Histological examination oftissue showed that the honey-treated tissue underwent earlier subsidence of acute inflammation[21].

**C. Clinical observations - wound healing**

There have been a number of reports on the clinical use of honey to treat skin wounds. Thesestudies are not double-blinded, placebo-controlled studies. Nevertheless they provide anoverview of the ways in which honey has been used successfully in humans. Much of thiswork has been conducted in developing countries, where the low cost of honey treatment is amajor incentive for its use.

Topical application of honey has been used successfully to treat infected wounds resulting from radical vulvectomy due to carcinoma of the vulva. Cavanagh et al used household honey (floral source not stated) in 12 patients who developed infected wounds following surgery. Undiluted honey was poured into the wound twice daily and the wound covered loosely with gauze. Wound cultures were taken from the wound at time of tissue breakdown, and at subsequent time intervals. Contaminating bacteria included *Proteusmirabilis, Pseudomonas aeruginosa, Escherichia coli, Enterobacter*species, *Streptococcusfaecalis, Staphylococcus aureas*and *Clostridium perfringens*. All wounds were found to befree of bacteria within 3 to 6 days of treatment. Complete healing occurred within 8 weeks for all patients and within 3 weeks for one patient. While the study did not use controlpatients for comparison purposes, the author notes that the wound from radical vulvectomy is known to present problems with healing, often requiring skin grafts. Two adverse effects were noted with this treatment.

Infection with the yeast *Candida* near the edge of the wounds, where the concentration of honey was reduced, was noted in 3 patients. Excessiveuse of honey overly-dehydrated the wounds, which could be remedied by the use of saline packs at night[22].

In two African studies honey was used successfully to treat ulcers, woundsand Fournier's gangrene (gangrene of the scrotal area). In the first of thesestudies, 59 patients (47 male, 12 female, aged 2 months to 78 years) with various wounds andulcers (including Fournier's gangrene, burns, tropical, diabetic and traumatic ulcers, cancrumoris, cancerous sores and bed sores) were treated with topical honey application. Most of thepatients' ulcers and wounds had failed to respond adequately to conventional treatmentincluding antibiotics in some cases. With one exception, all non-cancerous ulcers respondedto a treatment regime of washing with saline and the topical application of 15-30 ml honeydaily. Pathogens isolated at the commencement of the study included *Pseudomonaspyocyanea* (35 cases), *Escherichia coli* (31), *Staphylococcus aureus* (15), *Proteus mirabilis* (9), coliforms (9), *Klebsiella*species (7), *Streptococcus faecalis* (3) and *Streptococcuspyogenes* (1).

In all successful cases, no pathogens were detected when cultures were takenafter 1 week of treatment. In the case of the non-responding patient, *Mycobacterium ulcerans* was isolated from the wound and intravenous antibiotic therapy commenced. Patients withmalignant ulcers underwent surgical treatment once a diagnosis of malignancy was reached.

In the study of Fournier's gangrene, 20 cases treated with topical honey (15 – 30ml, dose frequency not stated) combined with oral amoxicillin and metronidazole, werecompared to 21 cases that underwent surgical management of the infection together with various oral antibiotics. Patients were not matched for age or for other complicating conditions, therefore reducing the value of the study but nevertheless providing interesting results. Both groups of patients had comparable hospitalization times, but three of the group treated surgically died, with no deaths in the honey group[23].

Thirty three Burundian patients with wounds of diverse origin were treated by daily topical honey application. The wounds were first washed with saline on day1 and then covered with a dry sterile dressing. The initial mean wound size in these patients was 57 $cm^2$ and healing was successful within 5 – 6 weeks in 29 cases. Where necessary,additional treatments such as the removal of necrotic tissue were administered. Burns werereported to respond more rapidly to honey treatment than did infected wounds, although data were not provided to support this claim[24].

In contrast to these studies, a small (10 patients, 11 ulcers) NZ trial of honey in the treatment of leg ulcers provided equivocal results. Patients (median age 61.5 years) with predominantly varicose ulcers of duration approximately one year, and average ulcer size of 9 $cm^2$, had honey applied once daily for 8 weeks. The ulcers were covered with gauze after honey was applied. There was little change in the bacterial flora other than a slight reduction in coliforms (not quantified in the paper). Four ulcers showed healing over morethan 25% of their surface area, six ulcers did not change and one worsened. Two patients withdrew after 5 weeks due to the presence of infections[25].

**D. Clinical observations - gastrointestinal conditions**

Two tablespoons of honey (30 ml) given before meals three times daily was used to treatmale and female patients (20 – 40 years) suffering from gastritis, duodenitis and duodenalulcers. The study, by Salem was poorly designed and reported and of little value beyond the anecdotal. Although a placebo was used (composition not stated), there was no comparison of results between the two groups. The author claimed that two-thirds of patients recovered following treatment that the haemoglobin levels of most patients increased and that faecal blood loss decreased. Salem also notes that he has used honey in the form ofenemas to treat ulcerative proctitis[26].

## CONCLUSION

The establishment by research that there are bioactive components in honey, and the wide dissemination of this knowledge, has led to a general acceptance that honey is a respectable therapeutic agent, and to a rapidly increasing uptake of its usage by clinicians as well as by the general public. The finding that there are multiple bioactive components involved in the therapeutic action makes it a much more attractive option to use the natural product rather than to attempt to identify individual active components and use synthesized copies of those.

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