



# Honey as nutrient and functional food

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## Nutrient And Functional Food

- Recent years have seen growing interest on the part of consumers, the food industry, and researchers into food and the ways in which it may help maintain human health.
- The important role that diet plays in preventing and treating illness is widely accepted.



The classical concept of nutrition :

“adequate nutrition,” that is, a diet that provides nutrients (carbohydrates, proteins, fats, vitamins, and minerals) in sufficient quantities to satisfy particular organic needs

“optimal nutrition,” which includes, besides the above, the potential of food to **promote health, improve general well-being, and reduce the risk of developing certain illnesses.** This is where functional foods, also known as nutraceuticals, designed foods, therapeutic foods, super foods, or medicinal foods, play their part.



# Honey

Honey bees are the only insects that produce a food consumed by humans.

Natural Honey (NH) is a liquid spoken of by all religious books, and accepted by all generations, traditions and civilizations, both ancient and modern.



# Honey Composition

- Honey is a source of carbohydrates — mainly fructose (about 38.5 percent) and glucose (about 31.0 percent). The remaining carbohydrates include maltose, sucrose and other complex carbohydrates. On average, honey is 17.1 percent water.
- Honey can contain up to 18 of the 20 amino acids. However, amino acid content is almost negligible in honey, accounting for only 0.05–0.1% of the composition. The main acid is proline.
- In addition, honey contains a wide array of vitamins, such as vitamin B6, thiamin, niacin, riboflavin and pantothenic acid.
- Essential minerals including calcium, copper, iron, magnesium, manganese, phosphorus, potassium, sodium and zinc.



Minerals	Amount (mg/100 g)	Vitamins	Amount (mg/100 g)
Sodium (Na)	1.6 – 17	Thiamine (B <sub>1</sub> )	0.00 – 0.01
Calcium (Ca)	3 – 31	Riboflavin (B <sub>2</sub> )	0.01 – 0.02
Potassium (K)	40 – 3500	Niacin (B <sub>3</sub> )	0.10 – 0.20
Magnesium (Mg)	0.7 – 13	Pantothenic acid (B <sub>5</sub> )	0.02 – 0.11
Phosphorus (P)	2 – 15	Pyridoxine (B <sub>6</sub> )	0.01 – 0.32
Selenium (Se)	0.002 – 0.01	Folic acid (B <sub>9</sub> )	0.002 – 0.01
Copper (Cu) <sup>a</sup>	0.02 – 0.6	Ascorbic acid (C)	2.2 – 2.5
Iron (Fe) <sup>a</sup>	0.03 – 4	Phyllochinon (K)	0.025
Manganese (Mn) <sup>a</sup>	0.02 – 2		
Chromium (Cr) <sup>a</sup>	0.01 – 0.3		
Zinc (Zn) <sup>a</sup>	0.05 – 2		



<sup>a</sup> Heavy metals.

- Clinical studies have shown that pure [honey](#) is a healthier choice for diabetics than sugar and other sweeteners. This is because -
- Honey has a **lower glycaemic Index (GI)** i.e. it does not raise blood sugar levels as quickly as sugar.
- Additionally, it also requires **lower levels of [insulin](#)** compared to regular white sugar to metabolize.

The trouble is, fructose is absorbed differently than other sugars. It is not utilized for energy like glucose, but stored in the liver as triglycerides. This presents a great metabolism burden on the liver and can eventually lead to major health problems.



Honey has been used as an alternative treatment for clinical conditions ranging from G.I problems to ophthalmologic disorders. More recently, honey has been examined for its potential to treat chronic conditions including risk factors for heart disease and seasonal allergies. Research into these areas is preliminary but potentially promising.





# Medicinal properties of honey

- **OSMOTIC EFFECT:** Honey is a supersaturated sugar solution of fructose and glucose, The interaction of the sugar molecules with water molecules leaves very little water available to support the growth of microorganisms.
- **ACIDITY:** The average pH of honey is 3.9, but can range from 3.4 to 6.1. Honey contains many kinds of acids. These acids may be aromatic or aliphatic (non-aromatic). The aliphatic acids contribute greatly to the flavor of honey by interacting with the flavors of other ingredients. The aromatic acids, such as malic acid, come mostly from the flowers, adding to the aroma and taste of the honey.

The acidity of honey is low enough to inhibit the growth of many pathogens.

- **HYDROGEN PEROXIDE:** It is the major antibacterial compound in honey. Bees secrete the enzyme glucose oxidase from nectar. It converts glucose in the presence of water and oxygen to glucuronic acid and hydrogen peroxide.



Asian Pac J Trop Biomed. 2011 Apr; 1(2): 154–160.  
doi: [10.1016/S2221-1691\(11\)60018-6](https://doi.org/10.1016/S2221-1691(11)60018-6)

PMCID: PMC3609166

## Honey: its medicinal property and antibacterial activity

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This article has been [cited by](#) other articles in PMC.

### Abstract

Go to: 

Indeed, medicinal importance of honey has been documented in the world's oldest medical literatures, and since the ancient times, it has been known to possess antimicrobial property as well as wound-healing activity. The healing property of honey is due to the fact that it offers antibacterial activity, maintains a moist wound condition, and its high viscosity helps to provide a protective barrier to prevent infection. Its immunomodulatory property is

- **SPEEDY CLEARANCE OF INFECTION:** Honey is effective in the treatment of wounds infected with antibiotic resistant bacteria – Methicillin-resistant Staphylococcus aureus ([MRSA](#)) and wounds infected with multi-resistant bacteria.
- **CLEANSING ACTION ON WOUNDS:** Honey has a debridement effect on wounds (removal of damaged tissue from a wound) so that surgical debridement is unnecessary or only a minimum required.
- **STIMULATION OF TISSUE REGENERATION:** Honey promotes the formation of clean healthy granulation tissue and growth of epithelium over the wound, thus helping skin regenerate. It has also been reported that dressing wounds with honey gives little or no scarring.



[Wounds](#), 2015 Jun;27(6):141-51.

**Honey: A Biologic Wound Dressing.**

[Molan P](#)<sup>1</sup>, [Rhodes T](#)<sup>2</sup>.

[⊕ Author information](#)

**Abstract**

Honey has been used as a wound dressing for thousands of years, but only in more recent times has a scientific explanation become available for its effectiveness. It is now realized that honey is a biologic wound dressing with multiple bioactivities that work in concert to expedite the healing process. The physical properties of honey also expedite the healing process: its acidity increases the release of oxygen from hemoglobin thereby making the wound environment less favorable for the activity of destructive proteases, and the high osmolarity of honey draws fluid out of the wound bed to create an outflow of lymph as occurs with negative pressure wound therapy. Honey has a broad-spectrum antibacterial activity, but there is much variation in potency between different honeys. There are 2 types of antibacterial activity. In most honeys the activity is due to hydrogen peroxide, but much of this is inactivated by the enzyme catalase that is present in blood, serum, and wound tissues. In manuka honey, the activity is due to methylglyoxal which is not inactivated. The manuka honey used in wound-care products can withstand dilution with substantial amounts of wound exudate and still maintain enough activity to inhibit the growth of bacteria. There is good evidence for honey also having bioactivities that stimulate the immune response (thus promoting the growth of tissues for wound repair), suppress inflammation, and bring about rapid autolytic debridement. There is clinical evidence for these actions, and research is providing scientific explanations for them.

- 🐝 Honey is used for **cosmetic purposes**. Many of cosmetics were honey based.
- 🐝 Ancestors used it as an **anti decaying agent** in the mummification process of the dead.
- 🐝 Honey as Energy Booster: It is composed primarily of **Carbohydrates** and **Water**, and also contains small amounts of a wide array of **Vitamins** and **Minerals**, including **Niacin**, **Riboflavin**, **Pantothenic acid**, **Calcium**, **Copper**, **Iron**, **Magnesium**, **Manganese**, **Phosphorus**, **Potassium** and **Zinc**.
- 🐝 Honey has a traditional folklore usage for the treatment of peptic ulcers. Also there are numerous reports of oral dosage of honey being successfully used in modern times to treat upper gastrointestinal dyspepsia, including gastritis, duodenitis and ulceration.

ScientificWorldJournal, 2011 Apr 5;11:766-87. doi: 10.1100/tsw.2011.78.

**Honey for wound healing, ulcers, and burns; data supporting its use in clinical practice.**

Al-Wallil N<sup>1</sup>, Salom K, Al-Ghamdi AA.

📄 **Author information**

**Abstract**

The widespread existence of unhealed wounds, ulcers, and burns has a great impact on public health and economy. Many interventions, including new medications and technologies, are being used to help achieve significant wound healing and to eliminate infections. Therefore, to find an intervention that has both therapeutic effect on the healing process and the ability to kill microbes is of great value. Honey is a natural product that has been recently introduced in modern medical practice. Honey's antibacterial properties and its effects on wound healing have been thoroughly investigated. Laboratory studies and clinical trials have shown that honey is an effective broad-spectrum antibacterial agent. This paper reviews data that support the effectiveness of natural honey in wound healing and its ability to sterilize infected wounds. Studies on the therapeutic effects of honey collected in different geographical areas on skin wounds, skin and gastric ulcers, and burns are reviewed and mechanisms of action are discussed. (Ulcers and burns are included as an example of challenging wounds.) The data show that the wound healing properties of honey include stimulation of tissue growth, enhanced epithelialization, and minimized scar formation. These effects are ascribed to honey's acidity, hydrogen peroxide content, osmotic effect, nutritional and antioxidant contents, stimulation of immunity, and to unidentified compounds. Prostaglandins and nitric oxide play a major role in inflammation, microbial killing, and the healing process. Honey was found to lower prostaglandin levels and elevate nitric oxide end products. These properties might help to explain some biological and therapeutic properties of honey, particularly as an antibacterial agent or wound healer. The data presented here demonstrate that honeys from different geographical areas have considerable therapeutic effects on chronic wounds, ulcers, and burns. The results encourage the use of honey in clinical practice as a natural and safe wound healer.



# Source of antioxidants

- The presence of free radicals and reactive oxygen species (ROS) is responsible and shearing in the processes of cellular dysfunction, pathogenesis of metabolic and cardiovascular diseases (CVDs) as well as aging.
- Researches indicate that NH contains several important compounds, and these include antioxidants that may help delaying the oxidative damage to cells or tissues in our bodies. and the other phytochemical substances.
- The color of honey also influences its antioxidant content, as darker honeys are known to have higher amount than lighter honeys.

[Curr Med Chem, 2013;20\(5\):621-38.](#)

**Honey as a source of dietary antioxidants: structures, bioavailability and evidence of protective effects against human chronic diseases.**

[Alvarez-Suarez JM<sup>1</sup>, Giampieri F, Battino M.](#)

⊕ **Author information**

## Abstract

In the long human tradition honey has been used not only as a nutrient but also as a medicine. Its composition is rather variable and depends on the floral source and on external factors, such as seasonal, environmental conditions and processing. In this review, specific attention is focused on absorption, metabolism, and beneficial biological activities of honey compounds in human. Honey is a supersaturated solution of sugars, mainly composed of fructose (38%) and glucose (31%), containing also minerals, proteins, free amino acids, enzymes, vitamins and polyphenols. Among polyphenols, flavonoids are the most abundant and are closely related to its biological functions. Honey positively affects risk factors for cardiovascular diseases by inhibiting inflammation, improving endothelial function, as well as the plasma lipid profile, and increasing low-density lipoprotein resistance to oxidation. Honey also displays an important antitumoral capacity, where polyphenols again are considered responsible for its complementary and overlapping mechanisms of chemopreventive activity in multistage carcinogenesis, by inhibiting mutagenesis or inducing apoptosis. Moreover, honey positively modulates the glycemic response by reducing blood glucose, serum fructosamine or glycosylated hemoglobin concentrations and exerts antibacterial properties caused by its consistent amount of hydrogen peroxide and non-peroxide factors as flavonoids, methylglyoxal and defensin-1 peptide. In conclusion, the evidence of the biological actions of honey can be ascribed to its polyphenolic contents which, in turn, are usually associated to its antioxidant and anti-inflammatory actions, as well as to its cardiovascular, antiproliferative and antimicrobial benefits.



# Alleviates Allergies

- Honey has anti-inflammatory effects and it can also reduce seasonal allergy symptoms.
- "A common theory is that honey acts like a natural vaccine."

A possible mechanism for honey's anti-allergenic effects derives from the fact that bees spread local pollen spores into honey as they produce it, and repeated small consumption to this pollen improve the immune response in the body.



[Ann Saudi Med](#), 2013 Sep-Oct;33(5):469-75. doi: 10.5144/0256-4947.2013.469.

**Ingestion of honey improves the symptoms of allergic rhinitis: evidence from a randomized placebo-controlled trial in the East coast of Peninsular Malaysia.**

[Asha'ari ZA](#)<sup>1</sup>, [Ahmad MZ](#), [Jihan WS](#), [Che CM](#), [Leman I](#).

[+](#) Author information

## Abstract

**BACKGROUND AND OBJECTIVES:** The role of honey in the treatment of allergic rhinitis (AR) is controversial. We studied the complementary effect of ingestion of a high dose of honey, in addition to standard medications, on AR.

**DESIGN AND SETTINGS:** Prospective randomized placebo-controlled study. Subjects were recruited from an otolaryngology clinic in 2 tertiary referral centers in the East coast of Peninsular Malaysia. The study period ranged from April 2010-April 2011.

# Ophthalmology

- The use of honey in the treatment of eye diseases is well documented.
- The Scientists observed **antibacterial, antifungal and anti-inflammatory actions** with the honey application to the eye under the lower eyelid. **It has been used for the treatment of burns to the eye caused by chemical and thermal agents, as well as conjunctivitis, and corneal infections.**

[Cesk Slov Oftalmol, 2013 Aug;69\(3\):128-32.](#)

**[The potential use of honey in ophthalmology].**

[Article in Czech]

[Maitánová N](#), [Cernák M](#), [Nekorancová J](#), [Cernák A](#), [Maitán J](#).

## Abstract

Honey is considered to be a natural product with antibacterial and anti-inflammatory properties. Its successful application in the treatment of chronic wounds and burns has promoted its further clinical use in other clinical departments, including ophthalmology. One of the major advantages of honey is its multi-factorial antibacterial action and the fact that there is no risk of developing bacterial resistance to it. In this work we discuss the current knowledge and new perspectives for honey therapy in treatment of eye diseases such as dry eye disease, age-related macular degeneration, cataracts and bullous keratopathy. Key words: honey, eye diseases, natural product, treatment.

PMID: 24437960 [PubMed - in process]



# Metabolic and cardiovascular effects

Diabetes mellitus, hypercholesteremia, hypertension (HTN), and obesity are well-known risk factors for cardiovascular diseases (CVD).

**Scientific data support the use of honey in patients with diabetes, HTN, dyslipidemia, obesity, and CVD** as its effect on blood sugar, body weight, lipid profile, C-reactive protein, nitric oxide, proinflammatory prostaglandins, and homocysteine.



J Med Food. 2013 Dec;16(12):1063-78. doi: 10.1089/jmf.2012.0285.

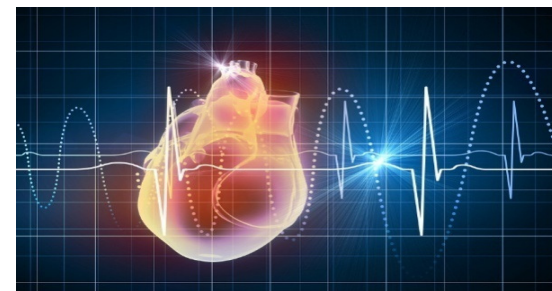
**Honey and cardiovascular risk factors, in normal individuals and in patients with diabetes mellitus or dyslipidemia.**

Al-Waili N<sup>1</sup>, Salom K, Al-Ghamdi A, Ansari MJ, Al-Waili A, Al-Waili T.

#### **Author information**

#### **Abstract**

Diabetes mellitus, hypercholesteremia, hypertension (HTN), and obesity are well-known risk factors for cardiovascular diseases (CVD). Various medications are currently in use for management of these comorbidities. Undesirable side effects are unavoidable and the ultimate and ideal goal is hardly achieved. Honey and other bee products are widely used in traditional medicine for management of many diseases. Others and the authors have found potent biological activities of these products. Honey is now reintroduced in modern medicine as part of wound and burn management. Honey has antioxidant, anti-inflammatory, and antimicrobial activities. More studies are exploring other aspects of honey activity such as its effect on blood sugar, body weight, lipid profile, C-reactive protein, nitric oxide, proinflammatory prostaglandins, and homocysteine. Growing evidence and scientific data support the use of honey in patients with diabetes, HTN, dyslipidemia, obesity, and CVD. This review discusses clinical and preclinical studies on potential influence of honey on diabetes mellitus and cardiovascular risk factors, and emphasizes the importance of conducting more clinical and controlled studies.



# Reduces risks for some forms of cancer

Honey has been shown to be effective in controlling tumor growth and metastasis . Honey has potential to become a **supplement for cancer therapy**. Studies show that **honey had anti-cancer qualities and significant cytotoxic effect on cancer cells cultured in the lab**.



## **Honey as a Potential Natural Anticancer Agent: A Review of Its Mechanisms**

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The main treatment for cancer is by using chemotherapy and radiotherapy which themselves are toxic to other viable cells of the body. Recently, there are many studies focusing on the use of natural products for cancer prevention and treatment. Of these natural products, honey has been extensively researched. The mechanism of the anti-cancer activity of honey as chemopreventive and therapeutic agent has not been completely understood. The possible mechanisms are due to its apoptotic, antiproliferative, antitumor necrosis factor (anti-TNF), antioxidant, anti-inflammatory, estrogenic and immunomodulatory activities. We collate the findings of several studies published in the literature in order to understand the mechanism of its action.





## Adverse effects

- NH like any other natural foods can also be exposed to contamination by antibiotics, pesticides, heavy metals (Arsenic ,lead and Cadmium) and other toxic compounds .

[ScientificWorldJournal](#). 2012;2012:930849. doi: 10.1100/2012/930849. Epub 2012 Oct 14.

### **Antibiotic, pesticide, and microbial contaminants of honey: human health hazards.**

[Al-Waili N<sup>1</sup>](#), [Salom K](#), [Al-Ghamdi A](#), [Ansari MJ](#).

#### **⊕ Author information**

#### **Abstract**

Agricultural contamination with pesticides and antibiotics is a challenging problem that needs to be fully addressed. Bee products, such as honey, are widely consumed as food and medicine and their contamination may carry serious health hazards. Honey and other bee products are polluted by pesticides, heavy metals, bacteria and radioactive materials. Pesticide residues cause genetic mutations and cellular degradation and presence of antibiotics might increase resistant human or animal's pathogens. Many cases of infant botulisms have been attributed to contaminated honey. Honey may be very toxic when produced from certain plants. Ingestion of honey without knowing its source and safety might be problematic. Honey should be labeled to explore its origin, composition, and clear statement that it is free from contaminants. Honey that is not subjected for analysis and sterilization should not be used in infants, and should not be applied to wounds or used for medicinal purposes. This article reviews the extent and health impact of honey contamination and stresses on the introduction of a strict monitoring system and validation of acceptable minimal concentrations of pollutants or identifying maximum residue limits for bee products, in particular, honey.



# Conclusion

- 🐝 The intake of honey as food and medicine resulted in high nutritional benefit and therapeutic promise.
- 🐝 Honey is now reintroduced in modern medicine as part of wound and burn management. Honey has antioxidant, anti-inflammatory, and antimicrobial activities.
- 🐝 Scientific data support the use of honey in patients with diabetes, HTN, dyslipidemia, obesity, and CVD.
- 🐝 The source and adverse effects of NH contamination identified should be prevented.



Thank  
you

