



# Phytochemistry and Medicinal Importance of Honey - A Review

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## Abstract

Honey is the God gift to human being and has been successfully used for medicinal purpose since antiquity. The medicinal and nutritional properties of honey depend on its chemical constituents. Although the chief constituents are sugars and water, but the presence of other composition as Carbohydrate, Proteins, Vitamins as well as minerals make it very beneficial for nutritional, preservative and therapeutic properties as well. Pharmacological profile of honey is quite large as being having anti-inflammatory, antioxidant, immune modulator and anti-cancerous activities as revealed by various studies. Present paper provides a brief review of Phytochemistry and medicinal properties of honey.

**Keywords:** Honey, Medicine, Therapeutic properties, Anti-inflammatory, Phytochemistry

## Introduction

Honey is one of the most valued and appreciated natural substances known to mankind since ancient times<sup>1</sup>. It is produced by honey bees, belong to the genus *Apis*, order Hymenoptera<sup>14</sup>, family Apidae and subfamily Apinae<sup>28</sup>. There are several species of Bees but most widely used species is the honey bee, *Apis mellifera*<sup>2</sup>. It has been mentioned in *Eberus papyrus* [1550 BC] and *Smith papyrus* [1700 BC] to be used for wound healing. *Jalinoos* stated that "Honey is best treatment of various diseases". *Aristotle* has written in his *Historia Animalium* that "Honey is good as a salve for sore eye"<sup>3</sup>. Ancient Egyptian, Assyrians, Chinese, Greeks and Romans employed honeybee products for wounds and diseases of the intestine<sup>1</sup>. It was also used by ancient Egyptian as preservative agent<sup>13</sup>. Russian soldiers in World War 1 used it, for wound healing purposes<sup>22</sup>. Even the Prophet Mohammed glorified the healing power of honey<sup>5</sup>. Honey has a valued place in Traditional Medicine as well as Modern Therapeutics for centuries but it has a limited use in Modern Medicine due to lack of scientific support<sup>1</sup>. It has been suggested that many medicinal properties of plants can be transmitted through honey, so that honey could be used as a vehicle for transporting plant medicinal properties<sup>4</sup>. According to the *Charak Samhita*, honey is of four types namely Makshika, Bhramara, Kshaudra and Paittaka. While Makshika, the best that produced by reddish variety of honey bee<sup>1</sup>.

## Vernacular

The honey is known by different vernacular names: Mali, Alqolees (Unani); Injubin, Asatulnahl (Arabic); Shadab, Angabina, Shahdaan (Persian); Madhu, Makhika, Madhvika, Saragha, Varti, Vanta (Sanskrit); Honey (English); Saht (Punjabi); Mhach (Kashmiri); Shahad (Dutch); Madhu, Madah, Pehapras, Mehpar, Shahad (Hindi); Mah (Bengali); Madh (Gujrati); Mhou, Tam (kannal); Mal (Tamil); Taenu (Telgu); Mippany (Sindh); Pya-ya (Burma); Ayurmader (Malyalam); Baal (Turky); Deesa (Siryani)<sup>6,7,8,9</sup>.

## Phytochemistry

The chemical composition of honey varies with the plants source, season and production method also<sup>10</sup>. It contains

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**How to cite this article:** Ahmed R, Khan NA, Waseem M. Phytochemistry and Medicinal Importance of Honey - A Review. *J Integ Comm Health* 2017; 6(3&4): 31-34.

ISSN: 2319-9113

carbohydrate (95-97%), Protein (0.5%) which are mainly enzymes and free acids<sup>12</sup>. Glucose [30-40%], fructose [40-50%], sucrose [0.1-10%], dextrin, formic acid volatile acid and pollen grains, wax<sup>8</sup>. Other types of sugars that are present in small quantities such as disaccharides, trisaccharides and oligosaccharides<sup>12</sup>. Fat soluble and water soluble vitamins are present in honey<sup>11</sup> such as Thiamine, Riboflavin, Niacin etc. Minerals (P, S, Ca, Cr, Ba, Ni etc.)<sup>12</sup> and trace amount of enzymes, maltose, melezitose, pentosans, gums and colouring matter also present in honey<sup>8</sup>.

Acetic, Butanoic, Formic, Citric, Succinic, Lactic, Malic, Pyroglutamic, Gluconic acids and a number of aromatic acids are found in honey. Honey is free of cholesterol<sup>1</sup>. The main volatile compounds in honey are alcohols, ketones, aldehydes, acids, esters, terpenes. Organic acids have been found as volatile compounds in different type of honeys such as gluconic acid (2, 3, 4, 5, 6 pentahydroxyhexanoic acid)<sup>12</sup>. In manuka honey, the major flavonoids are pinobanksin, pinocembrin and chrysin, while luteolin, quercetin, 8-methoxykaempferol, isorhamnetin, kaempferol and galangin are also in minor concentration<sup>4</sup>. Phenolic Acid and Flavonoids such as Caffeic acid, Isoferulic acid, p-Coumaric acid, Gallic acid, 4-hydrobenzoic acid, Syringic acid, Quercetin, Luteolin, 8-Methoxykaempferol, Pinocembrin, Isorhamnetin, Kaempferol, Chrysin, Galangin, Pinobanksin are present. Other compounds like Phenylactic acid, 4-Methoxyphenolactic acid, Kojic acid, 5-Hydroxymethylfurfural, 2-Methoxybenzoic acid, Phenylacetic acid, Methyl syringate, Dehydrovomifoliol, Leptosin, Glyoxal, Methylglyoxal, 3-Deoxyglucosulose are also present in this type of honey<sup>4</sup>. Pure honey yields from 0.3 to 0.8 % of ash containing traces only of sulphate and chlorides and usually exhibits slight dextro- or laevorotation (+3° to 3°)<sup>14</sup>.

### Medicinal Properties

Honey has antibacterial, anti-inflammatory, immunostimulant, antiulcer and wound/burn healing (regenerative) effects.

### Antibacterial Activities

The antibacterial effect of honey against gram-positive bacteria. Hydrogen peroxide was responsible for the antibacterial activity of honey, but hydrogen peroxide were destroyed by light.<sup>15,16</sup> The sugar content of honey is also high enough to hinder the growth of microbes, along with pH of honey lie between 3.2 and 4.5 and this acidity is low enough to inhibit the growth of microorganisms<sup>2</sup>. A study has shown that one group of light-sensitive, heat-stable antibacterial factors in honey which inhibited the growth of *B. subtilis*, *E. coli*, *B. alvei*, *pseudomonas*, *S. aureus* and *salmonella*. Another study reported that bactericidal and bacteriostatic activity of honey as well

as antibacterial properties particularly against bacteria, developed resistance to many antibiotic<sup>15,17,18</sup>.

### Antifungal Activities

The antifungal activities of honey is due to synergistic action of starch<sup>15</sup>. In vitro, anti-fungal activity of honey has been tested on *Candida albicans*, *C. pseudotropicalis*, *C. stellatoidea* and *C. tropicalis*<sup>21</sup>. It was reported that honey inhibit the growth of *Candida albicans*. It has also have fungicide activity against different dermatophyte<sup>15,18</sup>.

### Anti-oxidant Property

Natural honey contain many flavonoid, tocopherols, phenolic acids, catalase and ascorbic acid<sup>17,20</sup>. Antioxidant foods that are rich in flavonoids are protective agents against oxidative damage like atherosclerosis, ageing and cancer diseases<sup>19</sup>. Strong antioxidants are present in honey are Pinocembrin, pinobaxin, chrysin and galangin, while pinocembrin is an antioxidant that merely exists in the honey<sup>23</sup>.

### Anti-Inflammatory Activity

Healing effect of honey have been mentioned in QURAN and traditional medicine, it is used as a curative agent for many diseases<sup>24</sup>. When honey is applied to wounds, it effectively reduces the inflammation as well as reducing oedema around wounds and exudation from wounds. Honey has been observed to relieve the pain that is a feature of inflammation<sup>26</sup>.

### Wound Healing property

Wet dressings or any form of irrigation moisten the tissues and therefore delay healing. Honey is an effective treatment of wounds because it is non-irritating, non-toxic, self-sterile, bactericidal, nutritive, easily applied and more comfortable than other dressings<sup>21</sup> and promote healing<sup>25</sup>. It was investigate that the patients suffering from wound breakdown after operation for carcinoma of the vulva were treated by pouring honey into the wounds twice daily. The wounds became bacteriologically sterile within 3-6 days<sup>21</sup>.

### Anti-mutagenic and Antitumor Activity

Mutagenic substances act directly or indirectly by promoting mutations of the genetic structure. During the roasting and frying of food heterocyclic amines are formed, e.g. Trp-p-1(3-Amino-1,4-dimethyl-5H-pyridol [4,3-b] indole). The anti-mutagenic activity of honey from seven different floral sources (acacia, buckwheat, fireweed, soyabean, tupelo and Christmas berry) against Trp-p-1 was tested by the Ames assay and compared to a sugar analogue as well as to individually tested simple sugar. All types of honey exhibited a significant inhibition of Trp-p-1 mutagenicity<sup>15,20</sup>.

In a study, the effect of honey was evaluated in gastric ulcer that gastric ulcer have been successfully treated by the use of honey as dietary supplement<sup>15</sup>. Recent research in Japan and Australia has revealed that advanced cancer of the stomach and bone have been cured successfully. Patients suffering from these kinds of cancer should daily take one tablespoon of honey with one teaspoon of cinnamon powder for one month 3 times a day<sup>15,17</sup>.

## Medicinal uses

### Effect of Honey on Gastritis, Gastroenteritis, Gastric and Duodenal Ulcer

Gastritis, gastric and duodenal ulcers are complications resulting from infection with *Helicobacter pylori*. Honey-derived remedies constitute a potential source of new compounds that may be useful in the management of *H. pylori* infections. 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<sup>2,21</sup>.

### Honey as antioxidant

Honey exerts its anti-oxidant action by inhibiting the formation of free radicals, catalyzed by metal ions such as iron and copper. Flavonoids and other polyphenols, common constituents of honey have the potential to impound these metal ions in complexes and preventing the formation of free radicals in the first place<sup>12</sup>. Antioxidants in honey have also been implicated in reducing the damage done to the colon in colitis<sup>19</sup>

### Stimulation of Tissue regeneration

The re-growth of tissue is very important in the wound healing process<sup>12</sup>. Honey facilitates healing process and prevents scarring. This is because honey stimulates the growth of epithelial cells that form the new skin cover over a healed wound. In this way, even in case of large wounds, honey may eliminate the need for tissue transplantation. It stimulates the regrowth of tissue involved in the healing process. It also stimulates the formation of new blood capillaries and the growth of fibroblasts that replace the connective tissue of the deeper layer of the skin and produce the collagen fibres that give strength to the repair<sup>23</sup>.

### Honey as anti-fungal remedy

A study reported that the usefulness of topical application of honey against Acyclovir for the treatment of recurrent herpes simplex lesions. It was demonstrated that the honey from different floral sources had antifungal activity against 40 yeast species (*Candida albicans*, *Candida krusei*,

*Candida glabrata* and *Trichosporon spp*). Cutaneous and superficial mycoses like ringworm and athletes foot are found to be responsive to honey<sup>12</sup>.

## Honey Enhance Immunity

It has been reported that honey stimulates B-lymphocytes and T-lymphocytes in cell culture to multiply and activate neutrophils<sup>22</sup>. In addition, it was reported that oral intake of honey augmented antibody productions in primary and secondary immune responses against thymus-dependent and thymus-independent antigens<sup>10</sup>.

## Used in Arthritis

Boron stimulates in a positive way, hormonal factors for both men and women, resulting in healthy bones. If this hormonal balance is disturbed, it will lead to osteo-arthritis and as honey contains boron, it's routinely consumption can avoid such problems<sup>10</sup>. For arthritis, patients daily morning and night take one cup of hot water with two spoons of honey and one small teaspoon of cinnamon powder. If drunk regularly even chronic arthritis can be cured<sup>27</sup>.

## Diabetic Benefits

Pure natural honey has been reported to produce a lower glycemic response in rabbits as compared to sucrose or commercial honey, possibly due to added sugar in the latter. Honey might provide protection against diabetic complications via its antioxidant and organ protective effects<sup>28</sup>.

## Conclusion

Honey produced in most of the countries of the world. Honey used in Unani medicine as a vital medicine since many centuries. Scientists also accept that honey is very effective medicine for all kinds of disease. It can be used without any side effect for any kind of diseases.

Due to variation of botanical origin honey differs in appearance, sensory perception and composition. It contains mainly carbohydrates and trace amount of micro-nutrients and macro-nutrients along with protein, which are responsible for producing numerous biological effect such as anti-microbial, antioxidant, antiviral, anti-inflammatory and immune modulatory effect. Use of honey is beneficial in Diabetes mellitus, arthritis, fungal diseases and also in some other diseases.

**Conflict of Interest:** None

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Date of Submission: 2017-12-02

Date of Acceptance: 2018-01-04