



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
[www.phytojournal.com](http://www.phytojournal.com)  
JPP 2020; 9(5): 234-242  
Received: 14-07-2020  
Accepted: 16-08-2020

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## Nutraceutical properties of natural honey to fight health issues: A comprehensive review

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DOI: <https://doi.org/10.22271/phyto.2020.v9.i5d.12220>

### Abstract

The natural honey is one of the most valued and appreciated nutraceutical known to mankind since ancient times. It is produced by bees from the nectar of flowers, which bees collect, transform and, store in the honey comb to ripen and mature. It is used for functional food, medicinal and industrial purposes and has been listed as remarkable commodity in the foreign exchange. This review spotlights the physical, biochemical and therapeutic properties of honey, which were discovered by various researchers since last forty years. The review broadly discusses composition, nutritional and therapeutic, and *Yogavahi* properties of honey. The relation of ophthalmology and Honey was also included along with cosmetic properties of honey. Its effectiveness on reproductive system and safety measures to be followed while using honey showed the path of future research. It is composed mainly from carbohydrates, lesser amounts of water and many minor components. It is rich in enzymes, phenolic acids, flavonoids, ascorbic acid, organic acids, amino acids, proteins and minerals. The knowledge about physicochemical parameters determines nutritional value, microbial safety, acceptability and commercial quality assessment of honey.

**Keywords:** Nutritive sweetener, traditional uses, chemical properties, medicine, honey

### 1. Introduction

Honey is the natural sweet substance produced by bees from the nectar of flowers, which bees collect, transform and, store and leave in the honey comb to ripen and mature<sup>[1, 2]</sup>. There are basically two major types of honey, *apiary* and *forest* honeys. Honeys produced by the honeybees, *Apis cerana* and *Apis mellifera*, in apiaries and collected by the modern extraction methods are called *apiary* honey. In contrast, those produced by rock bee, *Apis dorsata*, or from wild nests of *A. cerana* and little bee *Apis florea* in natural habitat and collected by the crude method of squeezing the comb are known as *forest* honeys. Honey bees belong to the genera *Apis* and stingless bees belongs to *Meliponini*<sup>[3]</sup>.

For many centuries, honey known as Madhu in ayurvedic scriptures is one of the most important medicines used in Ayurveda and is one among the foods having religious significance<sup>[4]</sup>. Hindus consider honey as one of the 'Panchamrita' (five elixirs of immortality). In temples, honey is poured over the deities in a ritual called 'Madhu abhisheka'<sup>[5]</sup>. The Vedas and other ancient literature describe honey as a great medicinal and health food<sup>[6-10]</sup>. In Buddhism, honey plays an important role in the festival of Madhu Purnima, celebrated in India and Bangladesh. On Madhu Purnima, Buddhists remember this act by giving honey to monks<sup>[11]</sup>. The group of monkey offered beehive rich with honey to the lord Buddha<sup>[12, 13]</sup>. Honey is suggested as a source of healing in the Quran and it is also declared as one of the foods of paradise<sup>[14, 15]</sup>. In harmony with this in Christian holy Bible verses was quoted as: "Eat honey my son, because it is good<sup>[16, 17]</sup>. According to Pythagoras and Democritus, honey was a source of long life and intellectual power<sup>[18]</sup>. Various ingredients of honey have helped it to become not only a sweet liquid, but also a natural product with high nutritional and medicinal value. There are many types of honey mentioned in Ayurveda. According to Charak samhita and Ashtang sangraha 'madhu' is of four types while in Sushruta samhita, and Bhavprakash nighantu 'madhu' is of eight types<sup>[6-10]</sup> (Table 1). Aient ayurvedic granthas also focus on the different therapeutic actions of honey (Table 2).

The quality of honey is mainly determined by its sensorial, physical, chemical and microbiological characteristics. Honey physicochemical quality criteria are well specified by EU<sup>[1, 2]</sup>. The major criteria of interest are moisture content, electrical conductivity, ash content, reducing and non-reducing sugars, free acidity, diastase activity and hydroxymethylfurfural (HMF) content. Diverse floral source (blossom) and different processing chain fluctuates the physicochemical properties by many ways<sup>[19-21]</sup>. It is consist of carbohydrates (of which

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fructose and glucose are the main contributors) and other minor substances, such as bioactive substances including minerals, proteins, free amino acids, vitamins, enzymes, organic acids, flavonoids, phenolic acids, and other

phytochemicals [22-26]. The dietary practice is shifting day by day and the suggestion to take honey a day is a great saying to serve along with other food stuffs of a day judiciously [27].

**Table 1:** Properties and therapeutic uses of different types of honey mentioned in ayurvedic granthas

S. No.	Type of honey	Special character	Medicinal uses	References
1.	<i>Pauttika</i> honey	<ul style="list-style-type: none"> <li>Honey collected by small black bee resembling a gnat called <i>Pauttika</i>. <i>Pauttika</i> bees build their home inside the hollows of trees.</li> <li><i>Pauttika</i> honey has ghee like colour.</li> <li>This honey is especially <i>Ruksha</i> (dry), <i>Ushna</i> (hot) because of its association with poison (bees feeding on poisonous flowers also).</li> </ul>	<ul style="list-style-type: none"> <li>It aggravates <i>Vata</i>, <i>Rakta</i> and <i>Pitta</i> and this is also <i>Chhedi</i> (cuts tissues).</li> <li>It produces heart-burn and intoxication.</li> </ul>	[6, 8, 9]
2.	<i>Bhramara</i> honey	<ul style="list-style-type: none"> <li><i>Bhramara</i> bees are popular common bees (which are black in color and of medium size) honey collected by them is called <i>Bhramara</i> honey.</li> <li>It is white in color.</li> <li>This honey is <i>guru</i> (not easily digested) because of its <i>Picchhila</i> (slimy) and <i>Atiswadu</i> (excessively sweet) properties.</li> </ul>	<ul style="list-style-type: none"> <li>It is <i>Rakta pitta shamaka</i>.</li> </ul>	[6,8,9]
3.	<i>Kshaudra</i> honey	<ul style="list-style-type: none"> <li>Honey produced by small brown bee is called <i>Kshaudra</i> honey.</li> <li>It is brownish in colour.</li> <li>This honey is especially <i>Sheetha</i> (cold), <i>Laghu</i> (easy to digest) and <i>Lekhana</i> (scarificant).</li> </ul>	<ul style="list-style-type: none"> <li>It is especially beneficial in diseases like <i>Prameha</i> (diabetes).</li> </ul>	[6, 8, 9]
4.	<i>Makshika</i> honey	<ul style="list-style-type: none"> <li><i>Makshika</i> bees are brown in colour and big in size, honey produced by them is called <i>Makshika</i> honey.</li> <li><i>Makshika</i> honey has oil-like colour.</li> <li>It is <i>Laghu</i> (lighter than <i>Kshaudra</i>) and <i>Ruksha</i> (dry).</li> </ul>	<ul style="list-style-type: none"> <li>It is especially beneficial in diseases like asthma.</li> <li>It is also useful in <i>Kamla</i> (jaundice), <i>Arsha</i> (piles), <i>Kshata</i> (phthisis), and <i>Kasa</i> (cough).</li> </ul>	[6, 8, 9]
5.	<i>Chhatra</i> honey	<ul style="list-style-type: none"> <li><i>Chhatra</i> bees are yellowish brown bees which makes umbrella shaped hives in forests. Honey produced by them is called <i>Chhatra</i> honey.</li> <li><i>Chhatra</i> honey is brown yellow in colour.</li> <li>It is <i>Madhura vipaka</i> (sweet after digestion), <i>guru</i> (heavy to digest), <i>Sheetha</i> (cold), and <i>Picchhila</i> (slimy).</li> </ul>	<ul style="list-style-type: none"> <li>It cures bleeding disorders, leucoderma, diabetes and worm-infestations.</li> </ul>	[8, 9]
6.	<i>Aarghya</i> honey	<ul style="list-style-type: none"> <li><i>Aarghya</i> bees make honey from <i>Madhuka</i> (<i>Madhuka indica</i>) trees, have sharp mouth, and are yellow in colour.</li> <li><i>Aarghya</i> honey is white in colour.</li> <li>It is <i>Kashaya</i> (astringent in taste) and <i>Katu vipaka</i> (pungent after digestion).</li> </ul>	<ul style="list-style-type: none"> <li>It eliminates vitiated <i>Kapha</i> and <i>Pitta dosha</i>.</li> <li>It is <i>Balya</i> (strengthening) and beneficial for eyes.</li> </ul>	[8, 9]
7	<i>Auddalaka</i> honey	<ul style="list-style-type: none"> <li><i>Auddalaka</i> are small brown insects which store honey inside ant hills.</li> <li>The color of <i>Auddalaka</i> honey is yellowish brown.</li> <li><i>Auddalaka</i> honey is <i>Kashaya</i> (astringent) and <i>amla rasa</i> (sour), <i>Katu vipaka</i> (pungent after digestion)</li> </ul>	<ul style="list-style-type: none"> <li>It aggravates <i>Pitta</i>.</li> <li>It is useful in skin diseases and helps in modulation of voice.</li> </ul>	[8, 9]
8	<i>Dala</i> honey	<ul style="list-style-type: none"> <li>Unprepared honey, found in flowers.</li> <li>The color of <i>Dala</i> honey is pink.</li> <li><i>Dala</i> honey is <i>Ruksha</i> (dry), sweet, sour and astringent in taste.</li> </ul>	<ul style="list-style-type: none"> <li>It mitigates vomiting and helps to control diabetes mellitus.</li> </ul>	[8, 9]

**Table 2:** Characteristics of *Madhu* (Honey) in Ayurveda

Character	Use	References
<i>Rasa</i> (Taste)	<i>Madhura</i> (sweet), <i>Kashaya</i> (astringent)	[6,9]
<i>Veerya</i> (Potency – active constituent of drug responsible for pharmacological activity.)	<i>Sheeta</i> (cold potency)	[6, 9]
<i>Guna</i> (Properties)	<p><i>Laghu</i> (easily digestible), <i>Ruksha</i> (dry), <i>Sookshma</i> (subtle density).</p> <p>Special Properties:</p> <ol style="list-style-type: none"> <li><i>Yogavahi</i> (Without changing its own properties, honey carries the effects of the drugs added to it. It means it enhances the properties and actions of the substances with which it combines.)</li> <li><i>Srotovishodhana</i> (Removes toxins from body)</li> </ol>	[6, 9]
<i>Karma</i> (Action/ Effect)	<ol style="list-style-type: none"> <li>Wound healing.</li> <li>Effective in eye disorders and increases strength of vision.</li> <li>Improves skin complexion</li> <li>Improves voice quality.</li> <li>Aphrodisiacs (stimulating sexual desire)</li> <li>Cures Diabetes, Cough, Asthma, Diarrhea, Vomiting, Skin diseases</li> <li>Antitoxic</li> </ol>	[6,7, 9, 10]

## 2. Composition of honey

The quality of honey is firm by its chemical, physical, sensorial and microbiological characteristics. The composition of honey is quite variable and largely depends on the floral resources; however, certain peripheral factors also play the considerable role, such as environmental factors and processing [3, 28, 29]. The composition also varies with collection by different species of honey bees [30].

Honey is composed of primarily carbohydrates and various minor components. Sugars are the main constituents of honey. Surveys of floral honey composition have recognized two main components are fructose, glucose averaging 38.0 and 32.0%, respectively. Glucose and fructose are the only monosaccharides in honey [4, 31] which comprising about 95% of honey dry weight. Apart from the two monosaccharides, more than ten different oligosaccharides were reported such as 1-kestose, panose, 6-kestose, palatinose [31, 32].

Honey moisture content depends on the environmental conditions, floral resources and harvesting practices [33]. High moisture content could increase speed of crystallization in some types of honey and increase its water activity which tends to fermentation. Moisture contents of honey ranged from 17-22% [3, 34, 35]. The compulsory limit of moisture content is  $\leq 20\%$  [1, 2]. Usually, honey is acidic in character. The different pH values and EC values were reported by various authors for honeys of different sources [35-42]. These parameters have great importance during the extraction, processing and storage of honey, as they influence the stability, texture and shelf life of honey [3, 37].

Colour in honey varies from clear and colorless to dark amber or black. The most important aspect of honey colour determines its marketing value [20, 43]. Honey color is the most important factor relating to its visual look, and is mostly dependent on various factors like nectar source and pollen content. Various color pigments deriving from the nectar and pollen (anthocyanins, phenolic acids, proanthocyanidins and flavonoids) and mineral contents make up that basic color of honey [44-48]. Mineral and vitamin complex is very broad in honey [3, 49].

The HMF (Hydroxyl-Methyl-Furfural) content is widely recognized as a factor of honey freshness, because it is missing in fresh honey samples and tends to rise during processing and aging of the product. Several factors influence the levels of HMF, such as temperature and period of heating, storage environment, pH and floral source; therefore it provides a hint of storage in poor conditions or over heating during processing [50-52].

## 3. Nutritional and therapeutic properties of honey

Little is known about the individual components of honey that are responsible for its specific activity.

### 3.1 Energy food

Honey is high energy carbohydrate food. Levulose and dextrose in honey are readily accepted in blood stream, providing immediate source of energy. Improved calcium fixation in bones and curing anemia and anorexia attributed to nutrient stimulations in honey [3]. The high nutritional profile of honey with wide range of nutrients encourages its use as food [53].

### 3.2 Food ingredient

Its application potential in bakery, snack foods, confectionery, value added products of fruits and vegetables, and beverages are ever increasing [54]. It is also a compulsory ingredient of

different health drinks like decoction, churned drink and fermented alcoholic product of crude drugs or aqueous extract or decoction of drugs [55].

### 3.3 Honey in food processing

Lee [56] found honey to have very useful characteristics in food processing such as a fruit juice clarifying agent. McLellan *et al.* [57] indicated that the honey solution treatments produced lighter and yellower raisins than the commercial treatments. The modified atmospheric packaging (MAP), honey solution dip or their combination significantly sustained the general quality of minimally processed grape by delaying quality loss and berry decay [58]. Vacuum impregnation with honey was more effective in controlling browning discoloration than that of simple immersion treatment [59]. Vacuum impregnation of orange fruit in honey syrup resulted with no browning, with good texture and shape and with typical organoleptically standard [60]. Jeon and Zhaw [61] suggested that honey has the potential to be used as a natural ingredient to prevent enzymatic browning in fresh-cut fruits.

### 3.4 Honey as medicine

Honey is extensively used in Ayurvedic and Unani system of medicines. It is used as blood purifiers, a preventive agent against cold, coughs and fever and a curative for eye sores, for ulcers of tongue throat and burns [3]. The general medicinal and curative properties of honey were mentioned by Sampath Kumar *et al.* [62] as:

- i) Honey is useful as sedative.
- ii) It stimulates digestion and regulates the acidity of the gastric juices.
- iii) Honey can be taken either with warm milk or with lemon juice and radish juice as a remedy for cold.
- iv) Honey in warm milk or water can give relief to sore throats.
- v) Gargling with honey is very useful in gingivitis.
- vi) One spoon of fresh honey mixed with the juice of half a lemon in a glass of warm water taken first thing in the morning is very helpful in constipation, hyperacidity and obesity.
- vii) A mixture of honey and rose petals when taken in the morning, at the initial stages of tuberculosis produces best outcomes.

### 3.5 Honey in child health

Honey has been widely used as infant feeding. It cures many deficiencies in infants and older children<sup>3</sup>. According to Charaka samhita granthas [6], after cutting umbilical cord the infant's birth rites should be performed. On first day of birth, the child should be given first feeding of honey and ghee consecrated with specific mantras [6]. Honey used after birth provide following benefits: It is Sheeta (cold potency), has sweet and astringent taste, pacifies raktapitta and kapha dosha (disease causing agents) [6]. It also acts as source of energy because it contains mainly fructose (about 38.5%) and glucose (about 31.0%) as well as vitamins and multi-minerals [63]. A daily intake of honey strengthens the immune system in children thus developing their disease resistance capacity [62].

### 3.6 Digestive

Honey is said to improve food assimilation and to be useful for chronic and infective intestinal problems such as constipation, ulcers and liver disturbance<sup>3</sup>. Honey is used to

cure gastrointestinal problems. It is used as a remedy for gastritis and stomach and duodenal ulcers [62].

#### 4. 'Yogavahi' property of honey

In Ayurveda certain drugs or a drug vehicle has this special property. It is special affinity to carry or to potentiate the actions of main drug to which it is additionally mixed. It helps and accelerates the bioavailability of the original drug. Honey has this special property [6, 9]. So, honey is used along with various medicine rather than using it alone in various diseased condition.

##### 4.1 Antimicrobial activity

Honey has been reported to have an inhibitory effect to different species of bacteria including aerobes, anaerobes, gram – positive and gram – negatives<sup>64</sup>. The anti – bactericidal and antifungal activity of honey has been attributed by its acidity, increased osmolarity, production of hydrogen peroxide, presence of phenolic acids, lysozyme, flavonoids etc. [65-70]. Hydrogen peroxide is produced from the oxidation of glucose by the enzyme glucose oxidase, when honey is ripening [66]. Glucose oxidase produced from the hypopharyngeal glands of honeybees [71]. The low pH level of honey and its high sugar content (high osmolarity) is enough to hinder the growth of microbes. Honey traditionally has an acidic pH, between 3.2 and 4.5, which is low to be inhibitory for many bacteria [72, 73]. Benazir Begum *et al.* [70] found that the honey was more effective against *Escherichia coli* and *Staphylococcus aureus*. The non-peroxide activity of honey from stingless honey bees has been demonstrated by Temaru *et al.* [74]. Carnwath *et al.* [75] have demonstrated the antimicrobial activity against common equine wound bacterial isolates.

##### 4.2 Antioxidant activity

Besides its antimicrobial properties, honey can clear infection in a number of ways, including boosting the immune system, having antioxidant activities [76, 77]. The free radical scavenging compounds in honey may inhibit reactive oxygen species mediated cytotoxicity [78]. The antioxidant capacity of honey is due to the phenolic compounds and flavonoids. These antioxidant compounds have a promising pharmacological agent for preventing cancer, cardiovascular diseases, inflammatory disorders, neurological degeneration, wound healing, infectious diseases and aging as well as it can be used as food preservatives [79].

##### 4.3 Anti-inflammatory activity

It has also been shown that honey relieves skin inflammation [80] oedema and exudation, diminishes scar size and promotes tissue regeneration [81]. Kogilavane and Yoke-Keong<sup>82</sup> indicated that Malaysian Tualang honey may ameliorate ultraviolet-induced inflammation of the skin, chemical-induced inflammation of the eyes and oxidative stress on the eyes.

##### 4.4 Skin and wound healing

Several experiments have shown that honey has an anti-inflammatory and antibacterial effect helps in wound healing [83-88]. A broad range of wounds is being treated all over the world with unprocessed honeys from different sources [89, 90]. Honey was most effective in reducing ROS levels, it was selected for use in wound-healing products. Indian honeys are potent antibacterial agents against *Staphylococcus aureus* obtained from wounds [91]. It is an immunomodulatory agent for various disorders of the skin. The immunomodulatory

properties of honey are complicated and not yet fully understood [92]. Honey can promote healing or even reduce further damage [93]. Honey is similarly found as an active ingredient in products such as ointments for the treatment of burns and cuts [94, 95].

##### 4.5 Anticancer activity

Honey potentiates the anticancer activity range from tissue cultures [96-98] and animal models [99-101] to therapeutic trials<sup>102</sup>. The anti-tumour effect of honey against bladder cancer was examined *in vitro* and *in vivo* in mice [103]. Polyphenols in honey are believed as one of the major factor responsible for the anticancer activity of honey [104]. Honey may have the potential to be anticancer agent through several mechanisms like apoptotic activity, antiproliferative activity, anti-inflammatory and immunomodulatory activities, and estrogenic modulatory activity [105]. Hamzaoglu *et al.* [106] reported that tumor implantation in rats was markedly reduced by the use of honey pre- and post- operatively. However, the full mechanism is yet to be fully understood.

##### 4.6 Gastroenterological effects

Pure honey has bactericidal activity against many enteropathogenic organisms, including those of the *Salmonella* and *Shigella* species, and enteropathogenic *E. coli* [107]. Gastritis, gastric and duodenal ulcers are complications resulting from infection with *Helicobacter pylori*. Conventional treatment for the eradication of *H. pylori* is far from satisfactory; thus there is search for alternative treatment. Honey derived remedies constitute a potential source of new compounds that may be useful in the management of *H. pylori* infections [108].

##### 4.7 Cardiovascular effects

The consumption of natural honey reduces cardiovascular risk factors such as total cholesterol, LDL-C (low-density lipoprotein cholesterol (LDL-C), HDL-C (high density lipoprotein cholesterol), triacylglycerole, CRP (C-reactive protein), and it does not increase body weight in overweight or obese subject [109]. Khalil and Sulaiman [110] demonstrated that certain honey polyphenols have a promising pharmacological role in preventing cardiovascular diseases.

##### 4.8 Honey for diabetics

The consumption of honey can provide beneficial effects on body weight and blood lipids of diabetic patients<sup>111</sup>. Studies have shown that honey consistently produces a lower glycemic effect when compared to glucose and sucrose in normal and type-I diabetics [112], and do not have additional acute hyperglycemic effects over an isoglycemic amount of bread in type II diabetics [113]. The commercial clover honey is a clinical and cost-effective dressing for diabetic foot ulcers in developing countries [114]. Wound dressing with honey is an option for managing Wagner grade-II Diabetic Foot Ulcers with the rate of the wound healing comparable with the use of iodine solution [115].

#### 5. Ophthalmology and honey

In Ayurveda *Chakshushya* (effective for curing eye diseases & to maintain eye side strength) property of honey is mentioned [6-10]. Honey is used worldwide to cure various ophthalmologic conditions like blepharitis, keratitis, conjunctivitis, corneal injuries, chemical and thermal burns to eyes [116]. There are evidences that honey may be helpful in treating dry eye disease, post-operative corneal edema, and

bullous keratopathy<sup>[117]</sup>. In one study, with topical application of honey as ointment, in patients with non responsive eye disorders, improvement was seen in 85% patients. Application of honey is effective in infective conjunctivitis<sup>[118]</sup>. Ali *et al.*<sup>[119]</sup> showed that drop of honey can be effective in reduction of redness and limbal papillae and in improving the vernal keratoconjunctivitis. Therapeutic effect of acacia honey on corneal abrasion wound healing was confirmed by Ker-Woon *et al.*<sup>[120]</sup>.

### 5.1 Cosmetic property of honey

In various cosmetic therapies, honey is used alone or mixed with other substances such as milk, eggs, oats, lemon juice, fruits and oils<sup>[121]</sup>. Honey-based cosmetic products include cleansing milks, lip ointments, hydrating creams, body lotions, facial creams shampoos and conditioners, balms, masks and ointments after bathing. In cosmetics, it exerts emollient, soothing, humectants, hair conditioning effects, retains the skin juvenile and hinders wrinkle formation and prevents pathogen infection<sup>[121, 122]</sup>. Some honey based lipsticks are created for lip treatments and shampoo with honey is considered as it acts like a moisturizer for hair fiber<sup>[121, 123]</sup>. The anti-aging potential of a cream containing herbal oils and honey was highlighted by Altuntas and Yener<sup>[124]</sup>.

### 5.2 Honey in panchakarma therapy

Panchakarma therapy is for elimination of disease causing agents out of body i.e. Detoxification of body. Honey is used in combination of drugs used for Panchakarma therapy mostly in *Basti* therapy (enema therapy with medicated oils and decoctions) and *Vamana* therapy (Emesis therapy). Here honey helps to reach the medicine easily at each and every minute part of body and thus helps in elimination of toxins out of body<sup>[125, 126]</sup>.

### 7. Effectiveness of honey on reproductive system

In ayurvedic granthas, 'Vrishya' property of honey is mentioned. Vrishya means it enhances infertility<sup>9</sup>. Various animal studies had been conducted to know the activities of honey on sperm parameters of young adult male rats and it showed that honey enhances the quality of sperm count, sperm motility and sperm morphology<sup>[127-130]</sup>. Abdula Ghani *et al.*<sup>[128]</sup> reported that treatment of honey increased spermatogenesis in adult rats. A study by Zaid *et al.*<sup>[131]</sup> on the effects of Tualang honey on female reproductive organs (uterus and vagina) and tibia bone in menopause rats (ovariectomised) showed that Tualang honey has a beneficial effect on menopausal rats by preventing uterine atrophy, increased bone density and suppression of body weight increase.

### 8. Safety measures to be follow while using honey

1. Do not consume honey in excess amount due to its properties - rough, heavy, astringent and cold. If taken in excess quantity, resulted a condition called Madhvama (a situation of indigestion of honey in Ayurveda) which is very difficult to treat. Hence it is very harsh and kills immediately like poison<sup>[6]</sup>.
2. Honey should not be heated, or mixed with hot foods<sup>6, 132</sup>. The study revealed that heated honey mixed with ghee produces HMF which may produce harmful effects and act as a poison in due course (Ushnam cha samagrutham madhu marayati)<sup>[133]</sup>.
3. Also should not be consumed when you are working in hot surroundings<sup>[134, 135]</sup>.

4. Honey should never be mixed with rain water, mustard, fermented beverages like whisky, rum, brandy etc.<sup>[136]</sup>.
5. Infants younger than one year of age should never be fed honey. It increases the risk of botulism, leading to illness and even death<sup>[137, 138]</sup>.
6. Honey contains nectar of various flowers of which some may possibly be poisonous<sup>[139]</sup>.
7. Honey can be fermented to produce ethanol, which can be intoxicating.

### 9. Conclusion

The physiochemical properties of natural honey depend on four major factor *viz.*, species, floral source, environmental factors and processing factors. The quality and use of processed honey depends on its floral source and its properties. The enormous amount of records concerning honey's therapeutic uses, along with the rapidly rising interest in and examinations into natural health remedies and food or drug supplement, has led to a reappearance in interest in honey's properties. It can be concluded that honey is a precious natural substance with several miscellaneous usages. It strengthens the immunity and helps to maintain the health by preventing various types of diseases but it must be pure and genuine.

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