Honey For Health

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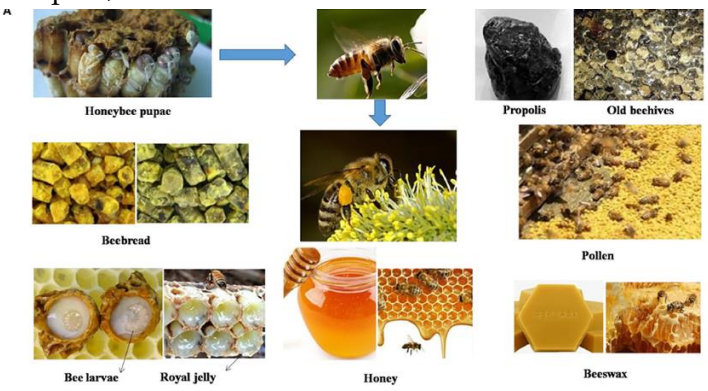
Beekeeping in India dates back to ancient times and people used to hunt/ rob honey from feral colonies of *Apis dorsata* Fab., *Apis florea* Fab. and *Apis cerana indica* Fab. Indian hive bee (*Apis cerana indica*), being domesticated species, was also kept into various indigenous feral hives such as log or wall hives till 19th Century. Bee-keeping is an absorbing hobby to some, and to others it is an industry for producing honey and wax, since ancient times, honeybees have been kept in a crude manner in India, Bee-keeping, today is based upon improved methods using the principles of movable frame-hive, honey extractor and the smoker. Rearing of honey bees is called, apiculture. Honeybee-derived products are used as traditional complementary medicines worldwide, especially in oriental countries. Bee products can be divided into three categories: (1) bee collection and brewing products, such as propolis, honey and BCP, BB; (2) Bee secretions, such as RJ, beeswax, and BV; and (3) bee ecological bodies and hives, such as bee larvae, bee corpses, and old beehives.



Source: Luo *et al.* (2021)

Honey is defined as "the sweets substance produced by honeybees from the nectar of blossoms or from secretions on living plants, which the bees' collect transforms and store in honey combs". Honey bee produces dense and stable energy food called as nectar which ripened into honey. Honey is prepared by bees from plant nectars, from plant secretions and from excretions of plant sucking insects ("honeydew"). The Food Standards Code defines it as "the nectar and saccharine exudations of plants gathered, modified and stored by the honey bee". The British Pharmacopeia (1993) defines purified honey as being "obtained by purification of the honey from the comb of the bee, *Apis mellifera* L, and other species of *Apis*. Colours of honey form a continuous range from very pale yellow through ambers to a darkish red amber to nearly black. The variations are almost entirely due to the plant source of the honey, although climate may modify the colour somewhat through the darkening action of heat.

Chemical composition

Honey is a complex natural product, containing more than 400 different substances, e.g. various carbohydrates, organic acids, proteins, amino acids, enzymes, aroma substances, mineral substances, pigments, waxes, etc. The composition and quantity of these components vary widely according to the floral and geographic origin of the honey. The average composition of honey is presented here under:

Sugars account for 95 to 99% of honey dry matter. The majority of these are the simple sugars fructose and glucose which represent 85-95% of total sugars. Generally, fructose is more abundant than glucose. This predominance of simple sugars and particularly the high percentage of fructose are responsible for most of the physical and nutritional characteristics of honey. The physical properties of honey such as sweetness, hygroscopicity, density and viscosity and food value are mainly dependent on honey sugars. Water is quantitatively the second most important component of ho=ney. Its content is critical, since it affects the storage of honey. Keeping quality, viscosity and granulation of honey depends on the proportion of water in it. An ideal honey on an average should contain 17.2 per cent of water (moisture). Only honeys with less than 18% water can be stored with little to no risk of fermentation. Acids (organic acids) are the most important. 16 different types of acids have been identified in the honey. Important among these are acetic acid, butyric acid, malic acid, succinic acid, gluconic acid, formic acid, phosphoric acid, hydrochloric acid, lactic acid and polyglutamic acid. Of these gluconic acid, which is a by-product of enzymatic digestion of glucose, predominates. Honey

contains traces of amino acids also. Because of its sweetness, the acidity of honey is largely masked. Although honey has an acidic reaction of pH 3.29 to 4.80, it is potentially alkaline food, because the acidity or alkalinity of foods depends on the predominant type of minerals they contain. The organic acids are responsible for the acidity of honey and contribute largely to its characteristic taste. Minerals are present in very small quantities, potassium being the most abundant. The minerals have most important biological role, since their interaction with number of enzymes, vitamins and hormones affect the irritability of the nervous system, tissue respiration, blood circulation and so on. Honey is also an important source of minerals. On an average, ash content of honey is 0.17 per cent. The salts of potassium, chlorine, sulphur, calcium, sodium, phosphorous, magnesium, silica, iron, manganese and copper are present in the honey. Dark honeys, particularly honeydew honeys are the richest in minerals. Honey may contain as many as 60 types of amino acids which are the building blocks of different types of proteins useful for us. The protein contents of an ideal honey is, however, only 0.26 per cent.

The main enzymes in honey are invertase (saccharase) diastase (amylase) and glucose oxidase. Traces of other proteins, enzymes or amino acids as well as water soluble vitamins are thought to result from pollen contamination in honey. Virtually absent in newly produced honey, hydroxy-methylfurfural (HMF) is a byproduct of fructose decay, formed during storage or during heating. Thus, its presence is considered the main indicator of honey deterioration. Enzymes are complex molecules formed in living cells that aid in carrying out the metabolic processes of life. They act as catalytic agents in bringing about chemical reactions involving chiefly starch and proteins. The most important enzyme in honey is *invertase* which converts the sucrose of nectar into glucose and fructose. The other important enzyme found in honey is *diastase*. Its importance lies in its instability to heat. People who prefer unheated honey use the diastase level as an index of the heating history of honey. Diastase also deteriorates during long storage. The other important enzymes found in the honey are amylase, catalase, oxidase, phosphatase etc. These enzymes are mainly contributed from the plants and some of them are added through glandular secretions by the bees. Most of the enzymes in honey are destroyed by exposure to too much heat for a long period of time which may occur in processing or in long storage. Thus, long storage and high heating to honey should always be avoided. Another enzyme glucose-oxidase is also reported in honey which oxidises glucose to gluconic acid and hydrogen peroxide, the inhibin which imparts antibiotic properties to honey. Vitamins are not only essential food elements in the diet but many of these are used for curing the diseases. Aroma and flavour substances in honey are terpenes, aldehydes, alcohols, esters etc. The aroma and flavour are the most important characteristics of honey from consumer's point of view. The delightful aroma and flavour of fresh honey are remembered with pleasure as there are as many different honey flavours as there are nectar sources. In addition to loss of volatile aroma, excessive heat can alter honey flavour and introduce off type flavour from the effect of heat on sugars, acids and protein material in it. Flavour loss also occurs in long storage of honey. The important pigments occurring in honey are carotenes, chlorophyll, chlorophyll derivatives and xanthophyll. Other minor components occurring in honey are sugar alcohols, tennins, acetylcholine, honey colloids, an antibiotic material and some other biological active material.

Use of Honey

Honey is one of the foods which have religious significance. Buddhists in India and Bangladesh celebrate a festival called '*Madhu Purnima*' by giving bee's honey to monks. This is to commemorate the offering of honey by a monkey to Lord Buddha when he retreated to wilderness due to a dispute among his disciples. Hindus consider bee's honey as one of the five elixirs of immortality (*Panchamruta*). Honey is poured over the statues of deities in a ritual called '*Madhu Abhisheka*'. In Jewish tradition, honey is the symbol of new year, 'Rosh Hashana'. Traditionally slices of apples dipped in honey are eaten to bring a sweet new year. In Islam, Prophet Mohammad strongly recommended honey for healing purposes and Quran promotes it as a nutritious and healthy food. As bee's honey has wide and vivid values, the present survey is conducted in order to view some

benefits of honey as a medicine, cosmetic, nutrient and a preservative.

Medicinal uses of honey

Antimicrobial properties of honey

In addition to important role of natural honey in the traditional medicine, during the past few decades, it was subjected to laboratory and clinical investigations. Antibacterial activity of honey is one of the most important findings that was first recognized in 1892; by van Ketel.

Unifloral honeys are used in folk medicine for different purposes. The applications given in the table below remain to be confirmed by experimental science. Indeed, in most scientifically conducted clinical studies the botanical origin of the honey was not determined. On the other hand, the antibacterial and the antioxidant activity of honey depends strongly on the botanical origin.

Table 3: Explanation for the use of honey in medicine

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

Table 4: Honey therapeutic properties

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

Source: Bodganov, 2011

Quality Control in Honey

Some scientists even advocate the addition of water into honey to avoid granulation problem. But it has been laid out that nothing is to be added or subtracted from honey and it has to be sold in natural form. Such recommendations may make the consumers more cautions and suspicious about adulteration. Moreover, the addition of water not only affect the AGMARK grade status of honey but also make honey more vulnerable to fermentations. Even addition of sorbic acid or isobutyric acid or treatment with HC1 and then with NaOH for preventing granulation should not be allowed and the honey showing the residues of such substances be branded adulterated and accordingly legal action be taken against packers.

All big traders and honey exporters are having their own full-fledged honey testing laboratories. Besides various tests prescribed by AGMARK, they have even provision for HMF testing of honey as per International Standards. For some specific sophisticated testing's, exports approach NRL of IARI, New Delhi or S G S, Nagpur. Since quality of the honey, it being a food item, is of prime importance, various organization such as (PFA, 1974), BIS (IS 4941 :1974; IS 8964: 1977; IS 4941, 1994), AGMARK (1984) and European code (1969) have set various standards for honey based on specific gravity, moisture, quantity or reducing sugars, sucrose, L/ D ratio, ash content, acidity. Fiehe's test, aniline chloride test, HMF and enzymatic (Diastase) activity. On the basis of the above parameters, both BIS and AGMARK have devised three grades of honey *vis.* Special grade, A grade and standard grade. In India, it is the AGMARK standards which are most commonly being followed. The AGMARK authorities have spread a network of testing laboratories with trained manpower at least at district level, through it has not been able to reach smaller towns. The beekeeping institutions can have their own AGMARK lab to test and AGMARK, their honeys. The laboratory which can be set up to a cost of about Rs 1 lac needs a trained Agmark analyst. The Agmark authorities provide such one-month's training to science graduates.

Table 1: Average composition of honey

Component (% except pH and diastase valute)	Average	Standard deviation	Range
Water	< >17.2	1.5	13.4 - 22.9
Fructose	38.2	2.1	27.2 - 44.3
Glucose	31.3	3.0	22.0 - 40.7
Sucrose	1.3	0.9	0.2 - 7.6
Maltose (reducing disaccharides calculated as maltose)	7.3	2.1	2.7 - 16.0
Higher sugars	1.5	1.0	0.1 - 8.5
Free acids (as gluconic acid)	0.43	0.16	0.13 - 092
Lactone (as glucolactone)	0.14	0.07	0.0 - 0.37
Total acid (as gluconic acid)	0.57	0.20	0.17 - 1.17
Ash	0.169	0.15	0.020 - 1.028
Nitrogen	0.041	0.026	0.000 - 0.133
pH	3.91	-	3.42 - 6.10
Diastase value	20.8	9.8	2.1 - 61.2

Table 2: Unifloral honey in practical apitherapy.

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

Source: Bodganov *et al.*, 2006

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