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Honey: Natural Medicine in Modern World

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Honey has a long medicinal history and is widely used for its therapeutic effects. Honey is a byproduct of flower nectar which is formed in the upper aero-digestive tract of worker honey bee, which is concentrated through a dehydration process inside the beehive. The chemical composition varies depending on the plant source. Primarily it is composed of fructose and glucose but also contains amino acids, proline, phenylalanine, vitamins, minerals and enzymes. However, almost all natural honey contains flavonoids (such as apigenin, pinocembrin, kaempferol, quercetin, galangin, chrysin and hesperetin), phenolic acids (such as ellagic, caffeic, p-coumaric and ferulic acids), ascorbic acid, tocopherols, catalase (CAT), superoxide dismutase (SOD), reduced glutathione (GSH), Millard reaction products and peptides. Almost all these compound works together to provide a synergistic antioxidant effect. (Alvarez-Suarez *et al*., 2010)

Chemical composition of Honey: Precisely, the composition of honey varies according to the plant source visited by worker bees during foraging. Averagely, it consists of Fructose (38.19%), Glucose (31.28%), Sucrose (1.31%), and Disaccharides as Maltose (7.31%), high sugars (1.5%), free acid as Gluconic (0.43%), Lactoneas Gluconolactone (0.14%), total acid as Gluconic (0.57%), Ash (0.169%), and Nitrogen (0.041%) (Jeffrey and Echazarreta, 1996). More than 95% of the solids in honey are carbohydrates and a highly complex mixture of sugars. Enzymes such as phosphatase, oxidase, invertase (saccharase), diastase (amylase), catalase, etc. are present in honey. Minerals like iron, copper, manganese, magnesium, sodium, potassium, calcium, silica, phosphates, some acid like acetic, butyric, citric, formic, lactic, malic and succinic acid and Vitamin A, B (B_1, B_2, B_3, B_5, B_6 and B_9) and C are present.

The physical composition of Honey: The freshly extracted honey is a viscous liquid that varies with the composition and substances of nectar. If the temperature is below 24^{o}C, dextrose in honey crystallizes and then the honey is said to have granulated. After granulation,

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dextrose settles down while levulose and water remain above increasing the danger of fermentation. It has the ability to absorb and hold moisture from the environment adding a new property to it i.e. Hygroscopicity with specific gravity 1.35-1.44g/cc/Kelvin. The honey is getting rid of moisture by wing beet. The whole process of eliminating the moisture by the fanning of bees themselves is called honey ripening and the cells containing ripe honey are then sealed with wax. The honey in the unsealed cells is called unripe or green honey.

Honey to heal wounds, cuts and burns: The most effective use of honey is found in wound healing. Wounds like abrasion, burns, ulcers, leprosy, surgical wounds, and wounds of abdominals are found to be responsive to honey therapy. It also helps in preventing the spreading of infection to healthy tissues. The antibacterial activity of honey is still controversial whether it is due to the source of honey being responsible for it or not. The greatest antibacterial activity is seen in honey produced by Africanized honey bees from predominantly *Mimosa* and *Eucalyptus*. The non-associated organic acids also play a role in antibacterial activity as they are highly soluble in cell membranes and induce alteration in cellular permeability and in oxidative phosphorylation. Other honey products like propolis and albumins in royal jelly reported having antibacterial activity.

Anticancer property of Honey: Honey contains a number of phenols having anti-cancer properties: these are flavonols (Quercitin, kaempferol, galangin, Fisetin and Myricetin), Flavones (Apigenin, Acacetin, Chryyysin, Luteolin, Genkwanin, Wogonin, and Triacetin), Phenolic acids (Caffeic acids), Flavones (Hesperidin), etc Among all Quercitin is showing the apoptotic ability of anti-CD95 and rTRAIL (recombinant tumor necrosis factor-related apoptosis-inducing ligand) in acute lymphocytic leukaemias (Spagnuolo *et al*., 2012).

Table 1. Phenols present in honey with anticancer properties (Abubakar *et al*., 2012)

Class of Phenolic compounds	Specific phenolic compounds researched

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Flavones	Hespridin
Flavone	Apigenin,acacetin, chrysin, luteolin genkwanin, wogonin, tricetin
Phenolic acids	Caffeic acid
Coumarins	Coumarin
Tannins	Eellagic acid

Antimicrobial property of Honey: Antibacterial activity is due to the combination of low pH, high osmolality, and hydrogen peroxide generation together with defence -1 and methyl-oxal, with the latter an aldehyde generated from pyruvic acid (Ratcliffe *et al*., 2011). Honey showed inhibitory action on Gram-positive MRSA (Methicillin-Resistant *Staphylococcus aureus*), of Vancomycin-sensitive and Resistant *Enterococci* (VSE and VRE) (Jenkins and Cooper, 2012). It also affects Gram-negative bacteria which are associated with wounds such as *Pseudomonas aeruginosa, Stenotrophomonas* sp. with *Acinetobacter baumannii* (Seckam *et al.,* 2013). Manuka honey is also having an antibacterial effect which is a non-peroxide honey blocking hydrogen peroxide activity. The mechanism it's based on may be related to the low pH level of honey and its high sugar content (high osmolarity) which can act as a growth inhibitor.

Antioxidant activity of Honey: Natural honey contains many flavonoids (such as apigenin, pinocembrin, kaempferol, quercetin, galangin, chrysin and hesperetin), phenolic acids (such as ellagic, caffeic, p-coumaric and ferulic acids), ascorbic acid, tocopherols, catalase, superoxide dismutase, reduced glutathione, Maillard reaction products and peptides provide synergistic antioxidant effect by working together. Hence, it can also be called Honey as a natural antioxidant and may serve as an alternative to some preservatives such as sodium tripolyphosphate in food preservation to delay lipid oxidation (Johnston *et al*., 2005)

CONCLUSION: To date, researchers are paying more attention to naturally originated medicine that have efficient therapeutics in comparison with synthetic drugs. It is a very important naturally originated product having different medicinal uses since ancient times. It is interesting to note that irrespective of geographical borders similar substances are used to cure particular diseases throughout human history.

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