



Review

Role of honey in modern medicine



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ABSTRACT

Use of honey has a very long history. Honey has been used since ancient time due to its nutritional and therapeutic values. There had been varied ways of consumption honey including its use as a sweetener and flavoring agent. Honey is produced all over the world. The most important nutriment of honey is carbohydrates present in the form of monosaccharides, fructose and glucose. Honey plays an important role as an antioxidant, anti-inflammatory, anti-bacterial agent and augments the adherence of skin grafts and wound healing process. The role of honey has been acknowledged in the scientific literature and there is convincing evidence in support of its antioxidant and antibacterial nature, cough prevention, fertility and wound healing properties. However, its use has been controversially discussed and has not been well accepted in the modern medicine. The aim of this review was explore and highlight the role of honey in modern medicine.

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1. Introduction

The consumption of honey has a very long history among human beings. It has been used in innumerable foods and beverages as sweetening and flavoring agent. Since ancient times, honey has been known for its nutritive and therapeutic values. Honey is produced all over the world. The global production of honey is approximately 1.20 million tons per annum (Bogdanov et al.,

2008). China, Turkey, Argentina, Ukraine, Mexico and United States are the main producers of honey. The most important ingredient of honey is carbohydrates present in the form of monosaccharides, fructose, glucose and disaccharides, maltose, isomaltose, maltulose, sucrose and turanose and the sweetness of honey is due to presence of these ingredients. It also contains oligosaccharides including the androse and panose and enzymes including amylase, oxidase peroxide, catalase and acid phosphorylase. Furthermore, honey contains amino acids, trace vitamin B, Vitamin B6, Vitamin C, niacin, folic acid, minerals, iron, zinc and antioxidants (David, 2007; Fatimah et al., 2013). Honey is commonly used as an anti-inflammatory, anti-oxidant and anti-bacterial agent (Noori et al., 2014).

Honey is highly valued by users for therapeutic purposes as an alternative medicine. However, its use has been controversially discussed in the literature, whether treatment with honey bee product is safe or not especially for metabolically compromised people. It is also strongly believed that honey bee is a main source of nurturing and dynamism. The health promoting characteristics of bee are mainly due to the presence of multiple metabolites including folic acid, thiamine, biotin, niacin, tocopherol, polyphenols, phytosterols besides enzymes and co-enzymes. The favorable facts on the anti-oxidant, anti-bacterial, anti-fungicidal, hepatoprotective are recurrently available in the scientific literature. In principle, honey is a valuable supplement for healthy population (Denisow and Denisow-Pietrzyk, 2016). Recent advances in research, literature highlighted that honey has potential biological activities with promising health promoting properties (Muhammad et al., 2016).

2. Types of honey

There are about 320 different varieties of honey originating from various floral sources. The flavor, color, and odor of a specific type of honey are depending on the various liquid sources of the flowers and plants visited by the honey bee. Assorted types of honey are comparable in terms of temperature, rainfall and seasonal and climatic changes. Honey color ranges from light brown to dark brown depending on where the honey bees buzzed (<http://www.honeyo.com/types.shtml>).

3. Biological bioactive compounds

Honey has various essential biological bioactive compounds including vitamins "A (Retinol), Vitamin E (Tocopherol), Vitamin K (Anti-Haemorrhagic Vitamin), Vitamin B1 (Thiamine), Vitamin B2 (Riboflavin), Vitamin B6, Niacin, Vitamin C (Ascorbic acid), Panthothenic acid and phenolics, flavonoids and fatty acids" (Bogdanov et al., 2008; Muhammad et al., 2015), "cinnamic acid, hydroxybenzoic acid, octadecanoic acid, ethyl ester and flavonoids". Moreover, it contains apigenin, pinocembrin, acacetin, abscisic acid and ferullic acid" (Marghitas et al., 2010; Muhammad et al., 2014). Furthermore, some amino acids of physiological significance are arginine, cysteine, glutamic acid, aspartic acid and proline (Qamer et al., 2007). Honey contains various flavonoid, phenolic, amino acid, protein, ascorbic acid and carotenoid contents and antimicrobial and antioxidant properties according to their weather and geographical conditions (Alvarez-Suarez et al., 2010a, b). The presence of these active compounds provides better understanding of the possible biological role of honey.

4. Antioxidant properties

The word "oxidative stress" defines the inadequate balance between free radicals and antioxidant protective activity

(Bogdanov et al., 2008). Antioxidant is an element that can inhibit the oxidation of other molecules. Oxidation is a biochemical reaction that generates free radicals to chain reaction that may harm the cells, tissues and ultimately the physiological functions. Antioxidants such as vitamin C terminate the chain reactions to protect the body from free radicals. To balance the oxidative state, human body maintain complex systems of overlapping antioxidants. The food containing antioxidants have been shown to improve the health. The literature suggests that honey contains potent anti-oxidative agents. The role of honey also depends on its concentration and its geographical origin. As an antioxidant, honey has numerous preemptive properties against many clinical conditions such as inflammatory disorders, coronary artery diseases, neurological worsening, aging and cancer. Increase in phenolic compound in honey provides antioxidant property (Kishore et al., 2011). The substances such as polyphenols and phenolic acids found in honey vary according to the geographical and climatic condition; for example, flavanol kaempferol can be found in rosemary honey and quercetin in sunflower honey (Akan and Garip, 2011).

Alvarez-Suarez et al. (2012) determined the role of phenolics from monofloral honeys on human Red Blood Cells (RBCs) membranes against oxidative damage. The results show that honey constrains RBCs oxidative damage most probably due to its assimilation into cell membrane and capability to enter and reach at the cytosol. Honey contains appropriate antioxidants which are responsible for biological activity, defense and increase RBCs functions.

5. Antimicrobial activity

In modern medicine the therapeutic use of honey requires that it must exhibit consistent and standardized antimicrobial activity. Pharmaceutical and biological scientists need to identify the floral species which give anti-microbial characteristics. Honeys contain low pH and high osmolarity combined through the enzymatic assembly of hydrogen peroxide exerts an anti-microbial result (Bang et al., 2003).

The practice of honey in wound dressing is gaining popularity in modern medicine as an outcome of its anti-microbial function (Ismail et al., 2015). Moreover, some specific kinds of honey show broad-spectrum antimicrobial role against antibiotic resistant bacterial pathogens (Blair et al., 2009; Cooper et al., 2002a, b; French et al., 2005). The floral sources are responsible for differences in the type and level of anti-microbial activity (Brady et al., 2004). It is mainly based on the environmental conditions and geographical location of the floral sources (Price and Morgan, 2006).

Julie et al. (2011) found that honey has clinical potential and shows a extensive range of antibacterial activity with an accepted possible therapeutic use. The anti-bacterial action was mainly due to hydrogen peroxide formed by the bee-derived enzyme glucose oxidase. Antibacterial activity of honey is mostly reliant on its peroxide activity and non-peroxide mechanisms. Mohd et al. (2013) reported that, honey has antibacterial impact resulting from overall and non-peroxide activities. There is evidence that honey has required broad spectrum activity against Gram-positive and negative bacteria (Katrina and Calvin, 2014).

6. Honey in cough

Cough is a major concern for all people and is one of the most frequent complaints presented to almost all general physicians. Cough is common among children allied with multi-factorial etio-pathological causes. The occurrence of etiology depends on the age, geographical, environmental, weather and epidemiology conditions. The etio-pathology of cough in pediatric population

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