Medicinal & Aromatic Plants
ISSN: 2167-0412
Moussa, Med Aromat Plants 2012, 1:5
DOI: 10.4172/2167-0412.1000e121
Editorial
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How Honey Acts as an Antioxidant?

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Although it is widely accepted that honey is beneficial to health, thanks to its antioxidant properties among all of its beneficial aspects. Explanation(s) remain obscure, and the mechanism by which it acts also so far remains to be elucidated. The antioxidant activity of honey has been extensively studied, but there are remarkable discrepancies in the published data. The main cause and far from being negligible is that honey is a very complex mixture containing a number of ingredients involved in "oxidant/antioxidant" physiological processes (hydrogen peroxide, nitrite, nitrate, glucose, glucose oxidase, iron, copper, chlorine, iodine, catalase, tyrosine, tryptophane, arginine, flavonoides, phenolics acids, Maillard reaction products, its pH is not stable, etc…). Till recent days, there was no standardized method to assess this property.

Beretta et al. [1] proposed a standard analytical platform for the reliable assessment of the antioxidant activity of honey. Significant correlations were recorded among the results of the different methods used by the researchers. Principal component analysis grouped the analyzed samples according to their antioxidant power and phenolic content. The authors emphasized the use of combined methods to either foresee or to confirm the health benefits of honey in relation to their antioxidants´ concentration.

Catalysis of the formation of free radicals from hydrogen peroxide (the Fenton reaction) iron in excess is believed to generate oxidative stress, and to induce and amplify lipid peroxidation reactions, leading to extensive oxidative damage to biomolecules [2-4].

According to Bunting [5] honey chelates and deactivates free iron, which would otherwise catalyse the formation of oxygen free radicals from hydrogen peroxide. However Alvarez-Suarez et al. [6] found that all the Cuban honeys (85 monofloral honeys) studied generate the hydroxyl radical to variable extents, upon addition of Fe2+ to the honey solution via Fenton-like reactions. A study by Henriques et al. [7] demonstrated that only the well-known manuka honey did not produce any hydroxyl radicals via the Fenton reaction and that even the honeys that generate hydrogen peroxide and free radicals through the Fenton reaction such as pasture honey also have an antioxidant activity.

However, directly measuring the ability of food products to sequester iron would not provide biologically useful information because chelation of iron does not always make it incapable of catalysing the Fenton reaction [8]. A strong correlation between honey phenolic content and antioxidant activity has been documented [1,9-14].

Nevertheless, these tests were just based on chemical reactions between honey and artificial free radicals and have no similarity with biological systems, but it is important to be aware that the bioavailability of dietary polyphenols is critical to realising their health benefits. Manach et al. [15,16] reported that polyphenol bioavailability is dependent upon many variables including gut absorption, glucuronide excretion to the intestinal lumen, microbiota metabolism, liver and gut metabolism, plasma kinetics, a variety of metabolites in the bloodstream, bonding to albumin, cell assimilation and metabolism, accumulation in tissues and bile, and urinary excretion. Data in a study by Schramm et al. [17] on buckwheat honey support the concept that phenolic antioxidants from processed honey are bioavailable, and that they increase antioxidant activity of plasma. It can be speculated that these compounds may augment defenses against oxidative stress and that they might be able to protect humans from oxidative stress.

In addition to polyphenols, other constituents are known to contribute to honey's antioxidant effect. These include vitamins (C and E), enzymes (catalase, peroxidase and glucose oxidase), carotenoids and products of the Maillard reaction [11,18]. Many honey components, particularly the flavonoids and phenolic acids, have been shown to contribute significantly to the antioxidant capacity. However, when separated from honey and tested in in vitro systems, they produce only a portion of the total antioxidant activity of honey. These results led to the conclusion that several antioxidants may act synergistically in honey [11].

It has been showed by Alvarez [19] that the reduction of proteins during honey storage was caused, partially, by the protein complexation with phenolics. Honey melanoidins are multi-component polymers consisting of protein–polyphenol–oligosaccharide complexes. On another hand, a direct interaction between polyphenols and melanoidins resulted in a loss or gain of function for melanoidin antioxidant activity. Depending on the initial concentration of melanoidins in unheated honeys, heat-treatment either caused an accelerated formation of high molecular weight melanoidins and an increase in the radical scavenging activity (light and medium honeys) or the degradation of melanoidins and the reduction in radical scavenging activity (dark honeys). This study led to a view of honey melanoidins as high molecular weight multi-component macromolecules possessing antioxidant activity [20,21]. Last three studies seem very plausible results because they establish a link between the different assumptions made by different researchers.

This editorial has no pretension to lift the curtain on the mystery of the mechanism of antioxidant activity of honey; a book would not be enough. Other numerous studies are necessary, but they must be conducted in vivo to avoid the artificial phenomena.

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Received March 05, 2012; **Accepted** March 09, 2012; **Published** March 12, 2012

Citation: Moussa A, Saad A, Noureddine D (2012) How Honey Acts as an Antioxidant?. Medicinal Aromatic Plants 1:e121. doi:10.4172/2167-0412.1000e121

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