

Honey Like Component of Functional Food

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Abstract

Honey has been used since ancient times as part of traditional medicine. Several aspects of this use indicate that it also has functions such as antibacterial, antioxidant, antitumor, anti-inflammatory, antibrowning, and antiviral based on the components. Biological activities of honey, and other bee products (propolis, bee bread and royal jelly) are mainly attributed to the phenolic compounds such as flavonoids. Flavonoids have been reported to exhibit a wide range of biological activities, including antibacterial, antiviral, anti-inflammatory, antiallergic, and vasodilator actions. In addition, flavonoids inhibit lipid peroxidation, platelet aggregation, capillary permeability and fragility, and the activity of enzyme systems including cyclo-oxygenase and lipoxygenase. The present study demonstrates that honey phenolic compounds are partially responsible for honey antioxidant activity, displaying the relevance of honey as both healthy foodstuff and source of antioxidant. Functional foods are an emerging field in food science due to their increasing popularity with health-conscious consumers.

Keywords: functional food, honey, health, propolis

1. Introduction

The present trends in food science and nutrition are based on the concept that a healthy alimentation is the premise of a healthy and active body, with higher life expectancy. Even more, the nutritionists recommend a varied and equilibrate diet in all active principles needed by the human body. As result, the consumers are more and more interested in the benefic effects of the food to the health, appreciating qualities that overcome the nutritive value and the organoleptic properties of foods. This qualitative advantage is assured by the functional foods. A functional food is a part of the everyday diet and contains one/ more components with have been proved to have benefic effect over the physiological functions of the organism.

According to the official statistics, the honey consume rate in Romania is rather the lowest in Europe. Realization of functional food from bee

products would increase the interest for consumers towards bee products [1].

In the framework of this review it is valorized the nutrition and therapeutically potential of bee products for elaboration of experimental models and innovative technologies for creation of functional foods.

The importance of nutritional value of foods was generally accepted after demonstrating that a monotonous feeding behavior can lead to shortage in essential nutrients and development of deficiency disorders (e.g. avitaminose like beriberi, pellagra, scurvy). In modern world the incidence of chronic diseases such as obesity, hypertension, diabetes, atherosclerosis and colon cancer increased significantly in the last years and there are indications that these developments have been influenced by changes in food habits of preparation steps. In reaction to these recent developments in the nutrition area, the food industry started with the production of foods containing a suitable amount of bio-active

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compounds which significantly reduces the disease risk (Figure 1) [2]. The bee products are

recognized since antiquity as very valuable nutritive resources.

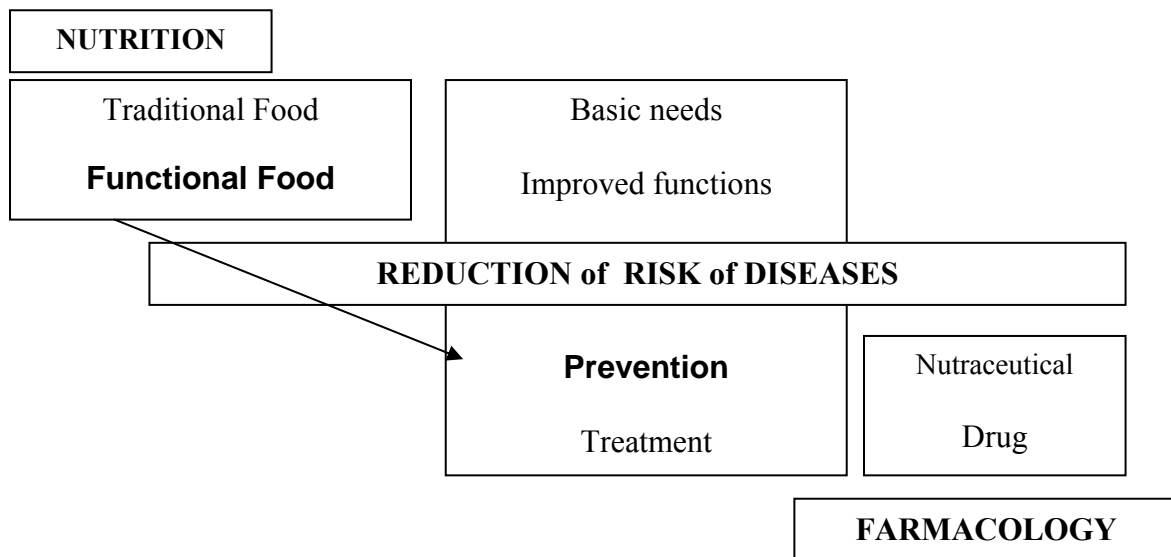


Figure 1. Correlation between nutrition and health/disease

In traditional medicine are found different mixtures from the bee products in various proportions taking into account the increasing of efficacy in various disorders. It's the moment of scientific evaluations of these preparations and their values for health. Also, the propolis and honey are also used with success in modern milk based functional foods (yogurts with *Bifidus esensis*).

The concept of the functional food is a relatively new one, that was born in Japan (functional food market surpassed 12 billions dollars in 2003), being developed in USA (sells over 10 billions Euro) and Europe (10 billions Euro). This concept presumes that the food or its components to present a potential benefices in what it concerns the improving the health of the organism and reducing the risk of disease. The proof of the public interest of the field of the functional foods is the fact that the EU legislation is actualized periodically with the rules regarding the quality and the nutrition requests of the functional foods. As a consequence of these rules, the research directions in the academic environment have focused on the new sector and till present there are, periodically with the rules regarding the quality and the nutrition requests of the functional foods. As a consequence of these rules, the research directions in the academic environment have focused on the new sector and till present

there are many research projects in the framework of the FP7 competitions, having the key words *functional foods* or *novel foods*. Also, there are in EU many advertising campaign for increasing the knowledge level of populations regarding to a healthy nutrition and over the responsibilities of the chosen diet. The bee products although are natural and very little processed – compared with other bee products are very little used in the daily diet.[3]. It's recognized at the national level a low level consumption in Romania of honey/inhabitant (<200g/inhabitant/year). The cultural tradition specific to us recommends the usage of these products only in case of disease. Due to the rich content in the active principle (essential amino acids, vitamins, phenol acids, flavonoids, pigments, mineral salts) the bee products may play an important role for improving the immunity state, in maintaining the health of the state and may participate with success at fortification of the weaken organisms. The special category from the children, pregnant women (increasing organisms), sportsmen (high physical effort), older age with chronically problems that can take profit of the functional foods from bee products.

2. Nutritive and therapeutically value of honey for functional food

It is given by their varied composition and is being known that honey, pollen, beebread and royal jelly are a valuable source of nutritive

principles: proteins, saccharides, fats, mineral salts and vitamins, organic acids, hormones. Also biological active compounds like phenolic acids, flavonoids and carotenoids are significantly increasing their therapeutical value by improvement of body's fight ability and degenerative affections like: cancer, arteriosclerosis, cardio-cerebro diseases, immune system weakening, Parkinson disease and Alzheimer, artrites and premature body aging.

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Numerous studies demonstrate that a great number of medicinal and aromatic herbs, as well as fruits and leaves of some berry plants biosynthesize phytochemicals possessing antioxidant activity and may be used as a natural source of free radical scavenging compounds [4].

The majority of these plants are used by the bees to collect honey nectar; consequently plant origin bioactive components can be transferred to honey. Numerous studies reported that a great number of natural compounds possess health-promoting properties. Honey is known to be rich in both enzymatic and non-enzymatic antioxidants, including glucose oxidase, catalase, ascorbic acid, flavonoids, phenolic acids, carotenoid derivatives, organic acids, Maillard reaction products, amino acids and proteins [5,6]. Flavonoids pinobanksin, pinocembrin, quercetin, chrysin, galangin, luteolin and kaempferol were reported in honey [6,7] while pinocembrin, pinobanksin and chrysin are characteristic flavonoids of propolis; these flavonoids were determined in the most previously analyzed European honey samples [2].

Honey is a functional food with unique composition (4-5% fructooligosaccharides with prebiotic function), with proved antimicrobial effects and bifidogenic effects. Since long time ago it has been established that regular honey

consumption is helpful in prevention of liver diseases, cardio-vascular and gastro-intestinal.

It was reported that the composition and antioxidant capacity of honey depend on the floral source used to collect nectar; seasonal and environmental factors, as well as processing may also have an effect on honey composition and antioxidant activity [2,4].

Some reports showed possible correlations between floral origin and flavonoid profiles.. Predominance of some individual components or a group of compounds in honey is a promising marker for the determination of honey botanical origin. For example, the flavanone hesperitin can be used as a marker for citrus honey; 8-methoxykaempferol was the main compound in rosemary, luteolin in lavender and quercetin in sunflower honey. In general, higher antioxidant capacity was found for darker honey samples [2,5,7]. Honey color depends on the potential alkalinity and ash content, as well as on the antioxidatively active pigments, such as carotenoids and flavonoids [3,7,8,9]. The antioxidant properties of honey were tested in ground turkey [10] and turkey breast meat [10,11] to protect against lipid oxidation, in fruit and vegetable homogenates to inhibit enzymatic browning [4] and in living organism to retard biologically destructive reactions [8,12,].

The composition of active components in plants depends on various factors, particularly plant bio and chemotype and climatic conditions. Consequently, it can be reasonably expected that honey properties from different locations should be different.

Honey production in Romania has very long traditions tracking to ancient times; however, its composition and bioactive properties until now have not been studied more comprehensively. The major purpose of this work was to evaluate the radical scavenging activity of different botanical origin Romanian honey samples and some other bee products. Although regarded as a first step in characterization of Romanian honey and other bee products this study is expected to expand existing knowledge on biological properties of honey and beebread and to assist in more focused design of further research, e.g. aiming at more specified applications of honey and other bee products as natural **remedies and/or functional food ingredients**.

3. Food Industry

The functional food industry, consisting of food, beverage and supplement sectors, is one of the several areas of the food industry that is experiencing fast growth in recent years. It is estimated by BCC Research that the global market of functional food industry will reach 176.7 billion in 2013 with a compound annual growth rate (CAGR) of 7.4%. Specifically, the functional food sector will experience 6.9% CAGR, the supplement sector will rise by 3.8% and the functional beverage sector will be the fastest growing segment with 10.8% CAGR. This kind of growth is fueled not only by industrial innovation and development of new products that satisfy the demand of health conscious consumers but also by health claims covering a wide range of health issues. Yet, consumer skepticism persists mainly due to the fact that benefits associated with consuming the products may be difficult to be detected. The industry suggests the establishment of a health claim regulating agency, which may increase consumer confidence. Strict examination of some of the functional food claims may discourage some companies from launching their products.

4. Health claims

Consumers are becoming interested in **safety and security issues** of every food product. Further research will be made on studying the mechanism of active principles effects over human system. Questions are arising whether they act as singular components or they may potentate each other leading to synergistic effects. Therefore, dietitians recommend healthy food for every individual (either young and growing, either old and affected by chronic diseases). By the time consumers become more and more aware of beneficial aspects of functional foods over their own health, the market value of functional foods and of their components will become higher and higher. Functional food products typically include health claims on their label touting their benefits: for example: "Cereal is a significant source of fiber. Studies have shown that an increased amount of fiber in one's diet can decrease the risk of certain types of cancer in individuals." [13]. Some countries, such as Canada, Sweden, and the United States, have specific laws concerning the labeling of such products. In the United States, the kinds of claims which are allowed are overseen and regulated by the Food and Drug

Administration (FDA). However, some claims will fall outside of the purview of the FDA and be accompanied by the disclaimer: "These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure or prevent any disease." Food supplements are harmonised within the European Union (EU). They are analysed beforehand and approved by the European Food Safety Authority (EFSA). The Commission is also responsible for establishing purity criteria for these substances **Functional foods have not as yet been defined by legislation in Europe.** Generally, they are considered as those foods which are intended to be consumed as part of the normal diet and that contain biologically active components which offer the potential of enhanced health or reduced risk of disease. Examples of functional foods include foods that contain specific minerals, vitamins, fatty acids or dietary fibre, foods with added biologically active substances such as phytochemicals or other antioxidants and probiotics that have live beneficial cultures. As interest in this category of foods has grown, new products have appeared and interest has turned to the development of standards and guidelines for the development and promotion of such foods. Such a disclaimer typically accompanies supplements rather than foods, but since the definition of functional food is still evolving and somewhat amorphous, a functional food may find itself bearing the warning. The term "oxidative stress" describes the lack of equilibrium in the organism between the production of free radicals and the antioxidant protective activity. The protection against oxidation is thought to prevent some chronic diseases. The oxidative modification of the lipoproteins is considered to be an important factor for the pathogenesis of arteriosclerosis.

Honey has been found to contain significant antioxidant activity including glucose oxidase, catalase, ascorbic acid, flavonoids, phenolic acids, carotenoid derivatives, organic acids, Maillard reaction products, amino acids, proteins [15]. The main antioxidants seem to be the phenols and the Maillard products named melanoidins.

There is a significant correlation between the antioxidant activity, the phenolic content of honey and the inhibition of the *in vitro* lipoprotein oxidation of human serum. It was found that honey intake caused a higher antioxidative effect

in blood than the intake of black tea, although its in vitro effect measured as ORAC activity was five times smaller than that of black tea .

Generally, the darker the honey, the higher its phenolic content and its antioxidative power. Further, in a lipid peroxidation model system buckwheat honey showed a similar antioxidant activity as 1 mM α -tocopherol. Also, the influences of honey ingestion on the antioxidative capacity of plasma was also tested.

Anti-inflammatory effects of honey in humans were studied by Al Waili and Boni after ingestion of 70 g honey. The mean plasma concentration of thromboxane B(2) was reduced by 7%, 34%, and 35%, that of PGE(2) by 14%, 10%, and 19% at 1, 2, and 3 hours, respectively, after honey ingestion. The level of PGF(2 α) was decreased by 31% at 2 hours and by 14% at 3 hours after honey ingestion. At day 15, plasma concentrations of thromboxane B(2), PGE(2) and PGF(2 α) were decreased by 48%, 63% and 50%, respectively.

The postulated mechanism of action is by preventing the formation of free radicals released from the inflamed tissues. The reduction of inflammation could be due to the antibacterial effect of honey or to a direct antiinflammatory effect. A support of the latter hypothesis was shown in animal studies, where antiinflammatory effects of honey were observed in wounds with no bacterial infection.

Other important honey effects on human digestion have been linked to honey oligosaccharides[16]. These honey constituents has a prebiotic effect, similar to that of fructo oligosaccharide. The oligosaccharide panose was the most active oligosaccharide. These compounds exert the prebiotic effect in a synergistic mode of action, rather to one of individual components, leading to an increase of bifidobacteria and lactobacilli.

It has been shown that fresh honey has probiotic *Bifidus* and *Lactobacilus* bacteria. However these probiotic bacteria are viable only in fresh honey, about 2-3 months old.

Due to different proportions of the possible sources, nectar and/or honeydew coming from a great variety of plants, no honey is completely the same as another one.

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