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Research Article

THE IMPORTANCE OF BOTANICAL ORIGIN OF BEE PRODUCTS

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ABSTRACT

Bee products are recognized in traditional and modern medicine as active agents in some biological processes. Bee products have functional properties and promote human health, and such properties depend largely on the floral source. Their botanical origin is matters of great interest worldwide since the floral source of bee products plays an important role on their biological properties.

INTRODUCTION

Therapeutic techniques with bee products, collectively known as apitherapy, of which several have appeared in recent years, are effective in the prevention and treatment of many diseases. Natural products such as honey, pollen, propolis and royal jelly have a high antioxidant capacity.

Many carbohydrates, vitamins and coenzymes, polyphenol, aroma compounds, phytosterols, terpenes, terpenoids, aliphatic compounds and volatile compounds such as fatty acids collected from nature and put into concentrated form by honey bees are found in these natural products (Mercan *et al.,* 2007).

Since plants have the capacity to produce unlimited numbers of aromatic and aliphatic compounds (Peterson *et al.,* 1998), the honey made from nectars and pollens collected from plants by honey bees contains high levels of polyphenolic substances.

Almost all apitherapy products are rich sources of vitamins A and C, phenolic acids, flavonoids and anthocyanins with strong antioxidant effects, B vitamins (B1-B12) used in metabolism regulation and with coenzyme functions and metal ions such as Na, K, Ca, Mg, Fe, Cu, Zn, Se, F and CI and trace elements (Ferreres *et al.,* 1993; Challem *et al.,* 1994; Leja *et al.,* 2007; Viuda-Martos *et al.,* 2008).

Regular consumption of honey, pollen, propolis and royal jelly, all natural products with high antioxidant properties, leads to an increase in the body's antioxidant capacity. Eraslan *et al.* (2009) used pollens in the treatment of changes caused in rats by carbaryl, an agricultural pesticide, and monitored MDA concentrations and enzyme levels in the blood, liver and heart. They determined that pollens reduced the negative effects of the pesticide.

Pollen has been reported to be effective against and prevent the growth of salmonella, Staphylococcus spp., *E. coli* and *Bacillus anthracis* (Grecianu *et al.,* 1976). Pollen has a healing effect on intestinal infection. From that point of view, pollens 'police' the intestine. The phenolic acids and flavonoids in pollen extracts have been shown to eliminate superoxide anions and lipid peroxide radicals and to stabilize oxidizing agents by establishing hydrogenation or complex structures in events associated with free radicals (Silva *et al.,* 2006). Basim *et al.*(2006) reported that methanolic extracts of pollen and propolis exhibit antibacterial activity, Medeiros *et al.* (2008) that phenolic pollen extracts exhibit an anti-allergenic effects in rats and Nasuti *et al.* (2006) that they prevent gastric lesions.

Moreira *et al.* (2008) examined the antioxidant properties of pollens and propolis collected from two different regions of Portugal and subjected pollens to microscopic analysis. They reported that propolis with a high antioxidant capacity also had a high pollen count. Almaraz-Abarca *et al.* (2007) showed that ethanolic extracts of pollen belonging to Mexican flora inhibited lipid peroxidation and that pollen extracts were rich in calcons at HPLC analysis.

Aliyazicioglu *et al.* (2013) determined high levels of quercetin, benzoic acid, caffeic acid, ferulic acid and coumaric acid in propolis specimens, but no catechin. They found that

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methanolic extracts of propolis were effective against tested bacteria.

Propolis has an immunity-enhancing property. Propolis is a wide-spectrum gland-activating natural antibiotic (Ghisalberti 1979). Its effect has been found to be 100 times greater than that of familiar antibiotics. With its antimicrobial and wide-spectrum antibiotic property, propolis is effective against bacteria, viruses, fungi and even penicillin-resistant streptococci. Since, unlike antibiotics, it does not form resistance it can be used with safety. One milligram of propolis is equivalent to approximately 20 mg of penicillin. In addition to preventing infections, propolis also removes them from the body. The reason why propolis has such a powerful effect against viruses may be the protective effect of the bioflavonoids in its compounds.

Honey has antibacterial properties (Aliyazicioglu *et al.,* 2015). A high sugar concentration, hydrogen peroxide and a low pH value constitute honey's antibacterial factor. This factor is based on the delicate interaction of several factors. If honey is concentrated with nothing added, then it exhibits antibacterial properties with a high sugar level of approximately 76%. A bacterium exposed to such an environment will lose water due to osmosis and become desiccated. When honey is diluted, the resulting acidic pH prevents bacterial growth.

Bacterial growth is also prevented in another way. When diluted with water, the enzyme glucose oxidase ready present in unprocessed honey affects the glucose in the environment and produces the gluconic acid and hydrogen peroxide contained in it. Since hydrogen peroxide is a very powerful antibacterial substance its effect again increases with the vitamin C found in honey. Another antibacterial property stems from the flavonoids, polyphenols and glycosides in honey. The amount of these compounds present in honey varies depending on the source of nectar. Additionally, the presence of a high level of potassium also contributes to the antibacterial effect. However, methylglyoxal and defensin-1, an antimicrobial peptide, have recently been identified as important antimicrobial compounds (Paulus Kwakman *et al.,* 2012).

The methyl syringate that represents 70% of the phenolic material in New Zealand Manuka honey (*Leptospermum scoparium*) (Weston *et al.,* 2000), the ellagic acid in heather, the hydroxycinnamic acids in chestnut honey (Andrade *et al.,* 1997), the quercetin in sunflower honey (Martos *et al.,* 2001), the 2.5-dihydroxyphenylacetic homogentisic acid in strawberry tree honey (Cabras *et al.,* 1999), the flavanone hesperidin in lemon flower honey (Ferreres *et al.,* 1994) and the ellagic acid and abscisic acid in eucalyptus honey (Yao *et al.,* 2004) are compounds responsible for honeys' biological activities, and honeys have also been reported to be capable of use as markers. Royal jelly is a valuable food produced by worker bees It contains proteins, amino acids, organic acids, sterols, phenols, sugars, minerals, antibacterial and antibiotic components (Viuda-Martos *et al.,* 2008).

Pharmacologically, it possesses many effects, such as expanding the blood vessels and lowering blood pressure, preventing tumors, overcoming fatigue, anti-allergic, antioxidative and antibacterial properties and stimulating the immune system (KaraçalTemamoğulları *et al.,* 2006)

10-dydroxy-delta (2)-decenoic acid is a fatty acid found in royal jelly and exhibits antibiotic activity against several bacteria and fungi (Blum 1959). Jelleines I, -II and -III exhibit antimicrobial activity against gram-positive and gram-negative bacteria and yeasts, while no such effect has been observed in jelleine IV (Fontana *et al.,* 2004). The protein royalisin in royal jelly exhibits antibacterial effects against gram-positive bacteria (*Lactobacilushelveticus, Clostridium, Corynebacterium, Leucnostoc Stafilococcus, Streptococcus* spp.*)*, but not against gram-negative bacteria (Fujiwara *et al.,* 2004).

Different types of honey vary considerably in terms of their antimicrobial effects.Differences in honeys with different floral origins lead to variations in acidity, osmolarity, and $H_2O_2$and other compounds. Manuka honeys from New Zealand have been reported to possess quite powerful antibacterial activity (Weston *et al.,* 1999; Weston 2000). One study showed that peroxy carboxylic acids are more powerful antimicrobial agents than hydrogen peroxide and exhibit antimicrobial activity in a low pH environment (pH:3.9) (Weston 2000).

The antimicrobial activity of honey is thought to be associated with its acidic structure, H_2O_2 produced enzymatically in honey, and osmolarity. The acidic structure of honey (pH: 3.3-4.9) is reported to originate from tartaric acid, formic acid, succinic acid, oxalic acid, acetic acid, citric acid, fumaric acid, gluconic acid, α-ketoglutaric acid, lactic acid, maleic acid, pyruvic acid and pyroglutamic acid (Sahin *et al.,* 2005). Mundo*et al.* (2004) reported that honey can inhibit bacterial growth because of its high sugar content.

Studies agree that physicochemical parameters such as pH, proline, enzyme activity, water and sugar content, diastase activity, free acidity and mineral content can be used for the characterization of uni floral honeys (Sancho *et al.,* 1992; PersanoOddo *et al.,* 1995; Serrano *et al.,* 2004). Serran o *et al.* (2007) reported that Andalusian (Southern Spanish) honeys' invertase and diastase activity varies greatly depending on the plant source (Helianthus annuus L, Citrus spp., Eucalyptus spp., Rosmarinus officinalis).

Verzera *et al.* (2001) investigated five different honey specimens and identified a large number of compounds in these using SPME-GC/MS techniques to analyze aroma compounds. Each type of honey was seen to have a typical aroma compound composition, and the same types of honey originating from different geographical areas were observed to have a similar chromatographic profile. In addition, a large part of the compounds identified were present in large quantities in each type of honey. The authors stated that various aroma compounds could be used as a criterion for determining the floral origin of honeys (Verzera *et al.,* 2001).

Propolis effectively controls the bacterium *Staphyloccus aureus,* (often associated with atopic dermatitis and food poisoning), including the antibiotic-resistant MRSA strain, and *Mycobacterium tuberculosis, Escherichia coli*, *Salmonella* and *Helicobacter pylori,* which are frequently associated with gastric ulcers. Propolis has also been shown to be effective in the treatment of several antibiotic resistant strains of these land other bacterial species. Propolis is also promising in the treatment of upper respiratory tract infections. It significantly lowers the incidence of these infections in addition to lowering recovery time. Propolis exhibits a number of antibacterial effects and interferes with bacterial cell division and metabolism. In terms of chemical composition, propolis varies widely between locations. These differences also appear to apply to propolis from very different geographic regions. Propolis has also been reported to exhibit antioxidant, anti-inflammatory, antitumor, anti-ulcer, hepatoprotective and immunostimulatory effects (Aliyazicioglu *et al.,* 2013).

Bees from varying global locations will use different flora for propolis. Analysis of propolis from Brazil has shown a very different chemistry to that of European propolis. Antibiotic activity is quite similar in both types, however. Propolis' antibiotic properties suggest that it can be used as a natural and safe agent for the preservation of food and as a disinfectant. The wide range of its beneficial effects suggests that propolis can also potentially be used as an agent to assist healing and tissue regeneration.

Propolis contains numerous antibiotic compounds. These, in turn, vary in proportion and type between different locations, times and hives. Propolis would seem to be a powerful anti-pathogen agent, because pathogens will find it difficult to acquire resistance to a chemical combination that is both complex and constantly changing, compared to just one isolated drug. Propolis extracts have also been reported to exhibit a strong synergistic effect in combination with antibiotics and antimicrobial drugs, and especially those that compromise bacterial protein synthesis. This means that while propolis can act as a stand-alone antibacterial agent, in combination with antibiotics, the dosages required can be reduced, thus lowering the risk of antibiotic-related side-effects, as well as the possibilities of drug resistance. Propolis thus acts as a far more complex and multifaceted antibacterial agent than any prescription antibiotic or drug, suggesting that it make have a positive contribution to antibacterial therapy.

CONCLUSION

In conclusion, bee products such as royal jelly, pollen, honey, bee venom and honey are used in the fields of medicine, drugs and cosmetics and are becoming increasingly important all the time. The compound and physicochemical properties of bee products may vary according to the species of flower visited by bees, region, harvest time and climatic conditions. Totally naturally obtained honey compounds may vary by region and species.

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