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Overview on Bee products in Skin care and Hair care

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ABSTRACT

Bee products, such as honey, propolis, royal jelly, bee pollen, bee bread, bee venom, and bee wax, have been used for centuries in traditional medicine for their various health benefits. In recent years, bee products have attained popularity in the cosmetics industry due to their potential benefits for the skin and hair. Bee products can be used in several cosmetics, including creams, serums, masks, shampoos, and hair conditioners. They can be used as ingredients in formulations or as independent products. This narrative review is designed to describe the current uses of bee products in skin and hair care.

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Abbreviations

MRJP1, Major royal protein 1.

Introduction

Bee products have received more and more attention due to their pharmaceutical and cosmetics properties to treat several skin and hair disorders, which offer important benefits in the skincare and hair care sectors. Interestingly, bee products such as honey, propolis, bee pollen, bee bread, royal jelly, bee wax, and bee venom have been used since ancient times for biological, nutritional, and therapeutic significance. The bioactive contents vary from one bee product to another which has a complex chemical composition [1-4]. Generally, diversification of the chemical composition of these products depends on the botanical composition, geometrical origin, time of collection, and environmental conditions [2]. Honey is a functional substance used as a humectant, skin conditioning, and flavoring. Also, honey can be used as cosmetics ingredient in shampoos for highlight hair. On the other hand, bee wax is suitable for all skin type and used as emollient, emulsifying, film forming and perfuming. Additionally, bee pollen, propolis and royal jelly are used as skin conditioning. Finally, bee venom is used as astringent, and skin conditioning particularly for mature skin [5,6].

Honey

Honey is a supersaturated solution of carbohydrates produced from the nectar of plants (honey blossom), secretions of living parts of plants, or excretions mediated by plant-sucking insects such as aphids (honeydew honey) or from blends of them [7, 8]. Moreover, the chemical composition is different between honeydew and blossom honey [9]. Mostly, the chemical composition of honey consists of sugar: fructose, glucose, and sucrose; amino acids: aspartic acid, asparagine, glutamine, glutamic acid, and proline; organic acids: acetic, butyric, citric, formic, fumaric, and glyoxylic acids; water-soluble vitamins; ascorbic acid (C), thiamine (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), biotin (H) and folic acid (B9). The majority of minerals are potassium (K), chlorine (Cl), sulfur (S), sodium (Na), calcium (Ca), iron (Fe), and manganese (Mn). Also, trace elements such as copper (Cu), chromium (Cr), and others. Another a set of compounds are enzymes such as α-glucosidase (invertase), α-amylase and β-amylase (diastase), glucose oxidase, catalase, acid phosphatase, proteases, and esterases; Major royal protein 1 (MRJP1) which is the main protein; polyphenols and flavonoids as the phytochemical compounds [10, 7].

Honey plays an important role as an anti-oxidant, anti-microbial, anti-inflammatory, wound healing, anti-cancer and anti-diabetic [1, 10]. Also, it is suitable for cosmetic products as a humectant, skin-conditioning agent, decoloring agent [11], a keratolytic agent to improve radiance and treat wrinkles [12], and hair conditioner and lubricates the hair [13]. Moreover, it has positive effects on acne, skin rashes, herpes, contact dermatitis, psoriasis, and diaper dermatitis [1, 14].

Propolis

Propolis or bee glue is a resinous substance collected by honeybees (Apis mellifera) from various plant sources [15]. The word propolis is derived from the Greek language and means "pro"= defense and "polis"= community, a substance in defense of the hive [16]. Generally, propolis is soft, flexible, and sticky in warm and hard and breakable in cold weather, so it is used to fill gaps, seal cracks, close holes, keep moisture and temperature stable and build the beehive [17]. Its color varies from brown, to red and green depending on its botanical source [10].

Also, the chemical composition of raw propolis and its biological properties vary according to geographical location and different plant sources. So, it includes 50% plant resins and balsam, 30% wax, 10% essential and aromatic oils, 5% pollen, and 5% others. Moreover, over 300 biologically active constituents have been identified in propolis including phenolic acids and flavonoids. In addition to other constituents, there are others such as terpenes, lipid wax, bee wax, vitamins, proteins, amino acids, minerals, and sugars [18]. Propolis is used as aqueous and ethanolic extracts for skin disorders treatment and as oral therapy for obesity, diabetes, cancer, and other conditions [1, 19].

Traditionally, propolis extracts rich in active compounds are obtained using soaking, shaking, and extraction with different solvents such as water, acetone, chloroform, hexane, and methanol [10]. In particular, propolis is useful as an anti-cancer, anti-inflammatory, and anti-microbial, stimulating skin tissue growth and wound healing [20, 21]. Moreover, the high contents of phenolic acids and flavonoids of propolis are responsible for anti-aging and anti-oxidant effects [22].

In cosmetics, aqueous propolis extracts are used as an anti-fungal [1], skin conditioning, and moisturizer [23]. While ethanolic extracts are used as sun blockers in sunscreen formulations and anti-microbial agents in anti-dandruff shampoo formulations [1, 24]. As solid extracts, they have significance in the treatment of hair damage and as an ingredient in lipsticks [1, 25]. Interestingly, propolis has a high sensitization capacity due to the presence of the ester of caffeic acid [26].

Royal jelly

Royal jelly is a creamy, yellowish-white substance secreted from the mandibular and hypopharyngeal glands of Apis mellifera (young worker honey bees called nurses). Furthermore, royal jelly is a pungent odor, relatively acidic material with a high buffering capacity [27, 28].

Predominantly, royal jelly is composed of water (60-70 %); proteins such as MRJPs family (the major royal jelly proteins have nine members) (9-18 %); carbohydrates: fructose, glucose, sucrose, trehalose, and maltose (7-18 %); lipids: the free form of organic acid mostly (3-8 %), waxes, phenols, steroids, and phospholipids; minerals (0.3- 3 %). All vitamins in royal jelly are water-soluble vitamins such as thiamine (B1), riboflavin (B2), niacin (B3), and pantothenic acid (B5) (the predominant in royal jelly), pyridoxine (B6), Biotin (B7), ascorbic acid (C), and folic acid (B9) and amino acids [10]. It is noteworthy to mention that the chemical composition of royal jelly is conditioned on the season, geographical origin, regional feeding conditions, and genetic variability [1].

Several pharmacologic investigations have proved that royal jelly has anti-oxidant, anti-microbial, anti-inflammatory, anti-cancer, anti-fatigue, anti-aging, and wound healing activity [28-30]. Moreover, royal jelly is commonly used in cosmetics to regulate skin photoaging [29], skin whitening by inhibiting tyrosinase, moisturizing by retaining water to stratum corneum, depigmenting skin and hair treatments [1, 28, 31, 32].

Bee pollen and bee bread

Bee pollen is floral pollen that has been agglutinated with nectar and honey bee secretions by bees. While bee bread refers to the fermented pollen under anaerobic conditions by Lactobacillus bacteria. The bee bread formation process starts with delivering the collected pollen loads by foraging bees to the hive which use as the source of protein for young bees and larvae [1, 33]. Ancient societies such as Egypt, China, and Rome have used bee pollen for public health and described it as "a life-giving dust" by Egyptians [34, 35, 36].

The chemical composition of bee pollen depends thoroughly on geographical origin, plant source, and climatic conditions [1, 37]. Chemically, bee pollen includes proteins, amino acids, carbohydrates, lipids, carotenoids, vitamins, minerals, and polyphenols. It is worth to be mentioned that flavonoids and phenolic acids control the anti-oxidant activity of bee pollen [38, 39]. Bee pollen differs from bee bread by higher nutritional value, lower pH (3.8- 4.3), fewer fats and proteins, and more lactic acid, and carbohydrates [33, 40, 41].

The anti-oxidant capacity of the bee pollen ranging from the highest one found in Brassica napus and Papaver somniferum to the smallest one from Helianthus annus [42]. Extracts contain valuable constituents of bee pollen that are used for anti-inflammatory, anti-bacterial, anti-fungal, anti-viral, and analgesic effects. The most frequently used solvents for bee pollen extracts were ethanol, water, glycerin, and propylene glycol. Lipid and lyophilized form extracts were also employed [1]. In the last few years, bee pollen and bee bread have been used as dietary supplements [40, 43].

Interestingly, Bee pollen could be used in cosmetics to protect skin from abnormal melanogenesis, spots, melasma, freckles, wrinkles, and other conditions. Bee pollen may also be used as a component of hair treatments in anti-dandruff shampoos and conditioner. The high phenolic content of bee pollen inhibits tyrosinase activity (a key enzyme in melanin synthesis) to reduce hyperpigmentation and prevent UV radiation damage. Sulfur-containing amino acids in bee pollen are responsible for strengthening the hair shaft. Furthermore, bee pollen helps to reduce fungal growth and itching of the scalp and shows moisturizing effects [44].

Bee venom

Bee venom is a typical toxin known as apitoxin. Chemically, it consists of a complex mixture of several bioactive components [45-47] that include peptides such as melittin, apamin, mast cell degranulating, secapin, tertiapin, and adolapin [48, 49]. Also, bee venom include enzymes such as phospholipase A, phospholipase B, hyaluronidase, acid phosphatase, α-glucosidase, acid phosphoesterase, and dipeptidylpeptidase [10, 48, 49].

In medicine, bee venom has potential benefits for some diseases such as Alzheimer, Parkinson, and rheumatoid arthritis. Additionally, bee venom possesses anti-cancer activity and can induce apoptosis in cancer cells [50, 51, 52]. Bee venom has been investigated for its ubiquitous potential use in the treatment of skin diseases. It is worth to mentioning that these effects such as anti-inflammatory, anti-bacterial, anti-viral, anti-fungal and skin diseases such as acne, alopecia, atopic dermatitis, photoaging, psoriasis, wound healing, and vitiligo [53, 54, 55].

Cosmetic applications of bee venom and its components have been promising. Remarkably, bee venom has been shown anti-aging (by reducing skin wrinkles and promoting collagen synthesis) [56], anti-acne [57, 58], and stimulate melanogenesis [59]. Bee venom enhances hair follicle development by inhibiting 5-reductase in female mice [60].

Bee wax

Bee wax is produced by honey bees Apis mellifera in the bee's hives and gathered as a by-product when honey is harvested and purified. The composition of beeswax varies according to the location, types of honeybees, and age of the wax. Primarily, beeswax contains hydrocarbons, esters, free acids, and other compounds [61]. Bee wax is used as an emulsifying agent for cosmetics and medicines to provide plasticity and elasticity [1].

Bee wax exhibits anti-septic, anti-bacterial, anti-fungal, anti-viral, anti-oxidant, and anti-inflammatory activities [62]. Especially in skin care products, bee wax has been shown to treat symptoms such as dermatitis, and psoriasis. Also, it plays an important role in restoring and maintenance of skin barrier [63, 64].

Conclusion

In conclusion, the seven bee products have shown promising results in improving skin and hair health due to their various bioactive compounds. Generally, honey has been found to have moisturizing and wound-healing properties, while propolis has been used in hair damage treatment formulations and as a sun blocker in sunscreen formulations. It is also noteworthy that propolis has a high sensitization capacity due to the presence of the ester of caffeic acid. Royal jelly has been found to have anti-aging and whitening effects, and bee venom has shown potential for promoting collagen synthesis and reducing wrinkles. Also, bee venom enhances hair follicle development by inhibiting 5-reductase in female mice. Bee pollen is a rich source of nutrients that can reduce hyperpigmentation and prevent UV radiation damage. Sulfur-containing amino acids in bee pollen are responsible for strengthening the hair shaft and helping to reduce fungal growth and itching of the scalp. On the other hand, bee wax has been shown to treat symptoms such as dermatitis and psoriasis.

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Conflicts of interest/Competing interests
The authors declare no conflict of interest.

Authors' contributions

AMA collected and sorted the sources. AHA carried out the process of designing the research and the existing figure. While AHG carried out the process of suggesting and writing the review topic.

Ethics approval
Not applicable.

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