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APITHERAPY: A REVIEW OF RECENT CLINICAL RESEARCH IN BEEKEEPING

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ABSTRACT

Honey bees are highly valued socially and commercially due to their honey production and pollination activities. Honey bees produce honey, bee wax, royal jelly, pollen, propolis, and venom. Different honey bee products comprising a variety of sugars, proteins, free amino acids, minerals, trace elements, enzymes, and vitamins with a relatively high caloric value. Natural product research has become increasingly popular in recent years as a means of preventing or treating a variety of medical conditions. Apitherapy is the use of bees or their products as therapeutic or preventative treatments to prevent disease or slow its course. Recent research on the pharmacological action of bee products has revealed a wide range of biological features. Different investigations and clinical trials have demonstrated that bee products can be used to cure a variety of ailments, as well as to maintain healthy balance and equilibrium. Furthermore, bee products are frequently employed in food, cosmetics, and by the pharmaceutical industry in its search for new medications. Apitherapy is now included in several countries alternative and integrative medicine programs. Different recommendations for the use of bee products have been established, and people consume varying amounts of bee products once or multiple times each day. Although we have made significant advances in our understanding of bee products, it is critical that we capitalize on their potential and standardize their use.

Keywords: Honeybee, propolis, bee wax, venom

Introduction

Honey bees are the "golden insects" that make honey and other essential honeybee products. The most well-known honey bee products are honey and bee wax, although pollen, propolis, royal jelly, bee venom, and queen bees are also viable primary bee products. The global use of primary products such as propolis, royal jelly, and bee venom has expanded, owing mostly to their incorporation in cosmetics preparation. Honey contains medical characteristics such as antiseptics and wound healing, whilst propolis is utilized to treat diabetes patients. Furthermore, pollen contains antioxidant qualities, and the anticoagulant and anti-inflammatory characteristics of bee venom are used to treat arthritis and other inflammatory disorders. Honey and beeswax are the most frequently used hive products around the world, offering a variety of functions ranging from local beverage to therapeutic uses (Faqihi and Taha). Bees produce a wide range of bioactive compounds, including honey, propolis, royal jelly, bee pollen, beeswax, and bee venom, which have been utilized for ages to cure a variety of ailments (Al Naggar *et al*., 2021).

Apitherapy is the application of bee products such honey, pollen, propolis, royal jelly, bee venom, wax, and apilarnil to prevent or treat sickness and promote recovery. This may involve the usage of honey, propolis, pollen, royal jelly, and bee venom. Dr. Stefan Stangaciu, editor in chief of the International Federation of Beekeepers' Association, defines apitherapy as "the art and science of treatment and holistic healing through the honeybee and her products for the benefit of mankind and all the animal kingdom" (Hellner *et al*., 2008). Honey was once thought to be

the gods' nourishment, as well as a symbol of riches and happiness. Honeybees generate a delicious syrupy fluid from blossom nectar, which people use as a sweetener and spread (Ahuja and Ahuja, 2010).

Apitherapy differs significantly from the usage of bee products in recognized medical settings. Apitherapists think that bee products can treat most ailments. However, the use of bee products in traditional medicine is restricted to specific conditions where they have demonstrated outcomes equal to or superior to those of normal treatments, such as in the treatment of wounds and burns and as an interesting approach in arthritis.

At the current level of medical science and technology, the state of medical care refers to medical insurance and medical care systems in society, as well as self-health care. As a result, popularizing and promoting apitherapy, which has been used successfully for thousands of years, is valuable because it is a simple, convenient, and readily available technique of self-healing.

History of Apitherapy

- Honey has been used as a wound treatment since antiquity, with Dioscorides (50 AD) mentioning its benefits for sunburn and ulcers. Apitherapy has its origins in ancient Egyptian medicine, which dates back over 6000 years. The Greeks and Romans employed bee products for therapeutic purposes. Hippocrates (460-370 BC), Aristotle (384-332 BC), and Galen (130-200 AD) all suggested honey and bee venom to treat baldness.
- Honey is mentioned in various religious writings, including the Vedas (Hindu scriptures), the Bible, and Quran.
- John Gerard's 'The History of Plant' published in 1597 discusses the medicinal properties of propolis.
- In 1932, Yoannovoitch and Chahovitch treated malignancies with bee venom.
- In 1935, Dr.Bodog F. Beck invented the name "Bee Venom Therapy".
- In 2003, Dr. Christopher Kim patented the first injectable type of bee venom, Apitoxin, in Korea.

Bee products and its use in Apitherapy

Honey

Honey is one of the items generated by bees and has been acquired by humans for centuries. For millennia, it has been used as a sweetener and, due to its medicinal properties, as a medicinal product. This is one of the items, along with royal jelly and propolis, that are classed as functional foods, or foods that have a positive influence on the physiological and psychological state of the body (Viuda *et al*., 2008). Honey contains water, proteins (glucose oxidase and catalase), organic acids (aspartic, butyric, citric, acetic, formic, fumaric, galacturonic, gluconic, glutamic, glutaric, glyoxylic acid), vitamins (particularly vitamin B6, thiamine, niacin, riboflavin, and pantothenic acid), minerals (calcium, copper, iron, magnesium, manganese, phosphorus, potassium, sodium, and zinc), phenolic acids and flavonoids, carotenoids, α-tocopherol, and ascorbic acid) (Przemysław *et al*., 2019).The major sugars in honey are fructose (38%), and glucose (31%). Sucrose, maltose, turanose, isomaltose, maltulose, trehalose, nigerose, cojibiosis, maltotriose, and melezitosis are also present (Gheldof *et al*., 2002; Kamal and Klein, 2011). Nectar honey is high in phenols such as p-coumaric acid, eugenol, ferulic acid, caffeic acid, and flavonoids such pinobanksin, pinocembrin, chrysin, quercetin, apigenin, and naringin (Rybak-Chmielewska, 2007). These are antioxidant chemicals that eliminate free radicals and prevent lipid oxidation (Ferreres *et al*., 1994). Przemysław *et al*. (2019) describe their anti-inflammatory, antibacterial, antiviral, and cardioprotective properties. Honey's antibacterial properties are the result of its complex composition as well as its specific physical and physicochemical properties, which include high osmotic pressure due to the presence of sugars, which limits the growth and multiplication of bacteria and, as a result, the possibility of biofilm formation (Molan, 1992). Furthermore, lysozyme in honey has an antibacterial activity that is enhanced by its combination with ascorbic acid and hydrogen peroxide (Al-Waili *et al*., 2011). Other characteristics of honey include low protein content, a high carbon to nitrogen ratio, a low redox potential, and high viscosity, which limits oxygen solubility and hinders bacterial growth (Patton *et al*., 2006).

It is also used to heal skin wounds and damage by increasing leukocyte inflow to injured tissues, stimulating fibroblasts, and promoting angiogenesis. Another advantage of antibacterial action is that the low pH of honey creates adverse conditions for bacterial development, promoting the healing process (Sell *et al*., 2012). According to researchers, honey inhibits cell proliferation, promotes apoptosis, and alters the cell cycle in a variety of cancers, including cervical cancer cells, endometrial cancer, liver cancer, kidney cancer, colorectal cancer, prostate cancer, and melanoma (Samarghandian *et al.*, 2017). Honey contains antioxidants such as flavonoids, polyphenols,

and vitamin C, which help lessen the risk of cardiovascular disease. There is also scientific evidence that honey has an antidiabetic impact. Recent research has also demonstrated that honey has an anti-cancer impact, causing apoptosis in many types of cancer cells through mechanisms such as mitochondrial membrane depolarization (Nicholson, 2000). Aside from its promising antibacterial activity, honey boosts the immune system and promotes immunocompetence, which may lower the severity of the new coronavirus pneumonia (Lima, 2020).

Bee Venom

Bee venom is produced by two glands located on the sting apparatus of worker bees. It contains a variety of proteins, including melittin, apamin, adolapin, phospholipase A2, hyaluronidase, histamine, dopamine, and protease inhibitors. Venom production begins within two or three days of an adult bee's existence and declines with age. It is a clear liquid that can turn yellow, is odorless, and has a harsh, bitter flavor. This chemical is water-soluble (Ishikawa *et al*., 2008).

Bee venom therapy can be provided in two ways: directly through a bee sting or via a prepared injection. Bee venom produces inflammation wherever it enters the body. The inflammation causes the body to boost circulation to that area and produce anti-inflammatory hormones to alleviate discomfort. Bee venom has long been utilized as a natural treatment for rheumatoid arthritis. Bee venom therapy is the use of live bee stings (or injectable venom) to treat numerous disorders such as arthritis, rheumatoid arthritis, multiple sclerosis (MS), lupus, sciatica, and low back pain (Gupta and Stangaciu, 2005). By injecting bee venom directly to the painful joint, the body's anti-inflammatory response will treat the arthritis joint (Ara *et al*., 2013). Apitoxin is also used to treat skin illnesses such as psoriasis, dermatitis, boils, and eye diseases like iritis and optic neuritis. Bee venom is used to treat skin problems as ointments and creams, and it is also a component of eye drops. Bee venom is also used as subcutaneous injections (Bogdanov, 2014).

Bee Venom Therapy is a typical example of the homeopathic principle, which holds that a substance that causes a disease's symptoms can also heal the sickness. Rheumatic disorders cause swelling, discomfort, and inflammation. A bee sting generates similar symptoms. The sting encourages the immune system to reduce the inflammation induced by the bee venom while also treating the symptoms of rheumatic disease (Gupta and Stangaciu.,2005).

Bee Pollen

Bees collect pollen, which is a fine powder produced by flowering plants. When combined with nectar (and/or honey) and salivary secretions, it serves as the primary food source for the hive. Bee pollen contains proteins (5%-60%), essential amino acids, reducing sugars (13%-55%), lipids (4%-7%), nucleic acids (especially RNA), crude fiber (0.3%-20%), minerals (Ca, Mg, Fe, Zn, Cu, K, and Na), vitamins (provitamin A [β-carotene], vitamin E [tocopherol], niacin, thiamine, biotin, and folic acid), enzymes, phytosterols (β-sitosterol, P-sitosterol, and terpenes), and flavon (Thakur & Nanda, 2020).Bee pollen, as a bioactive substance, is thought to have a variety of therapeutic properties, including antibacterial, antiviral, antifungal, anti-inflammatory, immunostimulatory, hepatoprotective, and anti-cancer properties, as well as antioxidant properties (Denisow and Denisow., 2016).

Bee Propolis

Propolis is a resinous substance gathered by bees from numerous plant sources. It is composed of approximately 50% resin, 30% wax, 10% essential oils, 5% pollen, and 5% miscellaneous chemical substances. It has a lengthy history of application in medicine. Propolis is believed to possess many biological actions such as anti-cancer, anti-oxidant, anti-inflammatory, anti-biotic, anti-microbial, anti-hepatotoxic, and antiseptic (Gokulakrishnaa and Thirunavukkarasu, 2020).

Polyphenols and flavonoids have been found as active components of propolis, and they show medicinal promise and may have applications in the pharmaceutical and food processing industries (Salomao *et al*., 2008). Propolis is said to have immunomodulatory, antibacterial, fungicidal, anti-inflammatory, healing, analgesic/anesthetic, and anticarcinogenic properties (Orsatti *et al*., 2010; Missima and Sforcin 2008; Gonsales *et al*., 2006; Silici *et al*., 2005; Moraes *et al*., 2011; Paulino *et al*., 2006). It has numerous applications, including anti-inflammatory and hypotensive agents, immune system stimulants, and bacteriostatic and bactericidal agents (Ghisalberti, 1979). Propolis has gained popularity in recent years because to its positive properties, which make it a possible preventative and therapeutic agent, as well as a valuable component in food and cosmetics.

Royal Jelly

Royal jelly is a white, viscous material made by the hypopharyngeal glands of worker bees and used to feed larvae and the queen mother. It contains a variety of chemical and inorganic compounds with proven medicinal effects. Proteins, lipids, carbohydrates, free

amino acids, vitamins such as riboflavin, thiamin, niacin, folic acid, biotin, and pyridoxine, as well as trace amounts of vitamins C, D, A, and E, as well as minerals calcium, sodium, potassium, copper, iron, zinc, and manganese. For millennia, people have used royal jelly as a cosmetic. It prevents skin aging by strengthening, renewing, and revitalizing. Numerous investigations have been conducted to evaluate the biological qualities (Ramadan and Al-Ghamdi, 2012). The antibacterial characteristics, combined with the proteins and fatty acids, make it suitable for skin applications. Royal jelly contains antimicrobial action, which is one of its key properties. The major ingredient, Royalactin, has several pharmacological properties such as antibacterial, anti-tumor, anti-allergy, anti-inflammatory, and immunomodulatory effects. (Gokulakrishnaa and Thirunavukkarasu, 2020). It can also be used successfully to improve overall health and weakness caused by aging. Sclerosis, frailty, menopause, and so on. There have also been reports of cardioprotective, anti-atherosclerosis, and anti-arteriosclerosis benefits. It may be beneficial in treating respiratory illnesses such as bronchial asthma and spastic bronchitis. Royal jelly has long been used to treat menopause symptoms by rebalancing the hormonal concentrations in the blood, decreasing follicle-stimulating hormones and raising estrogen concentrations. (Gokulakrishnaa and Thirunavukkarasu, 2020). Other biological effects include anti-oxidative, radiation-protective, and hepatoprotective (liver-protecting, hyperglycemic, preventing insulin resistance, stimulating bone formation and promoting bone healing, preventing osteoporosis in, promoting collagen building in cell cultures, and suppressing the development of atopic dermatitis-like skin lesions. (Denisow and Denisow).

Bee Wax

Bee wax is derived from the bee's own body and is the least allergenic substance. Beeswax is considered safe for human consumption. It is used to coat medicines. Beeswax slows the breakdown of the contained chemicals until they enter the digestive tract. It delivers the medicine over a longer length of time and, as an inert chemical, does not interact with the digestive system. Chewing comb without honey, brood, or bee bread is beneficial against colds. When applied to the skin, it enhances suppleness and leaves it looking fresh and smooth. It can be chewed to strengthen the gingiva, increase saliva and stomach fluids (Gokulakrishnaa and Thirunavukkarasu, 2020).

Application Methods of Apiproducts

Api-Laser Therapy: Creams, , gels, liniments, liquids, ointments
Api-photophoresis: Creams, gels, liniments, liquids, ointments
Apipuncture: Direct bee stings
Biopuncture: Sterile injectables
Homeoacupuncture: Liquids, sterile injectables
Homeopathy: creams, oral liquids, tablets
Homeosineatry: sterile injections
Injectables: sterile injections
Mesotherapy: sterile injections
Neural Therapy: sterile injections
Oral: Blends, extracts, oral liquid, pills, pellets, raw products, syrups, tablets
Topical: Balms, creams, liniments, ointments, rubs

Principles, Guidelines and Precautions

Practitioner and recipients must follow following Principles of Apitherapy (Mihaly 2004; Stangaciu 2005)

i. Seek professional assistance or supervision before attempting self-treatment.
ii. It should only be used if conventional therapies are ineffective or cannot be used as the primary treatment option.
iii. Conduct an allergy test before using any api-products. The test should be performed by a qualified health practitioner in a medical clinic that is equipped with appropriate materials and designated life-saving emergency measures.
iv. Proper sleep and relaxation improve the effectiveness of bee products.
v. Apitherapists must have a thorough understanding of the bee colony's life cycle and be proficient in amateur beekeeping.
vi. To find the ideal medical approach for each individual, it's important to do ongoing research, exchange information with specialists from different nations, and use the internet on a frequent basis.
vii. Before beginning apitherapy, purify the body by food, fasting, and colon cleansing if necessary.
viii. Certain medications administered before apitherapy can reduce or eliminate the benefits of a specific api-product.
ix. Apitherapy treatment time depends on the severity of the condition, adherence to therapy standards, knowledge of the practitioner, and the

receiver's positive attitude and willingness to participate.

Apitherapy may need to be repeated after initial symptom alleviation to preserve improved health status that did not respond to conventional medicines.

Conclusion

Bee products are high in bioactive chemicals and perform biological actions that help to avoid disease. Those with severe allergies, TB, and other conditions should not utilize venom therapy. There have been reports of mortality due to anaphylactic reaction after bee acupuncture therapy. As a result, additional research is required to establish the critical processes behind the pharmacological effects of these bee products, as well as the suitable doses that can be consumed to achieve prospective health advantages.

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