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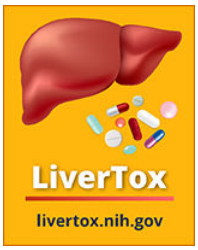

Bee Products: Beeswax, Bee Pollen, Propolis

Updated: May 1, 2022.

OVERVIEW

Introduction

Products made by bees that are used in alternative medicine include honey, beeswax, bee pollen, propolis and royal jelly. These natural substances have several uses, for both bees and humans, as foods, sealants, lubricants, construction material and medications. Beeswax is a secreted oily solution used by bees to build the honeycomb. Bee pollen is the mixture of various pollens collected by bees to make honey. Propolis is a mixture of beeswax and other oils and resins collected by bees and used in construction of the bee hive and in preserving honey and other perishables. Royal jelly is a secreted milky substance used to feed larvae. When used for medical purposes the products are referred to as apitherapy. The products are generally well tolerated and there is no evidence that they cause liver injury, either in the form of ALT elevations or clinically apparent liver injury.

Background

Bees make a variety of products that they use as food, for production of honey, in construction and repair of the hive and as sealants to prevent spoilage.

Beeswax (cera alba) is the natural wax produced in the abdominal segments of worker bees which is secreted and deposited in scales and then collected and used to build the honey comb for storage of honey and protection of larvae in the hive. Beeswax consists largely of fatty acid esters of long-chain alcohols. Beeswax has been used by humans for centuries as a lubricant, glaze or polishing solution or waterproofing gel. Beeswax is edible, but is usually combined with other ingredients or used as a covering for products such as cheese for preservation and prevention of mold or fungal contamination.

Bee pollen is the mixture of plant and flower pollen with nectar and saliva that is used in honey production by bees. The pollen is collected by placing traps in the bee hive that knocks off some of the pollen collected by the bees. Its composition is highly variable but includes vitamins, minerals and carbohydrates. Bee pollen is sold as a dietary supplement and is claimed to have antiinflammatory and antibacterial activity. Bee pollen is purported to be beneficial for cancer, arthritis and to improve athletic performance, but has not been shown to have these activities. Bee pollen has been reported to cause allergic reactions in patients with asthma, atopic dermatitis and with allergies to pollen.

Propolis is a natural resinous product that is collected by bees from various plants and mixed with beeswax and salivary enzymes. Propolis is hard and breakable in cold temperatures but soft, flexible and sticky when warmed, so that it can be used to fill gaps, close holes and build the beehive. The sealant action of propolis protects the hive from microorganisms, spores and mold. Propolis has been used by humans topically for treatment of wounds, skin ulcers and rashes and in oral forms as therapy of diabetes, obesity, cancer and other conditions.

Propolis is purported to have antiinflammatory, antioxidant, antidiabetic and even antineoplastic activity based upon studies in cell culture and animal models of diseases such as diabetes, obesity and cancer. None of these activities have been convincingly shown in humans with diabetes, obesity or cancer. In most clinical trials, adverse event rates have not been mentioned, but propolis is reported to be well tolerated. Propolis, like bee pollen, is highly variable with chemical compositions that differ markedly by genus of bees and geographic location (based upon local plant species). Propolis may contain contaminants, insect parts and allergens from the environment. Contact dermatitis from propolis is a well known complication of bee-keeping and can occur with topical and oral administration of propolis. Allergic reactions including angioedema and anaphylaxis from commercial sources of propolis have been reported. The allergic reactions are likely due to plant flavonoid aglycones.

Royal jelly is a milk-like secretion from the mandibular glands of worker bees that is used to feed larvae of workers and drones and, when given in larger amounts and for extended periods, for feeding and development of queen bees (fertile females). Royal jelly is collected from individual cells of queen bees and is frequently used in alternative and traditional medicine as is described in further detail in a separate chapter (Royal Jelly).

Hepatotoxicity

Liver injury attributable to bees products has not been reported. In clinical trials of beeswax and propolis as therapy of diabetes, obesity and cancer, side effects were rarely mentioned and ALT elevations and hepatotoxicity were not reported. Despite their availability and widespread use as an alternative therapies, there have been no published reports of liver injury attributed to bee products.

Likelihood score: E (unlikely cause of clinically apparent liver injury).

Mechanism of Injury

Bee products such as beeswax, bee pollen and propolis have many components, but none of them has been shown to be particularly hepatotoxic.

Outcome and Management

Hepatotoxicity from bee products has not been reported.

Drug Class: Herbal and Dietary Supplements

PRODUCT INFORMATION

REPRESENTATIVE TRADE NAMES

Beeswax – Generic

Bee pollen – Generic

Propolis – Generic

DRUG CLASS

Herbal and Dietary Supplements

SUMMARY INFORMATION

Fact Sheet at MedlinePlus, NLM [Bee Pollen]

CHEMICAL FORMULA AND STRUCTURE

DRUG	CAS REGISTRY NUMBER	MOLECULAR FORMULA	STRUCTURE
Beeswax	8012-89-3	Apitherapy	Not Applicable
Propolis	9009-62-5	Apitherapy	Not Applicable

ANNOTATED BIBLIOGRAPHY

References updated: May 1, 2022

Zimmerman HJ. Unconventional drugs. Miscellaneous drugs and diagnostic chemicals. In, Zimmerman, HJ. Hepatotoxicity: the adverse effects of drugs and other chemicals on the liver. 2nd ed. Philadelphia: Lippincott,1999: pp. 731-4.

(Expert review of hepatotoxicity published in 1999; several herbal medications are discussed, but not bee products).

Liu LU, Schiano TD. Hepatotoxicity of herbal medicines, vitamins and natural hepatotoxins. In, Kaplowitz N, DeLeve LD, eds. Drug-induced liver disease. 2nd ed. New York: Informa Healthcare USA, 2007, pp. 733-54.

(Review of hepatotoxicity of herbal and dietary supplements [HDS] published in 2007; no mention of bee products).

Hausen BM, Wollenweber E, Senff H, Post B. Propolis allergy. (I). Origin, properties, usage and literature review. Contact Dermatitis. 1987;17:163–70. PubMed PMID: 3315436.

(Review of the clinical features of propolis contact dermatitis, nearly 200 cases of which have been described in the literature).

Hausen BM, Wollenweber E, Senff H, Post B. Propolis allergy. (II). The sensitizing properties of 1,1-dimethylallyl caffeic acid ester. Contact Dermatitis. 1987;17:171–7. PubMed PMID: 3677659.

(Analysis of the sensitizing properties of constituents of propolis suggested that the hypersensitivity reactions are due to flavonoid aglycones found in buds of poplar trees, possibly dimethylallyl caffeic acid ester).

Greenberger PA, Flais MJ. Bee pollen-induced anaphylactic reaction in an unknowingly sensitized subject. Ann Allergy Asthma Immunol. 2001;86:239–42. PubMed PMID: 11258697.

(56 year old woman with a history of allergic rhinitis and previous desensitization developed urticaria, pruritus, dyspnea and throat tightness within minutes of drinking a "smoothie" that included bee pollen, analysis of which demonstrated ragweed pollen).

Cohen HA, Varsano I. Kah an E, Sarrell EM, Uziel Y. Effectiveness of an herbal preparation containing echinacea, propolis, and vitamin C in preventing respiratory tract infections in children: a randomized, double-blind, placebo-controlled, multicenter study. Arch Pediatr Adolesc Med. 2004;158:217–21. PubMed PMID: 14993078.

(Among 430 children, ages 1 to 5 years, treated with an herbal extract containing propolis, echinacea and vitamin C [Chizukit] or placebo twice daily for 6 months, respiratory illnesses were less frequent with Chizukit and adverse events were infrequent [4.2%], mild and mostly consistent with gastrointestinal intolerance).

Menniti-Ippolito F, Mazzanti G, Santuccio C, Moro PA, Calapai G, Firenzuoli F, Valeri A, et al. Surveillance of suspected adverse reactions to natural health products in Italy. Pharmacoepidemiol Drug Saf. 2008;17:626–35. PubMed PMID: 18327867.

(Among 223 spontaneous reports of adverse reactions to natural products reported over a 5 year period to an Italian national registry, 14 were attributed to propolis, 12 of which were allergic reactions, 4 requiring hospitalization).

Jacobsson I, Jönsson AK, Gerdén B, Hägg S. Spontaneously reported adverse reactions in association with complementary and alternative medicine substances in Sweden. Pharmacoepidemiol Drug Saf. 2009;18:1039–47. PubMed PMID: 19650152.

(Review of 778 spontaneous reports of adverse reactions to herbals to Swedish Registry found none attributed to beeswax, bee pollen, royal jelly or propolis).

Reuben A, Koch DG, Lee WM; Acute Liver Failure Study Group. Drug-induced acute liver failure: results of a U.S. multicenter, prospective study. Hepatology. 2010;52:2065–76. PubMed PMID: 20949552.

(Among 1198 patients with acute liver failure enrolled in a US prospective study between 1998 and 2007, 133 [11%] were attributed to drug induced liver injury of which 12 [9%] were due to herbals, including several herbal mixtures, usnic acid, Ma Huang, black cohosh, and Hydroxycut, but not bee products).

Teschke R, Wolff A, Frenzel C, Schulze J, Eickhoff A. Herbal hepatotoxicity: a tabular compilation of reported cases. Liver Int. 2012;32:1543–56. PubMed PMID: 22928722.

(A systematic compilation of all publications on the hepatotoxicity of specific herbals identified 185 publications on 60 different herbs, herbal drugs and supplements does not include any attributed to bee products).

Navarro VJ, Barnhart H, Bonkovsky HL, Davern T, Fontana RJ, Grant L, Reddy KR, et al. Liver injury from herbals and dietary supplements in the U.S. Drug-Induced Liver Injury Network. Hepatology. 2014;60:1399–408. PubMed PMID: 25043597.

(Among 839 cases of liver injury from drugs collected in the US between 2004 and 2013, 130 were due to HDS products, including 45 from body building agents [probably anabolic steroids] and 85 from diverse HDS products, but none were attributed to bee products).

Seeff LB, Bonkovsky HL, Navarro VJ, Wang G. Herbal products and the liver: a review of adverse effects and mechanisms. Gastroenterology. 2015;148:517–532.e3. PubMed PMID: 25500423.

(Extensive review of herbal associated liver injury does not discuss bee products).

Lambrinoudaki I, Augoulea A, Rizos D, Politi M, Tsoltos N, Moros M, Chinou I, et al. Greek-origin royal jelly improves the lipid profile of postmenopausal women. Gynecol Endocrinol. 2016;32:835–839. PubMed PMID: 27227757.

(Among 36 postmenopausal women treated with oral royal jelly [150 mg] daily for 3 months, serum HDL cholesterol levels increased [60 to 65 mg/dL] while LDL cholesterol decreased slightly [144 to 136 mg/dL]; no mention of adverse events or changes in serum ALT levels).

Medina-Caliz I, Garcia-Cortes M, Gonzalez-Jimenez A, Cabello MR, Robles-Diaz M, Sanabria-Cabrera J, Sanjuan-Jimenez R, et al; Spanish DILI Registry. Herbal and dietary supplement-induced liver injuries in the Spanish DILI Registry. Clin Gastroenterol Hepatol. 2018;16:1495–1502. PubMed PMID: 29307848.

(Among 856 cases of hepatotoxicity enrolled in the Spanish DILI Registry between 1994 and 2016, 32 were attributed to herbal products, the most frequent cause being green tea [n=8] and Herbalife products [n=6], while none were attributed to bee products).

Sharif SN, Darsareh F. Effect of royal jelly on menopausal symptoms: A randomized placebo-controlled clinical trial. Complement Ther Clin Pract. 2019;37:47–50. PubMed PMID: 31470366.

(Among 200 postmenopausal woman treated with royal jelly [1000 mg] or placebo once daily for 8 weeks, menopausal symptoms improved with royal jelly therapy but not placebo; no mention of adverse events).

Afsharpour F, Javadi M, Hashemipour S, Koushan Y, Haghighian HK. Propolis supplementation improves glycemic and antioxidant status in patients with type 2 diabetes: a randomized, double-blind, placebo-controlled study. Complement Ther Med. 2019;43:283–288. PubMed PMID: 30935545.

(Among 60 patients with diabetes treated with propolis [500 mg] or placebo 3 times daily for 2 months, fasting glucose and HbA1c levels improved in the propolis treated group but not in controls; adverse events were not reported).

Lima WG, Brito JCM, da Cruz Nizer WS. Bee products as a source of promising therapeutic and chemoprophylaxis strategies against COVID-19 (SARS-CoV-2). Phytother Res. 2021;35:743–750. PubMed PMID: 32945590.

(Review of the preclinical and clinical evidence for the activity of bee products [including royal jelly, beeswax, bee pollen, bee venom and propolis] against SARS-CoV-2; no mention of adverse events).

Matsushita H, Shimizu S, Morita N, Watanabe K, Wakatsuki A. Effects of royal jelly on bone metabolism in postmenopausal women: a randomized, controlled study. Climacteric. 2021;24:164–170. PubMed PMID: 32880201.

(Among 72 postmenopausal women treated with royal jelly [3000 mg daily] or placebo for 6 months, bone mineral density did not change in those receiving royal jelly but decreased to some extent in those on placebo; no mention of adverse events).

Ballotin VR, Bigarella LG, Brandão ABM, Balbinot RA, Balbinot SS, Soldera J. Herb-induced liver injury: Systematic review and meta-analysis. World J Clin Cases. 2021;9:5490–5513. PubMed PMID: 34307603.

(Systematic review of the literature on herb-induced liver injury identified 446 references describing 936 cases due to 79 different herbal products, the most common being He Shou Wu [Fo-Ti: n=91], green tea [90], Herbalife products [64], kava kava [62], greater celandine [48] and aloe vera [22], among others; bee products were not mentioned).

Li JD, Cui L, Xu YY, Guan K. A case of anaphylaxis caused by major royal jelly protein 3 of royal jelly and its cross-reactivity with honeycomb. J Asthma Allergy. 2021;14:1555–1557. PubMed PMID: 35221696.

(56 year old Chinese woman developed two episodes of anaphylaxis with urticaria, pruritus, laryngeal edema, hypotension and collapse within 1 hour of consuming royal jelly and was found to have a positive skin prick test to crude extracts of royal jelly; immunoblotting with her serum identified evidence of antibodies to purified royal jelly protein 3).

Bessone F, García-Cortés M, Medina-Caliz I, Hernandez N, Parana R, Mendizabal M, Schinoni MI, et al. Herbal and dietary supplements-induced liver injury in Latin America: experience from the LATINDILI Network. Clin Gastroenterol Hepatol. 2022;20:e548–e563. PubMed PMID: 33434654.

(Among 367 cases of hepatotoxicity enrolled in the Latin American DILI Network between 2011 and 2019, 29 [8%] were attributed to herbal products, the most frequent being green tea [n=7], Herbalife products [n=5] and garcinia [n=3] while none were attributed to bee products).

El-Seedi HR, Eid N, Abd El-Wahed AA, Rateb ME, Afifi HS, Algethami AF, Zhao C, et al. Honey bee products: preclinical and clinical studies of their anti-inflammatory and immunomodulatory properties. Front Nutr. 2022;8:761267. PubMed PMID: 35047540.

(Extensive review of the preclinical and clinical studies of honey bee products including royal jelly, bees wax, bee pollen and propolis; no mention of adverse event rates or hepatotoxicity).