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ORIGINAL ARTICLE

Evaluation of propolis, honey, and royal jelly in amelioration of peripheral blood leukocytes and lung inflammation in mouse conalbumin-induced asthma model

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Abstract Bee products have been used since ancient times to treat many diseases, including respiratory ailments. The present study aimed to examine the modulatory effect of honey, royal jelly, and propolis extract on peripheral blood leukocytes and lung inflammation in a mouse conalbumin-induced asthma model. The mice in group I were not sensitised or treated; they were kept as controls. The mice in group II were sensitised and challenged with conalbumin. Twenty-four hours after the first challenge with antigen, the mice in group III received 0.5 mg/kg of dexamethasone intraperitoneally per day for 18 consecutive days and kept as positive controls. The mice in groups IV, V, and VI received 650, 1000, and 30 mg/kg of honey, royal jelly, and propolis (aqueous and ethanolic extract), respectively, once per day for 18 consecutive days. Blood was collected from all of the mice for white blood cell differentiation, and the lungs were removed for histopathological studies. The groups treated with propolis extract exhibited considerable ameliorative effects against asthma, which might be explained by the flavonoids and phenolics found in propolis, which might

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have antioxidative effects. Otherwise, the sensitised and honey- or royal jelly-treated groups exhibited an increased incidence of asthma cascade events due to increased inflammatory cells. These results might be due to the immunostimulatory and vasodilatory effects of royal jelly and honey, which are antagonistic to bronchial asthma cases. Histopathological examination revealed that the sensitised treated propolis extract groups had significant decreases in inflammatory scores compared with other treatments and the sensitised untreated group. These results confirmed the previous data of peripheral blood cells.

1. Introduction

Honey bees are well known as superior chemists and engineers. They biochemically synthesised beeswax, venom, and royal jelly (Bogdanovt, 2014; Viuda-Martos et al., 2008; Mahmoud, 2012), and the successful utilisation of honey bee products has been described (Schmidt, 1996). The economic importance and usefulness of honey bees and the therapeutic effects of their products have motivated scientists to conduct numerous studies.

Honey and their products have been used since ancient times as food and medicine to cure many diseases; this practice is called apitherapy (Manyi-Loh et al., 2011). Honey, propolis, wax, and other honey bee products were used in combination with herbs to treat wounds and other diseases by ancient Egyptians, Assyrians, Chinese, Greek, Romans, and Arabians (Molan, 1999; El Denshary et al., 2012). The use of honey to cure diarrhoea was recommended by the Muslim Prophet Muhammad (PBUH) (Molan, 1999), and there is a whole Surah in the Quran named "Al-Nahl," describing the life and benefit of bees. Humans and honey bee use honey as a source of energy and as a stable sweetener (Manyi-Loh et al., 2011). The original resins are produced by various types of plants, collected by honey bees, and converted further into propolis (Wagh, 2013). Propolis has very good pharmacological activities, and it is used as an antimicrobial against microbes such as viruses, bacteria, fungi, and moulds. It is used extensively by honey bees to seal the nest cavity and to mummify the cadavers of intruders into the hive that have been killed (Wagh, 2013). Royal jelly is a complete balanced food source for bee larvae. It has various properties and is used by humans not only for moisturising, emulsifying, and stabilising, but also for antitumour and anti-inflammatory properties, antifatigue and hypotensive activity, (Nagai and Inoue, 2004; Inoue et al., 2003), antioxidant activities (Silici et al., 2009), antibacterial effects (Fujiwara et al., 1990), and enhancement of immune activity (Sver et al., 1996). With these unique properties, honey bees have become very important for human beings (Schmidt, 1996).

Bronchial asthma is considered one of the most chronic diseases affecting children; it is the main cause of children's absence from school and for hospital admissions of patients under 15 years of age (Hockenberry and Wilson, 2007). Asthma is an inflammatory condition characterised by hypersensitivity of the airways, producing symptoms of cough, especially in the early morning or at night, dyspnoea or expiratory wheezing, and chest tightness. The prevalence of asthma, its complications, and related morbidity and mortality are increasing worldwide. This increase is attributed to air pollution, poor access to health care services, misdiagnosis, and mistreatment (Global Strategy for Asthma Management and Prevention, 2014). According to the World Health Organisation, the number of asthmatic patients will increase to 100 million by the end of 2025. Currently, allergic asthma is treated with a standard combined therapy that includes inhaled corticosteroids and leukotriene receptor antagonists (Li and Brown, 2009), which lack a consistent cure and produce side effects (Tinkelman et al., 1993). In recent years, a new trend of using complementary and alternative medicines (CAM) has increased worldwide (Barnes et al., 2008). The CAM includes herbs, acupuncture, Chinese medicine, and apitherapy. Primary health care for 80% of the world population is dependent on alternative medicine (Barnes et al., 2008), and using herbs to treat asthma is a popular practice (Ernst, 1998; Eisenberg et al., 1998). The traditional Chinese remedy 'ma huang', a derivative of herbs and tea leaves, is used to develop theophylline and ephedrine for asthma drugs (Ziment, 2000). Lung function has been shown to improve up to four hours using caffeine, related to theophylline, which has been used for centuries to treat asthma (Bara and Barley, 2001).

This study was conducted to examine the ameliorating effect of honey, royal jelly, and propolis on peripheral blood leukocytes and lung inflammation in conalbumin-sensitised mice.

2. Materials and methods

2.1. Animals

Thirty-six albino CD1 mice (male, ~6 weeks old, weighing 18–20 g), obtained from Helwan Breeding Farm, Ministry of Health, Helwan, Cairo, Egypt, were kept in well-maintained animal facilities at Biotechnology Research Laboratory, Gastroenterology Surgery Centre, Mansoura University, with proper food and water *ad libitum* throughout the experiment. The room was maintained on a 12 h light–dark schedule at a temperature of 25 ± 2 °C and a relative humidity of 58.41–72.18%. The experiments were performed in accordance with the guidelines for the use of laboratory animals established by the Institute of Laboratory Animal Resources Commission of Life Sciences (1996).

2.2. Honey

One kg of pure, freshly gathered honey was purchased from Meet El-Aamel apiary, Dakahlyia.