



# The consumption of propolis and royal jelly in preventing upper respiratory tract infections and as dietary supplementation in children

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## ABSTRACT

Propolis and royal jelly (RJ), two important honeybee products, have been used commonly all over the world as traditional and ethnopharmacological nutrients since ancient times. Both of them have a lot of active ingredients which are known to be effective for several medical conditions. In this article, medical databases were searched for the usage of RJ and propolis in upper respiratory tract infections (URTI) and as a dietary supplementation, together and separately. 10-hydroxy-2-decenoic acid is the most prominent active compound showing antimicrobial effect within RJ. Caffeic acid phenethyl ester is the most famous one that shows antimicrobial and anti-inflammatory effect within propolis. When compared with propolis, RJ was found to have richer content for all three main nutrients; proteins, carbohydrates, and lipids. More clinical, experimental, and basic studies are needed to find out the best standardized mixture to cope with URTI in which RJ and propolis will be main ingredients in addition to the other secondary compounds that have health-beneficial effects.

**KEY WORDS:** 10-hydroxy-2-decenoic acid, caffeic acid phenethyl ester, infections, nutrition, propolis, respiratory tract, royal jelly

## INTRODUCTION

The term “herbal medicine” has been used to identify the therapeutic plants or particular substances derived from the plants to support the body to fight against various diseases including infections or improving overall health. The utilization of complementary and alternative medicine (CAM) products in such type of infections is very popular. The similar things can be brought forward for nutritional usage of phytotherapeutic products as well. Two honeybee products, propolis and royal jelly (RJ), have been used commonly all over the world as traditional and ethnopharmacological nutrients since ancient times. Both of them have a lot of active ingredients which are known to be effective for several medical conditions. For example, caffeic acid phenethyl ester (CAPE) from propolis is thought to be responsible well-known effects of propolis including anticancer, antioxidant, immune-modulatory, antibacterial, antiviral, and anti-inflammatory [1]. As a lipid soluble antioxidant, CAPE has been used in a number of inflammatory and infectious diseases as traditional medicine [2]. 10-hydroxy-2-decenoic acid (10-HDA) from RJ has also several activities such as protective and therapeutic effects on infections and has nutritious properties [3].

## REVIEW METHODOLOGY

Literature searches from PubMed, Medline, Scopus, ScopeMed, and Google Scholar were performed to find out the published articles about the topic to identify the nutritional value of propolis and RJ and the usage of them in upper respiratory tract infections (URTI). All articles written in English or having just an English abstracts were analyzed up to March 2016. Databases were searched for RJ in URTI, propolis in URTI, RJ in nutritional requirements, and propolis in nutritional requirements. As a second step, these parameters were combined for two mixtures and searched for new compounds or mixtures being used for the same purposes. If there is no actual contemporary review or original articles, older ones were considered to reach a reliable conclusion.

## PROPOLIS

### General Information

It is a mixture produced by honeybee after processes within his saliva. This product is used by the bees to protect their hives from infected single cells such as fungi and bacteria to moisture

and stabilize temperature within the hives, and to embalm the foreign materials and to repair all the cracks within the hives [4]. A study revealed the presence of 60 different important phytochemicals in methanolic extract of Nigerian bee propolis including phlobatannins, glycosides, tannins, anthraquinones, steroids, saponins, flavonoids, and alkaloids [5]. This greenish-brown and sticky product has different mixtures depending on what flowers and trees they accessed to and the place of the bees [6]. It has been claimed that every single molecule of propolis needs to be studied to show the source of the real effect and the underlying mechanism of these effects [6]. Akyol *et al.* suggested that the clinical importance of CAPE stems not only from free radical scavenging and antioxidant activities, but also by marked nuclear factor- $\kappa$ B (NF- $\kappa$ B), nitric oxide synthase activity, and apoptosis inhibition together with the suppression of caspase-3 activities and p38 phosphorylation [7].

### The Antimicrobial Effects

Lately, antiviral features of CAPE have been reviewed by scientists suggesting CAPE and its targets may have been regarded as a new field to design new therapeutics [8]. The other goal of that study was to understand the molecular mechanism of virus-related diseases. Propolis was tested for experimental *Pseudomonas aeruginosa* keratitis in rabbits and found that it can be regarded as a useful supplemental compound but should not be considered as a substitute for a contemporary antibiotic cure for this type of keratitis [9]. A mixture of ethanolic extract of propolis (EEP) was found to inhibit viridans Streptococci and regarded as an antimicrobial compound [10]. On the other hand, several different propolis samples were found to have noteworthy antimicrobial activities against yeasts and Gram-positive bacteria [11]. It has been found to be effective on fungi as well [12]. All oral candidiasis patients administered to standardized propolis extract exhibited a significant lesion suppression comparable to those treated with nystatin [12].

### The Value of Propolis as Dietary Supplement

Many investigations have been conducted to evaluate the effectiveness of propolis on experimentally induced diabetes including antidiabetic properties of Nigerian propolis [13]. The study indicated that EEP could benefit hypertriglyceridemia, hypercholesterolemia, and hyperglycemia along with keeping safe pancreas and liver against alloxan-induced diabetes in terms of biochemical and histological parameters [13].

The effectiveness of bee propolis on physical fitness and some other parameters were investigated after adding it to the food as a supplementation in rats [14]. Improved regeneration efficiency of hemoglobin, increased calcium and phosphorus absorption, improved utilization of iron, and increased weight gain were notified in the rats fed with propolis. In an experimental study, propolis and/or multifora pollen was found to be beneficial as co-adjuvants in the medical care of nutritional ferropenic anemia; supplemented the regular foods of rats with propolis and/or multifora pollen caused to a considerable amelioration

in the digestive utilization of magnesium, iron calcium, and phosphorus [14].

## RJ

### General Information

RJ is a mix of yellow-white creamy and acidic secretion produced by the worker honeybees using their mandibular and hypopharyngeal glands to supply a principal food for queen honeybee. It is a nutritive secretion rich in minerals, vitamins, carbohydrates, and proteins [15]. It has a lot of minerals (mainly calcium and iron), vitamins (mainly riboflavin, niacin, thiamin), fatty acids, sugars, proteins, and free amino acids. Many important activities of RJ have been attributed to its one of active contents, 10-HDA.

### The Antimicrobial Effects

There seems to be some evidence of a possible role of RJ in infections, but the evidence even now inadequate to accept suggestions for medical care of children with respiratory tract infections. Four antimicrobial peptides were isolated and sequenced by quadrupole-time-of-flight tandem mass spectrometry: PFKLSLHL-NH<sub>2</sub> (Jelleine 1), TPFKLSLHL-NH<sub>2</sub> (Jelleine 2), EPFKLSLHL-NH<sub>2</sub> (Jelleine 3), and TPFKLSLH-NH<sub>2</sub> (Jelleine 4) from RJ and noticed that some of them have antimicrobial properties against yeast, Gram-negative and Gram-positive bacteria [16,17]. There are very short peptides presenting hydrophobic sequences. RJ exhibits bacteriostatic [18] and antimicrobial activities [19] just because of the acidic content, organic acids and proteins (mainly known as royalisin) it has. Sver *et al.* found that RJ exhibits immune-modulatory features by stimulating immune-co-potent cell proliferation and production of antibodies in mice or by reducing humoral immune functions in rats [20].

### The Value of RJ as Dietary Supplement

RJ was investigated for its supplemental value that can enhance athletic performance which can also give an idea for its supporting role to human well-being without classifying those adults and children [21]. Most of the health-protecting properties of RJ have been attributed, at least in part, to actions of lipids found in RJ [22]. A possible beneficial effect of fresh RJ was reported in mice in terms of recovery from swimming to exhaustion [23]. No other effects of RJ were found in exercise but it was found to be effective on new bone formation and rapid maxillary expansion, which shows its valuable support to the general condition of the body [24]. Epidermal hydration, maintained by the epidermal lipid barrier, of which ceramide is one of the constituents, has been enhanced by dietary supplementation of RJ in mice [25]. The effects of RJ and CAPE on aggrecanases in chondrosarcoma cells were investigated to enlighten the molecular basis of these compounds in osteoarthritis [26]. interleukin-1 alpha (IL-1 $\alpha$ ) was used to induce the cells. 10-HDA has been well known to have an activity to promote collagen production. It was shown that these compounds could block the NF- $\kappa$ B cascade, which

is very important in osteoarthritis pathogenesis, which in turn might give estimation about the prevention of infections [27]. On the other hand, RJ has been suggested to support brain levels of dopamine in male bees, showing, in turn, the importance of tyrosine amino acids taken by nutritious supplements such as RJ [28].

## MIXTURE OF PROPOLIS, RJ AND OTHER CAM PRODUCTS

*Echinacea*, a common immune-stimulant, is very well known as an anti-inflammatory and antioxidant product as well. Some clinical studies have shown that *Echinacea* could intensify the production of cytokines including tumor necrosis factor- $\alpha$ , IL-10, IL-6, and IL-1 by macrophages [29]. The effectiveness of a preparation containing propolis, vitamin C, and *Echinacea* extract for URTI in young children was investigated in a randomized, double-blind, and placebo-controlled study with a 3 months follow-up time interval [30]. The number of children who affected from URTI, the total number of disease episodes, and the mean number of episodes per child were found significantly lower. The total number illness days and duration of episodes were also lower compared to placebo group. According to this clinical study, the days affected by fever, the usage of antipyretics and antibiotics, the numbers of physician visits for URTI was significantly lower [30]. The positive effect of combination of *Echinacea*, propolis and vitamin C in URTI in children was reviewed by another study showing decrease the number of episodes, the duration of symptoms, and the number of days of illness [31].

There are several studies showing bee products to have antibacterial, antiviral and anti-inflammatory features [32], especially for the prevention of URTI [33]. Henatsch *et al.* overviewed of the effectiveness beehive products in otorhinolaryngology [34]. What they found is propolis might be used in safe in the medical care of acute otitis media, mouth ulcer, and stomatitis, while RJ could safely be used to reduce mucositis.

## SELECTED THERAPEUTICAL EXPERIENCES

Due to the fact that foods ingested may influence attention, moods, emotion and cognition of children, there is growing evidence that parents are more inclined to use dietary supplements for their children [35]. Children more commonly take bee propolis as dietary supplement possibly due to the parental encouragement for children to prevent colds and flu and strengthen the immune system [36]. Propolis was found to be the fifth one within the top five supplements consumed among elementary school children in Taiwan [35].

## CONCLUSION

Reviewing of the scientific reports on RJ and propolis could help us to reach two main conclusions in terms of nutritional properties and the usage of these mixtures in URTI as remedial agents: First, no published evidence reach a level that scientists

and public accept the exact supportive role of these two CAM. Still there is a tremendous need for advanced good quality experimental and clinical studies. Second, placebo-controlled, randomized, double-blinded, and high-quality studies on the safety and efficacy of herbal therapy, especially for the mixture of propolis, RJ, and *Echinacea* in URTI are needed. There is obviously an urgent need to find out the best reliable and standardized mixture, which have been approved for health-beneficial effects such as propolis, RJ, *Echinacea* for children to cope with seasonal URTI as an alternative option in addition to classical treatment modalities.

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