

Use of honey in dentistry – literature review

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ABSTRACT

Aim: To assess the effects of honey and its derivatives on oral health.

Materials and methods: PubMed, Google Scholar, Scopus, Embase, Cochrane databases were searched using relevant keywords and Boolean operators.

Conclusions: Honey is a promising natural alternative for the treatment of various dental diseases due to its antimicrobial, anti-inflammatory and wound-healing properties. Scientific studies show that honey has numerous health properties, including antibacterial, antiviral, anti-inflammatory, wound-healing and anticancer effects. In the context of dentistry, honey shows potential in the treatment of various oral conditions, such as dental caries, gingivitis, halitosis, radiotherapy-induced mucositis, xerostomia or post-extraction stomatitis. Honey's safety and multifunctional benefits make it a valuable potential addition to dental treatments.

KEY WORDS: honey, mucositis, caries, halitosis, dry socket

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INTRODUCTION

Honey is a product naturally produced by honey bees. Chemically speaking, it consists of an average of 17% water, 38% fructose, 30% glucose, while the rest is made up of other disaccharides, gluconic acid, lactones and minerals and nitrogen [1]. Fructooligosaccharides, of which honey contains 4 to 5% in its composition, are a good source of prebiotics that support the intestinal bacterial flora. Honey also contains vitamins, including B2, B6 and C, as well as calcium, iron, zinc and potassium. Many of honey's pharmacological properties are derived from polyphenols and, as with the rest of the composition, the amount depends on the source of the nectar [2]. The earliest known written reference to honey is on a clay tablet belonging to the Sumerians, who inhabited the Euphrates valley between 2100 and 2000 BC. This tablet mentions the use of honey as a drug and an ointment [3]. Propolis is a resinous product collected from plants by bees to cover holes and cracks in their hives. After collecting propolis, the bees mix it with wax flakes and saliva in the hive. Although bees use propolis to strengthen the walls of the hive and protect the hive from the onslaught of

infection, humans use these products to strengthen their immune systems. Propolis has strong antibacterial, antiviral, anti-inflammatory, wound-healing and anti-cancer properties. It is similar to aspirin in its functions without side effects [4, 5].

AIM

The study aims to evaluate the medicinal properties of honey, particularly its applications in dentistry, by reviewing the existing literature. It seeks to explore the potential of honey as a treatment for various oral conditions, such as dental caries, gingivitis, halitosis, mucositis, xerostomia, and dry socket, and to determine its effectiveness as a natural adjunct in dental care.

MATERIALS AND METHODS

The PubMed, Scopus, Embase, Cochrane and Google Scholar databases were searched using syntaxes consisting of keywords and Boolean operators: ("honey" OR "propolis" OR "propolis farinosa" OR "propolis versicolor" OR "apitherapy") AND ("oral

health" OR "mouth diseases" OR "periodontitis" OR "ulceration" OR "stomatitis" OR "oral ulcer" OR "mucositis" OR "dental caries") adapted as appropriate for each database. Polish and English language search restrictions were used.

REVIEW AND DISCUSSION

CARIOUS CAVITIES

Caries is undoubtedly one of the biggest global problems of the present day [6]. A biofilm, comprising mucus, bacterial cells, saliva polymers and food particles, covers the tooth surface. If left unchecked, the biofilm can increase in thickness to a level of hundreds of cells on the tooth surface. This biofilm, known as plaque, provides an optimal surface for bacterial adhesion, colonization, and proliferation [7]. Laboratory studies have shown that different types of honey have significant antimicrobial activity against various periodontal pathogens, including *Streptococcus mutans*. Although the antibiofilmic effect of honey has been reported mainly against *S. mutans*, these results are limited to a few studies. In clinical settings, honey was found to significantly reduce plaque, but was not superior to conventional agents. Honey has shown positive in vitro results in the prevention of dental caries. Further robust clinical studies are needed to determine its efficacy in clinical settings [8]. Voidarou et al. showed that simultaneous preparations of artificial saliva into honeys, enhances their antimicrobial activity [9]. Patel et al. observed that the inhibitory effect on *S. mutans* had a honey concentration of no less than 60% [10]. Conversely, the interaction of honey with hard tissues remains uncertain. The low pH of the honey samples tested by Habluetzel et al. [11] and Grobler et al. [12] did not result in any erosive damage to enamel, as reported in their respective studies. Furthermore, one specific type of honey was demonstrated to alter the composition of the enamel membrane, thereby conferring a protective effect against demineralization caused by cariogenic factors [11]. Atwa et al. in their study showed that the pH decrease with honey application was greatest after 5 minutes, but quickly returned to its original value within 10-20 minutes, and additionally the pH decrease did not exceed the pH critical for demineralisation (pH = 5.5) [13].

GINGIVITIS

Gingivitis caused by plaque build-up is an inflammatory condition characterised by bleeding, red-

ness and swelling of the gums. It is most often due to the presence of harmful bacteria in the gingival crevices, which triggers an inflammatory response in the tissues. It is one of the most common oral conditions, along with tooth decay. Although not all cases of gingivitis progress to an advanced state, i.e. periodontitis, treatment of gingivitis is a key strategy for the prevention of this condition [14]. Nayak et al. conducted a study comparing the efficacy of honey, chlorhexidine (0.2%) and xylitol gum rinses in reducing plaque and gingivitis. In the group utilising Manuka honey, participants were instructed to gently apply the honey to the gingival crevices of all teeth, wait for a period of five minutes, and then repeat the process on two further occasions. The application was conducted twice daily, following the consumption of meals. The use of both Manuka honey and chlorhexidine mouthwash was found to be significantly more effective in reducing plaque formation than the use of xylitol chewing gum [15]. Atwa et al. in a randomized trial considered honey chewing as a worthy alternative to traditional measures to prevent caries and gingivitis with orthodontic treatment. They found that bacterial counts were significantly reduced in the honey group compared to the other treatment groups, and honey significantly inhibited the growth of all strains tested compared to the inhibition observed with antibiotics [13]. A double-blind, randomised, study by Singhal et al. showed that manuka honey and raw honey were as effective as chlorhexidine as a mouthwash. However, chlorhexidine showed maximum reduction in average plaque and gums [16].

HALITOSIS

Halitosis is a common problem that manifests as an unpleasant and disgusting odour emanating from the mouth. The cause of the unpleasant odour is mainly due to the putrefactive action of microorganisms on endogenous or exogenous proteins and peptides. Bad breath is an embarrassing condition that affects a large percentage of the human population [17]. The antimicrobial action of honey effectively combats bacterial colonisation of healing wounds and provides nutrients to the bacteria so that they produce lactic acid during metabolism rather than odorous gases [18]. Drain and Fleming demonstrated that manuka honey is a safe, effective palliative treatment to reduce odour and inflammation in wounds secondary to oral squamous cell carcinoma in this patient. Makmuriana et al, on the other hand, demonstrated the superiority of honey over chlorhexidine in patients with post-stroke halitosis [19].

MUCOSITIS WITH RADIOTHERAPY

The mucosal epithelium's inflammatory response to the cytotoxic effects of chemotherapy and radiotherapy results in mucositis, a painful side effect of cancer treatment. Approximately 40% of patients undergoing chemotherapy will develop mucositis, with the incidence rising to approximately 90% among those with head and neck cancer who are treated with both chemotherapy and radiotherapy. Of these cases, 19% will require hospitalisation and result in delays to cancer treatment due to severe mucositis. This leads to a reduction in quality of life, an adverse prognosis and increased patient costs [20]. An important study by Biswal et al. first showed that honey was effective in preventing radiation mucositis [21]. Since then, many studies worldwide have shown that honey was beneficial in reducing the incidence of radiotherapy/chemotherapy-induced oral mucositis, reducing treatment interruptions, weight loss and delaying the onset of oral mucositis [22–25].

XEROSTOMIA

Saliva plays a key role in maintaining dental integrity, diluting food debris and bacteria, mechanical cleaning of the mouth and oral comfort. Saliva also provides an antimicrobial effect to prevent oral infections and plays an important role in upper gastrointestinal tract functions, including taste perception, food bite formation, facilitation of chewing, swallowing and speech, as well as oral and upper oesophageal mucosal orocrisitation. Accordingly, salivary gland hypofunction is associated with an increased risk of oral infections, candidiasis, scarring of teeth, dysgeusia, and oral mucosal discomfort [26]. A randomized study by Charalambous et al. showed that the use of honey by patients with radiotherapy-induced xerostomia resulted in significant improvements in both saliva secretion and quality of life for patients [27]. Similar results were obtained in another randomized study by Ibrahim et al. on a group of patients with end-stage renal failure treated for xerostomia [28]. Heydarirad et al. also obtained positive results in a randomized trial on patients with chemotherapy-induced xerostomia for breast cancer. They showed that the use of a honey and lemon spritz every 2 hours had a positive effect on saliva production [29]. It was also shown that in patients with xerostomia induced by radiation therapy, honey caused a reduction in *S. mutans* [30].

DRY SOCKET

Alveolar osteitis, or dry socket, represents a potential complication of tooth extraction, with a higher

prevalence observed in cases involving mandibular molars. The condition is typified by acute discomfort two to three days following surgery, with or without halitosis, and an alveolus that may be partially or completely devoid of a blood clot, frequently necessitating more frequent postoperative visits [31]. Unlike eugenol used for dry alveolus, which can lead to bone necrosis, honey has no side effects, which is associated with its high biocompatibility [32]. To date, many studies have been produced that confirm the efficacy of honey in the treatment of post-extraction osteoarthritis by significantly reducing pain sensations, and reducing inflammation [32–34]. Moreover, González-Serrano et al. showed that after using honey as a dressing, the infected wound showed sterility after 3–6 days [35].

ULCERATIONS

Mucosal cell turnover in the oral cavity depends on a balance between cell differentiation and exfoliation, which acts primarily as a defence mechanism against pathogens. However, this can be disrupted and lead to the development of several conditions, including hyperplasia and dysplasia and a reduced proliferation rate, which can lead to the development of ulcers [36]. A systematic review by Hunter et al. showed that honey is an effective treatment for various oral ulcer conditions. It accelerates healing time, reduces pain sensation in patients and reduces co-morbid inflammation [37].

As a natural product, honey is not only enriched with nutritional value, but also possesses a number of medicinal properties that make it a noteworthy agent in the field of dentistry. Its richness in fructooligosaccharides, vitamins, minerals and other components brings numerous health benefits, especially in the context of various oral disorders. In the treatment of tooth decay, honey has been shown to have antimicrobial effects, which can help to reduce plaque and inhibit the growth of harmful bacteria such as *Streptococcus mutans*. In addition, research suggests that honey may accelerate the healing process of wounds on the oral mucosa, which may be particularly beneficial in cases of ulcers and inflammation. In the context of gingivitis, honey shows potential in reducing plaque and reducing gingival inflammation. Its antimicrobial action can also help to combat harmful bacteria, which are the main cause of gingivitis. Halitosis, or bad breath, can also be alleviated by honey's antibacterial action, which helps to combat the bacteria responsible for putrefactive processes in

the mouth. In addition, honey can help to reduce inflammation and improve overall oral hygiene. For patients undergoing radiotherapy or chemotherapy, honey can be an effective agent in the prevention and treatment of radiation-induced oral mucositis. Its antimicrobial and wound-healing properties can provide relief to patients, reducing pain sensations and promoting tissue regeneration processes. The aforementioned benefits of honey in the context of various oral conditions suggest that honey may be a valuable addition to traditional dental therapies, offering patients natural and effective support in maintaining oral health. However, further clinical studies are needed to confirm these benefits and to

determine the optimal doses and methods of using honey in dental practice.

CONCLUSIONS

Honey offers a promising natural alternative for managing various dental conditions due to its antimicrobial, anti-inflammatory, and wound-healing properties. While its efficacy has been supported by several studies, particularly in reducing plaque, gingivitis, and oral ulcers, more clinical research is necessary to validate its use in routine dental practice and establish appropriate application methods. Honey's safety and multifunctional benefits make it a valuable potential addition to dental treatments.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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