REVIEW ARTICLE

Hidden Secrets of '*Punica Granatum*' Use and Its Effects on Oral Health: A Short Review

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ABSTRACT

The interest in evaluating therapeutic effects of plants has increased dramatically with more and more people inclining toward alternative medicine for their health care needs as they are effective, nontoxic, economical and usually have no side-effects. Pomegranate is one such fruit/ plant which is beneficial with added effect on oral health.

This plant source of polyphenols has antioxidant properties, meaning they help protect cells from damage and may lower the inflammation in the body. Apart from this various other components of the pomegranate plant such as flowers are rich source flavonoids. Peel extracts have been demonstrated to have antibacterial and antifungal activity due to the presence of hydrolysable tannins and polyphenols. The stem part is known to have astringent and antihelminthic properties and the leaves have been used for conjunctivitis.

Thus, the purpose of this review is to summarize the therapeutic benefits of various extracts derived from the pomegranate plant and its benefits on oral health.

Keywords: Pomegranate, Antiplaque, Antioxidant, Anti-inflammatory, Antifungal.

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INTRODUCTION

Pomegranate is scientifically termed as *Punica granatum* and is a member of the family Punicaceae. It is an ancient, mystical, unique fruit borne on a small long living tree cultivated throughout Himalayas in Northern India up till Iran. It has been cultivated and naturalized since ancient times over the entire Mediterranean region, Southeast Asia, the East Indies, and tropical Africa.[1]

In recent decades the interest in evaluating therapeutic effects of plants has increased dramatically, as 80% of the world relies on alternative medicine for their health care needs.[2] Significant progress has been made in establishing the pharmacological mechanism of pomegranate. The extracts of all parts of the fruit appear to have therapeutic properties and some studies report the bark, roots and leaves of the tree also have medicinal benefits.[1] The dried flowers are used in hematuria, hemorrhoids, hemoptysis and dysentery. The powdered flower buds are being used in bronchitis (Ross et al 2001).[3] Flower juice is recommended as a gargle for sore throat, in leukorrhea, hemorrhages and ulcers of the uterus and rectum (Ali et al 2006).[4] The root bark and stem bark of the plant are used as an astringent and anthelmintic specification against tapeworms.

The rind is valued as an astringent in diarrhea and dysentery. The seeds are considered to be stomachic and the pulp as cardiac and stomachic. The leaves are made into a paste and applied in conjunctivitis (Li et al 2005).[5] The flower extracts of *Punica granatum* and rind of this plant have been reported to exert some glucose lowering action in animals (Jafri et al 2000).[6]

The use of antioxidant property of pomegranate in oral cavity has been explored in recent times and studies have shown promising results. This article reviews the various forms of pomegranate and their applicability in promoting oral health.

THERAPEUTIC USES OF *PUNICA GRANATUM* IN ORAL CAVITY

Pomegranate Fruit Extract

Pomegranate is fast becoming recognized as an antioxidant power house, possibly beating green tea and red wine. The antioxidants extracted from pomegranate are polyphenols, hydrolysable tannins and anthocyanins. These antioxidants help bind harmful oxygen containing molecules in our body called free radicals and peroxides that otherwise could damage DNA, cell membrane and other cell components.

These hydrolysable tannins are used as botanical ingredients in herbal supplements for their antioxidant, antibacterial, anti-inflammatory, anticancer and antiatherosclerotic activities.[7]

Pomegranate Juice

According to Guo et al, 250 ml of pomegranate juice given daily for 4 weeks to healthy elderly subjects increased plasma antioxidant capacity from 1.33 to 1.46 mmol, while subjects consuming apple juice experienced no significant increase in antioxidant capacity.[8]

Pomegranate-Methanolic Extract (MEPGP) on Oral Pathogens

In vitro study conducted by Abdollahzadeh 2011[2] showed that extract of pomegranate might be used in the control of common oral pathogens responsible for caries stomatitis

and periodontal diseases however, their study requires further photochemical studies to determine the type of compounds responsible for the antibacterial effect of pomegranate.[2]

Pomegranate Gel

Vanconcelos et al in 2006,[9] investigated the antimicrobial effect of pomegranate gel against *Streptococcus mutans*, *Streptococcus mitis* and *Candida albicans* and found that pomegranate gel has greater efficiency in inhibiting microbial adherence. Their results suggests that this gel might be used in the control of adherence of different microorganisms in the oral cavity that is responsible for caries periodontal disease and stomatitis.[9]

In 2003 Vanconcelos et al conducted *in vivo* studies using pomegranate gel as antifungal agent against candidiasis associated with denture stomatitis and found that there was a resolution of the symptoms and an improvement in general oral health.[10]

A gel containing the extract of pomegranate fruit peel, applied to the gums of patients with candidiasis associated with denture stomatitis three times daily for 15 days seems to be as effective as miconazole gel, a topical antifungal agent.[11]

Pomegranate Extract

The extracts have been found to work against methicillin-sensitive as well as methicillin-resistant *Streptococcus aureus*, *E. coli*, *Salmonella typhi* and some other species of streptococci.[7] Research shows that pomegranate extract suppresses the ability of these microorganisms to adhere to the surface of the tooth. It inhibits common species of streptococcus, preventing it from producing chemicals that create favorable conditions for fungi and other microorganisms to thrive.[12]

Plaque may involve four or more different microorganisms combining forces to colonize the surface of the teeth. Remarkably, natures own pomegranate fights the organism's ability to adhere by interfering with production of the very chemicals the bacteria use as a glue.

Pomegranate Hydroalcoholic Extract as Mouthrinse

The antibacterial effect on dental plaque microorganisms was tested using 15 ml of hydroalcoholic extract of pomegranate (HAEP) solution in comparison with chlorhexidine (CHX) mouthwash. They found that HAEP and CHX were effective against *Staphylococcus*, *Streptococcus*, *Klebsiella* and *Proteus* species as well as *E. coli*.

The ellagitannin, punicalagin fraction is thought to be responsible for pomegranate antimicrobial activity.[13]

Pomegranate Mouthrinse Antiplaque Efficacy

Study conducted by Bhadbhad in 2011 tested the mouth rinse against *A. actinomycetemcomitans*, *P. gingivalis* and *P. intermedia* strains *in vitro*. The results showed that the extract was effective against these organisms and can be used as an antiplaque agent, but its efficacy as a long-term antiplaque rinse with prophylactic benefits should be further explored.[14]

When used regularly in combination with toothpaste that has been reinforced with bioactive botanical extracts, pomegranate containing mouthwash may fight dental plaque and tartar formation by inhibiting the activities of the microorganisms that causes plaque. Additionally, pomegranate compounds possess anti-inflammatory properties that may help soothe irritated tissues.[15]

The addition of pomegranate-polyphenols extract (POMx) to various oral agents, including toothpaste and mouthwash, gave these agents an antimicrobial effect which gives even better results compared to that of white tea and green tea extracts.[16]

Pomegranate Mouthrinse

Ohio state study done to compare the use of pomegranate mouthwash with a placebo mouthrinse used three times daily for 4 weeks, showed that there was a reduction in saliva total protein content which is normally higher in people with gingivitis and may correlate with the plaque forming bacterial count. They also found significant decrease in salivary activity of the enzyme aspartate aminotransferase, an enzyme considered as a reliable indicator of cell injury which is elevated among periodontitis patients.

Pomegranate rinse also lowers salivary activity of alpha-glucosidase, an enzyme that breaks down sucrose, while it increased activity of ceruloplasmin, an antioxidant enzyme.[15]

Anti-inflammatory Activity

Studies by Lee et al 2010, Chakraborthy 2008 also showed that it has antipyretic and analgesic activity.

Inhibition of inflammation by pomegranate components involves inhibition of both cyclooxygenase (COX) and lipoxygenase (LOX) enzymes (Sehuburt et al 1999), and reduction in the prostaglandin levels from the cells (Polagrauts et al 2003). The phytochemical analysis of the flower extract also reveals that it contains flavonoids (Bagri et al 2010). Flavonoids are known for their ability to inhibit

pain perception and also have anti-inflammatory properties due to their inhibitory effects on enzymes involved in the production of chemical mediator of inflammation (Owoyele et al 2005).[17]

The anti-inflammatory effect of pomegranate may be attributed to its considerable immune regulatory activity over macrophage and T and B lymphocyte subsets (Ross et al).[4] *In vivo* study conducted by Grindwit et al in 2003[18] tested the effects of combined extracts from *Centella asiatica*, commonly known as Asiatic pennywort, and Pomegranate pericap on periodontal wound healing following scaling and root planing. The placement was done subgingivally after scaling and root planing. All treatment sites demonstrated a trend toward decreasing plaque and significant improvements were noted in pocket depth and attachment level at 3 months compared to placebo. They also found significant decrease in IL-1β and IL-6 at 3 and 6 months compared to baseline.[18]

Several recent studies have documented that supplementation with pomegranate fruit extract inhibits inflammatory symptoms *in vivo*. However, the molecular basis of the observed effects has not fully revealed. According to Meeenakshi et al in 2008, they determined the effect on rabbit plasma obtained after ingestion of a polyphenols rich extract (PFE) of pomegranate fruit extract on COX enzyme activity *ex vivo* and the IL-1β induced production of nitric oxide (NO) and prostaglandin (PGE2) in chondrocytes *in vitro*. Plasma samples collected after oral ingestion of PFE were found to inhibit the IL-1β induced PGE2 and NO production in chondrocytes. These plasma samples also inhibited both COX-1 and COX-2 enzyme activity *ex vivo* but the effect was more pronounced on the enzyme activity of COX-2 enzyme. Furthermore, their study suggests that PFE-derived bioavailable compounds may exert an anti-inflammatory effect by inhibiting the inflammatory cytokine-induced production of PGE2 and NO *in vivo*.[19]

CONCLUSION

Substantial health benefits of pomegranate has recently become popular among people, unfortunately they are consuming only commercially available pomegranate juice and are missing out many other beneficial parts of the plant, such as leaves, flowers and oil from seeds. Each component of pomegranate works together synergistically to maximize its beneficial effects on our health. Currently, numerous clinical trials are in progress exploring the therapeutic potential of pomegranate extracts. Further, studies are required to find their effects in order to replace synthetic medications with natural remedies. Although, considerable evidence exists regarding the antioxidant, antibacterial, anti-inflammatory and antifungal properties, further human trials are necessary to refute or substantiate these properties.

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