

Efficacy of cinnamon in the treatment of orofacial conditions

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Abstract

Background: Cinnamon is a spice which has been in use for 1000 of years for its taste, condiment, and for its medicinal values. It has a history of medicinal use in China, Egypt, and Europe. In traditional medicine, cinnamon is used in respiratory, digestive, and skin ailments. It has anti-inflammatory, antibacterial, antidiabetic, antiarthritic, anticlotting, and immune regulatory properties. Cinnamon oil is used topically in the treatment of certain skin diseases such as acne, eczema, and pimples. In recent times, there has been a gradual rise in interest in the use and research on medicinal plants the world over due to their safety margin and minimal side and adverse effects. **Aim:** This paper aims to review the available scientific literature and to provide a comprehensive summary on the potential medicinal benefits of cinnamon in orofacial disease conditions. A review of the scientific literature available on cinnamon conclusively proves its efficacy in the management of several ailments including metabolic disorders like diabetes and lifestyle-associated conditions like hyperlipidemia. **Conclusion:** A review of its mechanism of action indicates its potential therapeutic benefit in the management of various orofacial conditions including trigeminal neuralgia and lichen planus. **Clinical Significance:** Cinnamon unfortunately like any medications does have its share of adverse effects and reactions, and therefore, its clinical use must be paved with caution and planned clinical trials, keeping in mind its potential adverse effects and interactions will result in a more standard formulation and protocol for the use of cinnamon as a therapeutic agent.

Keywords: Antioxidants, *Cinnamomum zeylanicum*, diabetes mellitus, immunity, immunomodulators, oral health

Introduction

From the inception of medicine, humankind and healers have strived to eliminate disease as a scourge of life. However, this panacea is still elusive. Despite medical practice and research going on for more than a millennia, we have cure for barely a handful of diseases. Immune-mediated diseases, in particular, have posed a diagnostic challenge. Our paper attempts to explore the available literature on cinnamon as a therapeutic agent and hypothesize its beneficial role in the management of immune-mediated diseases, manifesting in the orofacial region.

History of Cinnamon

From ancient times, cinnamon has been a treasured spice. It finds mention in the Bible and has been used not only as a flavoring agent but also been used for its embalming properties in ancient Egypt. Cinnamon finds great value in Chinese medicine from

around 2700 BC. The Romans considered cinnamon sacred and burnt it at funerals. Cinnamon was the first commodity which was traded between countries. It is an aromatic spice that is obtained from the inner bark of cinnamon tree.^[1]

Cinnamon

Cinnamon is the dry bark of a small evergreen tree belonging to the Lauraceae family. There are two varieties of cinnamon; *Cinnamomum cassia* and *Cinnamomum verum*. *C. verum* often considered the true cinnamon and is originally from Sri Lanka. Other types of cinnamon include *Cinnamomum tamala*, *Cinnamomum burmannii*, and *Cinnamomum oliveri*. The most important constituents of cinnamon are cinnamaldehyde and trans-cinnamaldehyde. These are present in the essential oil and contribute to its biological properties, antityrosinase activity, and antioxidant activity.

Cinnamomum zeylanicum is the preferred variety of cinnamon for medical use since the Journal of Federal Institute has specifically stated that this form of cinnamon contains negligible

quantities of coumarin. Other forms of cinnamon mainly *C. cassia* also known as *Cinnamomum aromaticum* or Chinese cinnamon were found to contain coumarin beyond tolerable limits.^[2] Coumarins are phytochemicals with carcinogenic and hepatotoxic actions, the mechanism of which is yet to be clearly understood.^[3]

C. zeylanicum is indigenous to Sri Lanka and parts of South India.^[4] Trans-cinnamaldehyde, eugenol, and linalool are the main components of its bark extract. Several studies are available in literature which have demonstrated the health benefits of *C. zeylanicum*, including its antimicrobial properties, ability to reduce inflammation, cognitive function enhancement, and beneficial role in colonic cancer.^[5]

Chemical composition

The chemical composition of cinnamon constitutes of cinnamic acid, cinnamaldehyde, tannin, eugenol, coumarin, ethyl cinnamate, and linalool, which contributes to the number of medicinal properties such as antioxidative, antimicrobial, anti-inflammatory, antidiabetic, anticancer, antiseptic, local anesthetic, weight reducer, anticlotting, and carminative.^[6] Cinnamon is available commercially in the form of powders, dried barks, bark oils, and capsules.

Antimicrobial activity

Various studies have conclusively proved the antimicrobial efficacy of cinnamon. Cinnamon oil has found to be effective against *Staphylococcus aureus*, *Enterococcus faecalis*, *Bacillus cereus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Aspergillus flavus*, *Candida lipolytica*, *Debaryomyces hansenii*, and *Candida albicans*.

S. aureus is found to be a causative agent in angular cheilitis, parotitis, stomatitis, and cellulitis. *E. faecalis* causes endodontic infections, periodontitis, and peri-implantitis. *C. albicans* causes oral thrush and candidal leukoplakia. *A. flavus* causes chronic granulomatous sinusitis, cutaneous aspergillosis, wound infection, and osteomyelitis.

Volatile oils from cinnamon demonstrated significant activity against *Streptococcus faecalis*.^[7] *C. zeylanicum* is found to be effective against *C. albicans* and can be used in the management of oral thrush.^[8] *C. zeylanicum* was found to inhibit the growth of *S. aureus*, which is the etiology in angular cheilitis, parotitis, stomatitis, and cellulitis. Moreover, hence, *C. zeylanicum* extract could have a beneficial role in the management of these orofacial conditions.^[9] *C. zeylanicum* is also found to be effective against *Candida glabrata*, *Candida parapsilosis*, *Candida krusei*, and *Candida tropicalis*, which in the past have demonstrated some resistance to conventional antifungal agents.

In addition to this, *C. zeylanicum* is also proven to demonstrate antiparasitic activity.^[10]

Anti-inflammatory activity

Extracts from various types of cinnamon have shown anti-inflammatory properties. *C. cassia* has been proven to have an

inhibitory effect on the production of nitric oxide suggestive that this substance could be used to counter inflammation.^[11] Extracts of *Cinnamomum ramulus* show anti-inflammatory activity by reducing the production of inducible nitric oxide synthase, cyclooxygenase 2, and nitric oxide in the central nervous system, which indicates that this could be used in the prevention or treatment of inflammation mediated neurodegenerative disorders.^[12] This indicates the potential role of cinnamon extract in the management of inflammatory disorders of the orofacial region and inflammation mediated neurological diseases such as postherpetic neuralgia.

Antidiabetic activity

“Insulin potentiating factor” is a substance isolated from cinnamon with high potential for modulating the effect of cinnamon.^[13,14] Naphthalene methyl esters which are again a cinnamon derivative facilitate by lowering of blood glucose levels. Several other polyphenols derived from cinnamon have demonstrated insulin limiting activity.^[14]

Murine models have demonstrated reduction in the absorption of alanine by cinnamon extract where alanine plays a primitive role in gluconeogenesis.^[15] The antidiabetic effect of cinnamon extract could be attributed to the counteractive action on oxidative stress and pro-inflammatory zones in the pancreas, thereby protecting the islet cells.^[16]

Antioxidant activity

The role of free radicals in the aging process and carcinogenesis is well established. Extracts from cinnamon including ether, aqueous extracts, and methanolic extracts have proven antioxidant activity. The volatile oils of cinnamon show significant antioxidant property at concentration ranging from 100 to 200 parts per million.^[17]

Cinnamon extract has proven action in reducing plasma lipid peroxidation level which is a biomarker for oxidative stress. Cinnamon extract has also found to have potent free radical scavenging activity. Given the proven antioxidant activity of cinnamon, extracts of the same could play a tangible role in the management of potentially malignant disorders plus improving their long-term prognosis.

Role of Cinnamon in Neurologic Disorders

Neurological disorders such as Alzheimer’s disease and Parkinson’s disease are debilitating diseases which are perhaps underemphasized in many developing countries. Neurodegenerative disorders are characterized by progressive and irreversible loss of neurons.

A thromboxane A2 receptor known as cinnamophilin isolated from *Cinnamomum philippinensis*.^[18] A study on cinnamophilin has reported to have cured that the ischemic damage in rat brains.^[19] Cinnamon has also proved to regulate the neurotrophic factors such as brain-derived neurotrophic factors and neurotrophin 3 in mice, with its one of the metabolite, sodium benzoate.^[20]

Antilipemic activity

Cinnamon in number of studies is found to be capable of reducing the level of low-density lipoproteins cholesterol and triglycerides in blood. This suggests the effective role of cinnamon in the prevention of number of heart diseases.

The antilipemic activity is credited to cinnamon due to the presence of its phenolic compound known as cinnamate. Cinnamate has the capability to decrease the level of serum total cholesterol and triglyceride concentrations and also to increase the high-density lipoproteins cholesterol levels.^[21]

Immunomodulatory activity

C. tamala and *C. cassia*, in particular, have certain procyanidin oligomeric compounds which play a significant role in immunomodulatory action. Cinnamtannin D1, one of the procyanidin oligomeric compounds, reduces the level of interferon- γ and interleukin-2 (IL-2) and suppresses the delayed hypersensitivity reaction, thereby enhances immunomodulatory action.^[22] This suggests the beneficial role of cinnamon in the administration of autoimmune diseases such as pemphigus, lichen planus, recurrent aphthous stomatitis, and lupus erythematosus.

Anticancer activity

Aqueous extracts of cinnamon have proved to inhibit the action of vascular endothelial growth factor subtype 2 kinase activity, thereby playing an effective role in preventing angiogenesis.^[23]

Cinnamaldehyde, an active component of cinnamon, has its own significant role in inhibiting angiogenesis. 2'-hydroxycinnamaldehyde, a chemical which is derived from cinnamaldehyde can inhibit the proliferation of tumor.^[24] Cinnamaldehyde also has an inhibitory action on NF- κ B and tumor necrosis factor alpha-induced IL-8 which adds additional support to cinnamon as antineoplastic agent.^[25]

Therapeutic Role of Cinnamon in Orofacial Conditions

Cinnamon as an antimicrobial agent can be used in the treatment of angular cheilitis, parotitis, stomatitis, cellulitis, endodontic infections, periodontitis, peri-implantitis, oral thrush, candidal leukoplakia, chronic granulomatous sinusitis, cutaneous aspergillosis, wound infection, and osteomyelitis by inhibiting wide range of microorganisms. Cinnamon due to its anti-inflammatory potential can be used in the management of inflammation mediated neurological diseases such as postherpetic neuralgia. Cinnamon also plays a beneficial role in the management of autoimmune diseases such as pemphigus, oral lichen planus, recurrent aphthous stomatitis, and lupus erythematosus due to its immunomodulatory activity. Cinnamon also can prevent oral cancer because of its ability to prevent angiogenesis.

Cinnamon dosage and side effects

The daily dosage of cinnamon is 2–4 g/day. Cinnamon >6 g/day may cause side effects such as sores in lips and mouth, runny

nose, stomach upset, fatigue, dizziness, redness, and irritation in skin and may also cause reduced blood glucose levels.

Conclusion

An attempt has been made to elucidate the therapeutic potential of cinnamon extract and postulate its proven and possible application in the field of orofacial medicine. Cinnamon is one of the many natural resources available with proven benefits in the management of diseases. Purity of the extracted compound and standardization of the derivative is pivotal to carry out further research, keeping in mind the possible adverse effects and drug reactions. This will enable one to explore cinnamon derivatives as a viable agent in the management of various orofacial disorders while negating the pitfalls of synthetic medicaments.

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