



Biological properties of turmeric for oral potentially malignant and malignant lesions

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Abstract

Curcumin is the active ingredient in turmeric. The medicinal properties of this spice have been slowly revealing themselves over the centuries. Long known for its anti-inflammatory properties, recent research has revealed that turmeric is a natural wonder, proving beneficial in the treatment of many different health conditions from cancer to Alzheimer's disease. Curcumin has: anti-inflammatory activity, anticancer activity, antioxidants activity, anti-diabetic activity, anti-aging, anti-fertility, hepato-protective activity, ophthalmic activity, antibacterial activity, antidepressant activity etc. Curcumin has shows significant effect in the treatment of oral mucosal disorders eg. aphthous stomatitis, oral ulcers, oral leukoplakia, oral lichen planus, oral submucous fibrosis etc. Curcumin affect systemic iron metabolism by reducing the levels of certain metal ions.

Keywords: malignant lesions, turmeric, anti-diabetic activity, anti-aging, anti-fertility

Introduction

Oral cancer is the sixth most common cancer worldwide [1] mainly attributed to the chewing and smoking habits. Oral Submucous fibrosis, oral Leukoplakia and oral lichen planus are three main potentially malignant disorders (PMDs) of oral cavity. Eight-ten % of these lesions eventually develop malignant changes [2]. Extensive research with in past half century have highlighted antioxidant and anticancerous properties of turmeric and indicated it as an effective phytotherapeutic measure for the treatment of precancerous lesions [3].

India produces nearly the whole world's turmeric crop and consumes 80% of it. Turmeric (*Curcuma longa*) is a perennial plant that belongs to ginger family [4]. *Curcuma* extracts contain three elements namely, curcumin, demethoxycurcumin and bisde methoxycurcumin [5]. Curcumin (1, 7-bis [4-hydroxy-3-methoxyphenyl]-1,6-heptadiene-3, 5-Dione), the orange yellow crystalline powder, is the active ingredient in the turmeric [6]. Curcumin, the yellow saffron of India, is recommended for a wide range of disorders and diseases for centuries in the ancient literatures of Ayurveda, Unani, Siddha and Chinese medicines and modern sciences provide scientific basis for such uses [7]. It has excellent anti-inflammatory, antiseptic, analgesic, antioxidant and anticarcinogenic properties [8]. As a natural product, it is nontoxic and has little or no adverse effects.

Anti-inflammatory Property

Curcumin has a potent anti-inflammatory activity and many clinical trials has proved it [9]. There are basically two pathways of inflammation: cyclooxygenase pathway by which prostaglandins are formed from arachidonic acid and lipoxygenase pathway by which pro-inflammatory leukotrienes are formed from the same. Curcumin downregulates both the mechanisms, both at the transcriptional level as well as via posttranslational enzyme inhibition [10]. Apart from that, curcumin, a pleiotropic

molecule, has the capability to interact and restrain many molecules associated with inflammation [11]. Curcumin also inhibits inflammatory cytokines i.e. tumor necrosis factor-alpha (TNF- α), interleukin (IL) -1, -2, -6, -8, and -12, monocyte chemoattractant protein (MCP), and migration inhibitory protein etc [12], through various mechanisms.

Besides this, curcumin plays an important antiinflammatory role by inhibiting Nuclear factor kappa B (NF- κ B), an inducible transcription factor [10]. NF- κ B is responsible for enhancing transcription of COX - 2 gene and other pro-inflammatory genes such as inducible nitric oxide synthase (iNOS). The COX - 2 and iNOS are important inflammatory mediators and improper upregulation of these is involved in pathogenesis of many inflammatory disease as well as cancers [13]. Thus, inhibition of NF- κ B plays a key role in anti-inflammatory action of curcumin.

Antioxidant Property

Curcumin is a strong antioxidant, both *in vitro* and *in vivo* [14]. Various studies have demonstrated its effectiveness in decreasing the oxidative stress and scavenging free radicals [15, 16]. The presence of methylene and phenolic hydrogens and a unique conjugated structure makes it capable to perform chainbreaking antioxidant actions by trapping free radicals [11, 14]. It acts by scavenging reactive oxygen species and reactive nitrogen species, inhibiting generation of reactive oxygen species, inhibiting oxidative enzymes, oxygen quenching and making it less available for oxidative reactions, interacting with oxidative cascade and preventing its outcome and chelating or disarming oxidative properties of metal ions like iron (Fe) [10, 11].

Apart from direct antioxidant action, curcumin also exhibits indirect antioxidant properties by potentiating the other antioxidant systems of body. Curcumin inhibits lipid peroxidation by using linoleate. It increases the activities of GSH S-transferase, superoxide dismutase and catalase to protect the body systems against oxidative injuries. It upregulates the cellular antioxidant activities by initiation of

cytoprotective Nrf2-induced target genes. Curcumin also raises the levels of glutathione, a significant antioxidant ^[14].

Anticancer Activity

Curcumin is an important anticancer agent and its anticancer potential is studied in multiple human carcinomas including melanoma, head and neck, breast, colon, pancreatic, prostate and ovarian cancers ^[10]. It induces apoptosis in cancer cells ^[17]. Cancer initiation is mainly mediated by two processes: inflammation and increased oxidative stress. Curcumin is reported to counteract the oxidative stress by increasing ornithine decarboxylase, glutathione, antioxidant enzymes and by expressing Heme oxygenase-1 (HO-1). Moreover, Curcumin exhibits excellent anti-inflammatory properties and it inhibits many inflammatory mediators. The pathways activated by NF- κ B has an important role in cancer initiation, promotion and progression. Curcumin has inhibitory effect on NF- κ B, there by inhibiting the process of cancer development. Inhibition of NF- κ B also inhibit cell proliferation and cytokine production ^[18]. Invasion of cancer cells in normal tissue is facilitated by the enzymes called matrix metalloproteinases; which are again inhibited by curcumin ^[19]. Additionally, it causes suppression of certain oncogens, inhibition of chromosomal damage, inhibition of tumor implantation, inhibition of tyrosine kinase c activity and inhibition of biotransformation of carcinogenesis ^[7].

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