

Nutraceutical Potential and Health Benefits of Curcuminoids from Turmeric (*Curcuma longa* L)

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Received: August 18, 2019; Published: August 30, 2019

Abstract

Turmeric (*Curcuma longa* L) has long been known in the Ayurvedic medical philosophy (traditional medicinal system) owing to its medical and nutraceutical importance. It belongs to the Zingiberaceae family and it has been since ancient times as spice and condiment in traditional and cuisines. In 1910, curcuminoids were first identified from turmeric by Lampe and Milobedzka. Curcuminoids usually exist in turmeric as volatile compounds and are yellow in color [1]. Scientific evidence based on extensive studies in recent years has established that curcuminoids exhibit divers pharmacological benefits as the chemoprotective and therapeutic agent in prevention and treatment of various chronic diseases. Specifically, curcuminoids comprise of three principal plant-derived compounds of interest: curcumin, demethoxycurcumin and bisdemethoxycur which accounts for 77%, 17% and 3% of total composition of turmeric [1,2]. The curcuminoid complex is termed as Indian Saffron also in the published literature. The curcuminoids have been reported to exist in conjunction with the curcuminoid pigments compounds and volatile oils which render pharmacological activities to turmeric extracts, powder and oleoresins. Apart from therapeutic benefits, curcuminoids play their roles in improving the keeping quality, freshness and nutritional attributes of wide range of foodstuffs [3].

Keywords: Curcuminoids; *Curcuma longa* L

Curcuminoids are used extensively for coloring the foodstuffs including fats, oils, dairy products edible ices, vegetables and fruits products, cereal, bakery, confectionary, spices soups and fish products As far as the therapeutic and health benefits are concerned, curcuminoids exhibits different biological activities: antioxidant, anti-atherogenic, antidiabetic, immunomodulatory, anti-psoriatic, anticancer, anti-inflammatory and bactericidal effects [1,3,4]. It also plays contributory role in prevention of the Alzheimer disease. The antioxidant properties of curcuminoids may be exploited in mitigation of the adverse effects caused by reactive oxygen species, nitrogen free and rancidity issue can also be prevented in foodstuffs comprising of free radicals or less oxidized fat [1,5]. Curcuminoids have also been reported to inhibit various metabolic pathways which can cause adverse health impacts on human wellness such as, inhibition of lipoxygenase (LOX), cyclooxygenase (COX), and arachidonic acid and release of hormones originating from steroids. Curcuminoids possess large range of targets in terms of its regulation effect on growth factors, transcription factors, gene regulation, cell apoptosis, signaling, proliferation, cytokines and various enzymes. It also helps to reduce the synthesis of pro-inflammatory leukotriene by means of inhibition of LOX [6].

Curcumin is classified as the polyphenolic compound and it is sparingly soluble in aqueous phase but it possesses quite good pH stability particularly in the acidic environment of human stomach. Recently published literature has elaborated the mechanistic overview with regard to anti-inflammatory activity of the curcuminoids. The underpinning anti-inflammatory mechanism actually comprises of interaction of the curcumin as highly pleiotropic molecule with various molecular moieties having the pertinent role in inflammation [1,4,6]. The brief nutraceutical advantages of curcuminoids with precise details are given in the following subsections.

Role as anti-inflammatory agent

Curcuminoids have been shown to have promising anti-inflammatory effects and this has been confirmed by the various animal studies conducted in recent past. A report published by Sarimal, *et al.* [7] has shown that a curcumin was effect in minimizing the edema as anti-inflammatory agent at the dose range of 50 - 200 mg/kg. Similarly, arthritis symptoms were relieved in the mouse which were induced by formaldehyde using a dose of 40 mg/kg. Phenylbutazone is a famous anti-inflammatory drug which is usually used to treat gout and arthritis and its ulcerogenic index is 1.70 while curcumin demonstrated much lower ulcerogenic index as compared to phenylbutazone without any acute toxicity.

Reduction of ulcerative colitis and inflammatory bowel disease

Curcuminoids have shown significant potential regarding reduction of the injury induced in the mucosa lining of the mice. A dose of 50 mg/kg administrated for 10 days resulted in significant amelioration of the ulcerative colitis (UC) symptoms. Moreover, curcumin also played inhibitory role to reduce lipid peroxidation and formation of neutrophil infiltration. All these factors led to suppression of the ulcer development in the mucosal lining of the mice and aided in the improvement of the colonic architecture [8].

In addition to this, ulcerative colitis is classified under the category of inflammatory bowel diseases along with Crohn's disease (CD) and these two diseases differentiate from each other with respect to the locality of the inflammation in the gastrointestinal (GI) tract. Curcuminoids have been reported to exert positive effects on amelioration of the symptoms of UC and CD. The confinement of the UC has been described to the colon and rectum, while CD may affect any part of the GI tract and both disease have been associated with other symptoms of abdominal pain, weight loss, diarrhea and bloody stool etc. Curcuminoids were reported to demonstrate a decreasing tendency in the subjects which were administrated with curcumin at the dose of 550 mg twice a day [1,8].

Role in cancer prevention as anticarcinogenic

Curcuminoids have been reported to possess strong antioxidant potential. The potent antioxidant activity of curcuminoids have been ascribed to the presence of phenolic hydroxyl groups. Carcinoma development process involves three stages such as, initiation, proliferation and progression stage. During first two phases of cancer development, transcription factors were modulated by the curcuminoids by maneuvering the carcinogen genes and down-regulation of the pro-inflammatory cytokines by means of COX and LOX pathways and acting as radical scavenger. The size and frequency of the tumors were decreased by induction of apoptosis process owing to antioxidant potential and anticancer properties of curcuminoids from turmeric [1,6]. Curminoids have also been reported to exhibit antiviral properties and the anticancer effects in combination with the antiviral effects, it may be a good viable option to help prevention of human papillomavirus (HPV) and cervical cancer and HPV is known as the causal agent of cervical cancer. Curcuminoids have also demonstrated significant potential as chemo-preventive agent for various other cancer types such as, breast, ovarian, colon, liver, lung, thyroid and prostate cancers. However, more intensive research is needed for providing clear insights about efficacy of curcuminoids as chemopreventive agent for treatment of active cancer types [3,5].

Conclusion

Conclusively, it can be implied that curcumin may serve as the excellent nutraceutical foods with several health benefits to combat lifestyle-related disorders. Curcuminoid bioavailability may be maximized by conducting further research of curcuminoid formulation with biopolymers and these products also find their practical applications in the form of nutraceutical products.

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Volume 14 Issue 9 September 2019

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