



**AN OVERVIEW OF MEDICINAL AND PHARMACOLOGICAL  
PROPERTIES OF TURMERIC (*CURCUMA LONGA*) IN THE  
TREATMENT OF VARIOUS HUMAN AILMENTS**



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**ABSTRACT**

*Curcuma longa* (Turmeric), belonging to Zingiberaceae family is one of the most useful herbal medicinal plants. Extensive researches have proven that most of the turmeric activities of the turmeric are due to curcumin. *Curcuma longa* commonly known as turmeric, is native to Southwest India with its rhizomes being the source of a bright yellow spice with various medicinal applications and also used for medicinal value in the cosmetic industry. Curcumin is one of the most important turmeric's bioactive constituent. Turmeric is widely cultivated throughout the tropics. Turmeric is having many medicinal uses to control many diseases such as cancer, inflammations, microbial infections, diabetes, arthritic, muscular disorders, biliary disorders, anorexia, cough, diabetic wounds, hepatic disorders, and sinusitis. Curcumin, the main bioactive constituent of turmeric, also shown various pharmacological activities including antioxidant, antineoplastic, antiviral, anti-inflammatory, antibacterial, antifungal, antidiabetic, anticoagulant, antifertility, cardiovascular protective, hepatoprotective and immunostimulant activities in animals. This research study provides information about the use of Turmeric in the treatment of various human ailments.

**KEYWORDS**

*Turmeric, Curcumin, Cancer treatment, anti-inflammatory*

## RESEARCH PAPER

### INTRODUCTION

Turmeric is a spice that has received much interest from both the medical and scientific world for its medicinal value. Turmeric is a rhizomatous herbaceous perennial plant (*Curcuma longa*) of the ginger family [1]. The medicinal properties of turmeric, the source of curcumin, have been known for thousands of years; however, the ability to determine the exact mechanism(s) of action and to determine the bioactive components have only recently been investigated [2]. Curcumin (1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione), also called diferuloylmethane, is the main natural polyphenol found in the rhizome of *Curcuma longa* (turmeric) and in others *Curcuma* spp. [3]. *Curcuma longa* has been traditionally used in Asian countries as a medical herb due to its antioxidant, anti-inflammatory [4], antimutagenic, antimicrobial [5,6], and anticancer properties [7,8].



**Fig. Turmeric rhizome and Turmeric powder**

### Phytochemicals of turmeric

Turmeric contains 69.4% carbohydrates, 6.3% protein, 5.1% fat, 3.5% minerals, and 13.1% moisture. The essential oil (5.8%) obtained by steam distillation possesses Sesquiterpenes (53%), zingiberene (25%),  $\alpha$ -phellandrene (1%), sabinene (0.6%), cineol (1%), and borneol

(0.5%). Curcumin (3–4%) is responsible for the yellow colour, and comprises curcumin I (94%), curcumin II (6%) and curcumin III (0.3%). Demethoxy and bisdemethoxy derivatives of curcumin have also been isolated from turmeric. Curcumin has a melting point at 176–177 °C; forms a reddish-brown salt with alkali and is soluble in acetic acid, ethanol, alkali, ketone and chloroform [9].

### **Phytopharmacology of turmeric**

Turmeric is having many medicinal properties, following are most important phytopharmacological properties of turmeric.

#### **Antioxidant activity**

Curcumin has been shown to be a powerful scavenger of oxygen free radicals. Its antioxidant activity is comparable to vitamins C and E [10]. It can protect lipids or hemoglobin from oxidation. It can significantly inhibit the generation of reactive oxygen species (ROS) such as H<sub>2</sub>O<sub>2</sub>, superoxide anions and nitrite radical generation by activated macrophages [11]. Its derivatives, bisdemethoxycurcumin and demethoxycurcumin also have antioxidant activities [10].

#### **Cardiovascular and anti-diabetic effects**

Turmeric exerts cardio-protective effects mainly by antioxidant activity, lowering lipid peroxidation, antidiabetic activity and inhibiting platelet aggregation. Turmeric effect on cholesterol levels may be due to decreased cholesterol uptake in the intestines and increased conversion of cholesterol to bile acids in the liver. Inhibition of platelet aggregation by turmeric constituents is thought to be via potentiation of prostacyclins synthesis and inhibition of thromboxane synthesis. Turmeric also decreases complications in diabetes mellitus [11].

#### **Gastrointestinal effects**

Turmeric exerts several protective effects on the gastrointestinal tract. Turmeric also inhibits ulcer formation caused by stress, alcohol, Indomethacin, reserpine, pyloric ligation, increasing gastric wall mucus in rats subjected to these gastrointestinal insults. It also inhibits intestinal spasm and increases bicarbonate, gastrin, secretin and pancreatic enzyme secretion [11].

#### **Anti-cancer effect**

Numerous animal studies have explored turmeric influence on the carcinogenesis. Several studies have demonstrated that curcumin is able to inhibit carcinogenesis at three stages:

angiogenesis, tumor promotion and tumor growth. Turmeric and curcumin are also able to suppress the activity of several common mutagens and carcinogens [11].

### **Antimicrobial activity**

Turmeric has been shown to inhibit the growth of a variety of bacteria, pathogenic fungi, and parasites. Khattak et al. 2005 [12] studied the antifungal, antibacterial, phytotoxic, cytotoxic and insecticidal activity of an ethanolic extract of turmeric. The extract showed antifungal activity towards *Trichophyton longifusus* and *Microsporum canis* and weak antibacterial activity against *Staphylococcus aureus*.

### **Dyspepsia and gastric ulcer**

Kim et al. 2005 [13] investigated the protective effect of turmeric ethanolic extract against gastric ulcers by blocking H<sub>2</sub> histamine receptors (H<sub>2</sub>R) of male Sprague-Dawley (pylorus-ligated) rats. The effect of *Curcuma longa* extract was compared to the properties of ranitidine. Curcuma was found to protect the gastric mucosal layer as effective as ranitidine. Orally administered ethanolic extract inhibited gastric acid, gastric juice secretion and ulcer formation comparable to the properties of ranitidine. Rafatullah et al. 1990 [14] investigated the antiulcer activity of an ethanolic extract of turmeric. Hypothermic-restraint stress reduction of gastric wall mucus was inhibited by turmeric extract treatment and reduced the severity of lesions induced by various necrotizing agents [15].

### **Irritable bowel syndrome**

In patients with irritable bowel syndrome (IBS) the most common symptoms are abdominal pain, bloating, altered bowel habits, and increased stool frequency [15].

### **Neuroprotective Effect**

Neuroinflammation is a chronic inflammation that leads to neuronal metabolism changes that result in neuronal degradation. In neuro-inflammatory states, the neuronal death is increased by microglia and astrocytes activation. The latter are responsible for proinflammatory cytokines' release, such as TNF $\alpha$  and IL-1. Based on existing studies, curcumin has been used as a potential therapeutic agent for various neurological disorders, such as dementia, AD, PD, multiple sclerosis, and Huntington's disease (HD), due its antioxidant, anti-inflammatory, and anti-protein aggregating abilities [16].

### **Arthritis**

One such disease associated with inflammation, both chronic and acute, is osteoarthritis (OA), a chronic joint condition. It affects over 250 million people worldwide, leading to increased healthcare costs, impairment in activities of daily living (ADL), and ultimately

decreased quality of life [17,18]. While there is no cure, there are several pharmaceutical options for treatment; however, many are costly and have undesirable side effects. Therefore, there is increased interest in alternative treatments including dietary supplements and herbal remedies [19]. Several studies have shown the anti-arthritic effects of curcumin in humans with OA and rheumatoid arthritis (RA) [20-23].

#### **Allowable Daily Intake (ADI)**

Curcumin has a long-established safety record. For example, according to JECFA (The Joint United Nations and World Health Organization Expert Committee on Food Additives) and EFSA (European Food Safety Authority) reports, the Allowable Daily Intake (ADI) value of curcumin is 0–3 mg/kg body weight [24]. Several trials on healthy subjects have supported the safety and efficacy of curcumin. Despite this well-established safety, some negative side effects like diarrhea, nausea, headache etc. have been reported.

#### **CONCLUSIONS**

Curcumin can be considered a great potential therapeutic agent for a variety of inflammatory conditions and cancer types. Turmeric is the unique source of various types of chemical compounds, which are responsible for a variety of activities. Although crude extracts from leaves or rhizomes of the plant have medicinal applications, modern drugs can be developed after extensive investigation of its pharmacotherapeutics, bioactivity, mechanism of action, and toxicities, after proper standardization and clinical trials. As the global scenario is now changing towards the use of non-toxic plant products having traditional medicinal use, development of modern drugs from *Curcuma longa* should be emphasized for the control of various diseases. Further evaluation needs to be carried out on *C. longa* in order to explore the concealed areas and their practical clinical applications, which can be used for the welfare of mankind.

## REFERENCES

- Priyadarsini, K.I. The chemistry of curcumin: From extraction to therapeutic agent. *Molecules* 2014, 19, 20091–20112. [CrossRef] [PubMed]
- Gupta, S.C.; Patchva, S.; Aggarwal, B.B. Therapeutic Roles of Curcumin: Lessons Learned from Clinical Trials. *AAPS J.* 2013, 15, 195–218. [CrossRef] [PubMed]
- Aggarwal, B.B.; Kumar, A.; Bharti, A.C. Anticancer potential of curcumin: Preclinical and clinical studies. *Anticancer Res.* 2003, 23, 363–398. [PubMed]
- Lestari, M.L.; Indrayanto, G. Curcumin. *Profiles Drug Subst. Excip. Relat. Methodol.* 2014, 39, 113–204. [PubMed]
- Mahady, G.B.; Pendland, S.L.; Yun, G.; Lu, Z.Z. Turmeric (*Curcuma longa*) and curcumin inhibit the growth of *Helicobacter pylori*, a group 1 carcinogen. *Anticancer Res.* 2002, 22, 4179–4181. [PubMed]
- Reddy, R.C.; Vatsala, P.G.; Keshamouni, V.G.; Padmanaban, G.; Rangarajan, P.N. Curcumin for malaria therapy. *Biochem. Biophys. Res. Commun.* 2005, 326, 472–474. [CrossRef] [PubMed]
- Vera-Ramirez, L.; Perez-Lopez, P.; Varela-Lopez, A.; Ramirez-Tortosa, M.; Battino, M.; Quiles, J.L. Curcumin and liver disease. *Biofactors* 2013, 39, 88–100. [CrossRef] [PubMed]
- Wright, L.E.; Frye, J.B.; Gorti, B.; Timmermann, B.N.; Funk, J.L. Bioactivity of turmeric-derived curcuminoids and related metabolites in breast cancer. *Curr. Pharm. Des.* 2013, 19, 6218–6225. [CrossRef] [PubMed]
- Chattopadhyay I, Biswas K, Bandyopadhyay U, Banerjee RK. Turmeric and curcumin: Biological actions and medicinal applications. *Curr Sci India* 2004;87:44-53
- Ammon HP, Anazodo MI, Safayhi H, Dhawan BN, Srimal RC. Curcumin: A potent inhibitor of leukotriene B4 formation in rat peritoneal polymorphonuclear neutrophils (PMNL). *Planta Med* 1992;58:226
- Nasri H., Shinfard N., Rafieian M., Rafieian S., Shirzad M., Turmeric- A spice with multifunctional medicinal properties, *J HerbMed Pharmacol* 2014: 3(1): 5-8
- Khattak S, Saeed ur R, Ullah Shah H, Ahmad W, Ahmad M. Biological effects of indigenous medicinal plants *Curcuma longa* and *Alpinia galanga*. *Fitoterapia.* 2005;76(2):254-7
- Kim DC, Kim SH, Choi BH, Baek NI, Kim D, Kim MJ et al., *Curcuma longa* extract protects against gastric ulcers by blocking H2 histamine receptors. *Biol Pharm Bull.* 2005;28(12):2220-4
- Rafatullah S, Tariq M, Al-Yahya MA, Mossa JS, Ageel AM., Evaluation of turmeric (*Curcuma longa*) for gastric and duodenal antiulcer activity in rats. *J Ethnopharmacol.* 1990;29(1):25-34.
- Louay Labban, Medicinal and pharmacological properties of Turmeric (*Curcuma longa*), *Int. J. Pharm. Biomed Sci.*, 2014; 5(1):17-23
- (Ye and Zhang, 2012; Wu et al., 2013; Song et al., 2016; Teter et al., 2019; Salehi et al., 2020a).
- Ye, J., and Zhang, Y. (2012). Curcumin protects against intracellular amyloid toxicity in rat primary neurons. *Int. J. Clin. Exp. Med.* 5, 44–49.
- Hunter, D.J.; Schofield, D.; Callander, E. The individual and socioeconomic impact of osteoarthritis. *Lancet Nat. Rev. Rheumatol.* 2014, 10, 437–441. [CrossRef] [PubMed]
- Vos, T.; Barber, R.M.; Bell, B.; Bertozzi-Villa, A.; Biryukov, S.; Bolliger, I.; Charlson, F.; Davis, A.; Degenhardt, L.; Dicker, D.; et al. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: A systematic analysis for the Global Burden of Disease Study. *Lancet* 2013, 386, 743–800. [CrossRef]

- Sahebkar, A. Molecular mechanisms for curcumin benefits against ischemic injury. *Fertil. Steril.* 2010, 94, e75–e76. [CrossRef]
- Henrotin, Y.; Priem, F.; Mobasheri, A. Curcumin: A new paradigm and therapeutic opportunity for the treatment of osteoarthritis: Curcumin for osteoarthritis management. *SpringerPlus* 2013, 2, 56. [CrossRef] [PubMed]
- Belcaro, G.; Cesarone, M.R.; Dugall, M.; Pellegrini, L.; Ledda, A.; Grossi, M.G.; Togni, S.; Appendino, G. Product-evaluation registry of Meriva®, a curcumin-phosphatidylcholine complex, for the complementary management of osteoarthritis. *Panminerva Med.* 2010, 52, 55–62. [PubMed]
- Belcaro, G.; Hosoi, M.; Pellegrini, L.; Appendino, G.; Ippolito, E.; Ricci, A.; Ledda, A.; Dugall, M.; Cesarone, M.R.; Maione, C.; et al. A controlled study of a lecithinized delivery system of curcumin (meriva®) to alleviate the adverse effects of cancer treatment. *Phytother. Res.* 2014, 28, 444–450. [CrossRef] [PubMed]
- Chandran, B.; Goel, A. A randomized, pilot study to assess the efficacy and safety of curcumin in patients with active rheumatoid arthritis. *Phytother. Res.* 2012, 26, 1719–1725. [CrossRef] [PubMed]
- Kocaadam, B.; Sanlier, N. Curcumin, an active component of turmeric (*Curcuma longa*), and its effects on health. *Crit. Rev. Food Sci. Nutr.* 2017, 57, 2889–2895. [CrossRef] [PubMed]