

REVIEW ARTICLE

Intrinsic Medicinal Qualities and Current Status of Curcumin: An Incisive Review

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Abstract: Curcumin is polyphenol product collected from the ground rhizomes of *Curcuma Longa*, which are commonly known as Turmeric. Curcumin has been procured by solvent extraction of turmeric and the purification of the extract by crystallization method. Traditionally turmeric is used as colouring agent in foods and textiles. Colouring principles are present to an intensity of 3-5 percent in turmeric and lesser amount of oils and resins, proteins, sugars may be naturally present in turmeric. Curcumin is an oily pigment and contains volatile oils like turmerone and zingiberone that are practically insoluble at neutral pH and in water at acidic medium.¹ It is freely soluble in alkali. It is stable in acids and at high temperatures, but unstable in presence of light and in alkaline conditions. It has the poor bioavailability. To improve of bioavailability of curcumin various approaches have been over taken. Curcumin has widely used in ancient Indian medicine to ailment anorexia, diabetic wounds, biliary disorders and rheumatism and therapeutically significant for its Antiseptic Activity, Cardiovascular Effects, Anticarcinogenic Effects, Hepatoprotective Effects etc. Recent study showed that curcumin has Anticancer Activity.²

Key words: Rosuvastatin calcium; Normal phase HPLC; Enantiomer; Impurities; Chiral method.

INTRODUCTION:

Curcumin is a hydrophobic polyphenol obtained from the

popular Indian spice rhizome of the herb *Curcuma longa* which belongs the family of the Zingiberaceae. The two curcuminoids are bis-desmethoxycurcumin and desmethoxycurcumin. Curcumin can be used for the boron quantification in curcumin method. It also reacts with boric acid to make a red-color compound, like rosocyanine. Curcumin are polyphenols that are responsible for yellow color turmeric. Curcumin contains at least two tautomeric forms, enol and keto³. The enol form is most energetically stable in solution and in the solid phase. Currently Curcumin is sold as dietary supplement. Traditionally, turmeric has been used for the may procurement, mainly for the Anti-inflammatory agent, and the curcumin identified as active principle of turmeric. It is non-toxic and has variety of therapeutic properties including Anti-inflammatory Effect, Analgesic Effect, Antiseptic Activity, Hepatoprotective Effects, Anticarcinogenic Effects, Cardiovascular Effects and Antimicrobial Effect. Recently Study show that curcumin has Anticancer Activity and Antiproliferative effects in multiple cancer and also show effect in cell adhesion molecules involved in tumor growth angiogenesis⁴⁻⁷

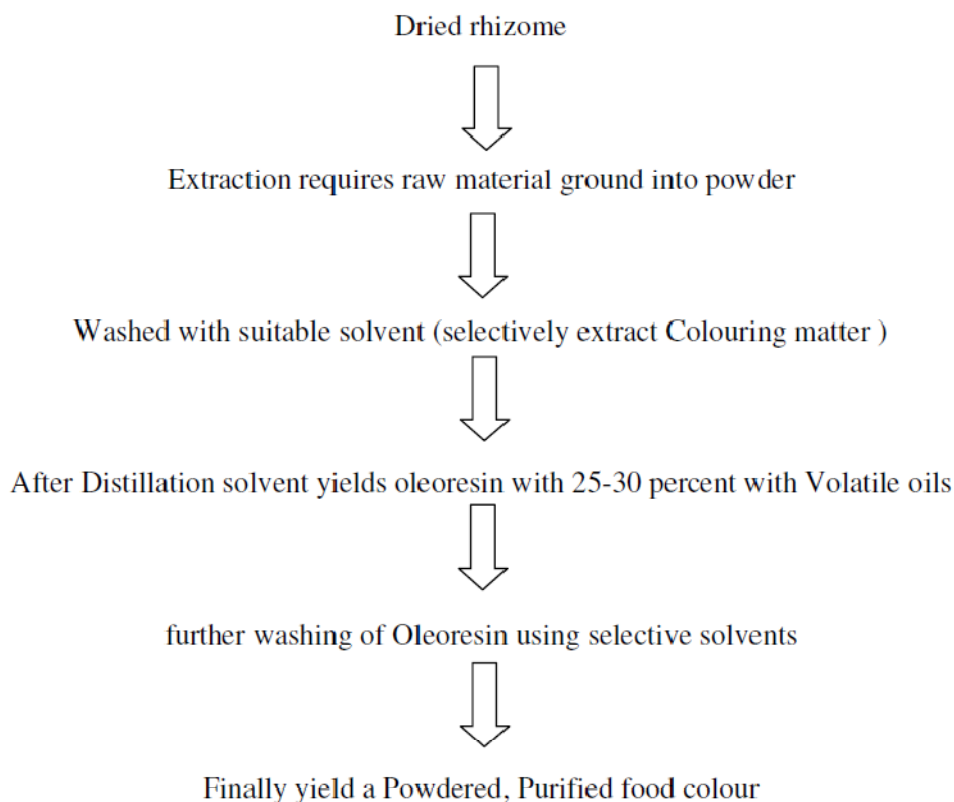
Description of the Product:

Curcumin (**Synonyms** : yellow turmeric , **Hindi** : Jangli Haldi or Van Haldi, **Malayalam** : kuzhikkoova, **KER-koo-muh**—from the Arabic *kurkum* , meaning saffron) is an orange yellow crystalline powder. It contains less amount of oils and resins naturally present in the turmeric rhizomes.

The yellow turmeric collected from the plant *Curcumin longa* L belongs to family Zingiberaceae in India. The plant is distributed Throughout subtropical and tropical regions of the world. It is more cultivated in southeast Asian Countries. The Curcumin extracted from natural source materials and also produced by chemical synthesis.⁸⁻⁹

Commercially Manufacturing of Product

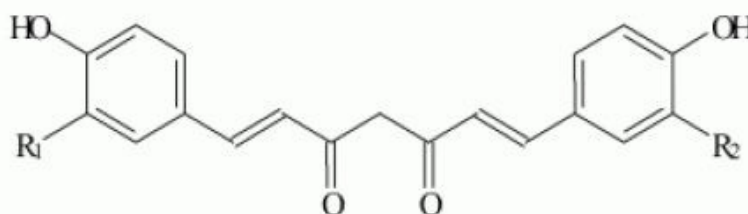
Generally Curcumin is collected by solvent extraction method, like solvent Hexane, Ethanol, Methanol. The European Commission Directive 95/45/EC lists the following solvents as suitable extraction : acetone, ethyl acetate, carbon dioxide, n-butanol. The commercially Curcumin are extracted by the following¹⁰ : -



Flowchart: 1 Synthetic approach for preparation of curcumin

Chemical Characterization ¹¹

The Basic colouring parts of curcumin which are present in various proportions of curcumin are keto derivatives. Curcumin aromatic ring give a more water-Soluble compound with a good therapeutic index and a great Kinetic stability. The curcumin Basic ring in keto form shows in figure



Sr. No	Chemical Name	Functional group	Properties
1	1,7-Bis-(4-hydroxyphenyl)-hepta-1,6-diene-3,5-dione	$R_1=R_2=H$	Chemical formula: $C_{19}H_{16}O_4$: Formula weight: 308
2	1,7-Bis-(4-hydroxy-3-methoxyphenyl)-hepta-1,6-diene-3,5-dione	$R_1=R_2=OCH_3$	Chemical formula: $C_{21}H_{20}O_6$: Formula weight: 368
3	1-(4-Hydroxyphenyl)-7-(4-hydroxy-3-methoxyphenyl)-hepta-1,6-diene-3,5-dione	$R_1=OCH_3, R_2=H$	Chemical formula: $C_{20}H_{18}O_5$: Formula weight: 338

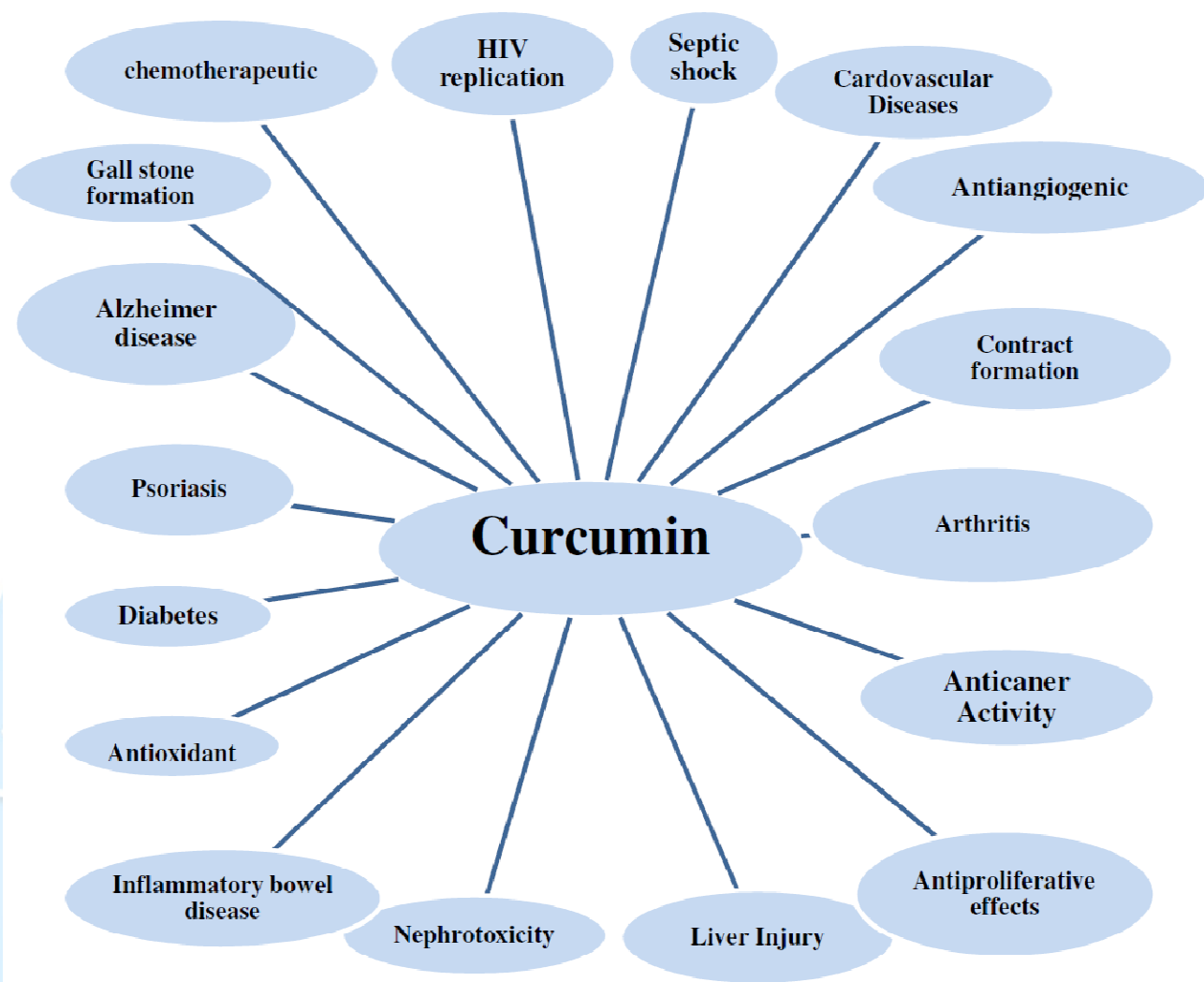
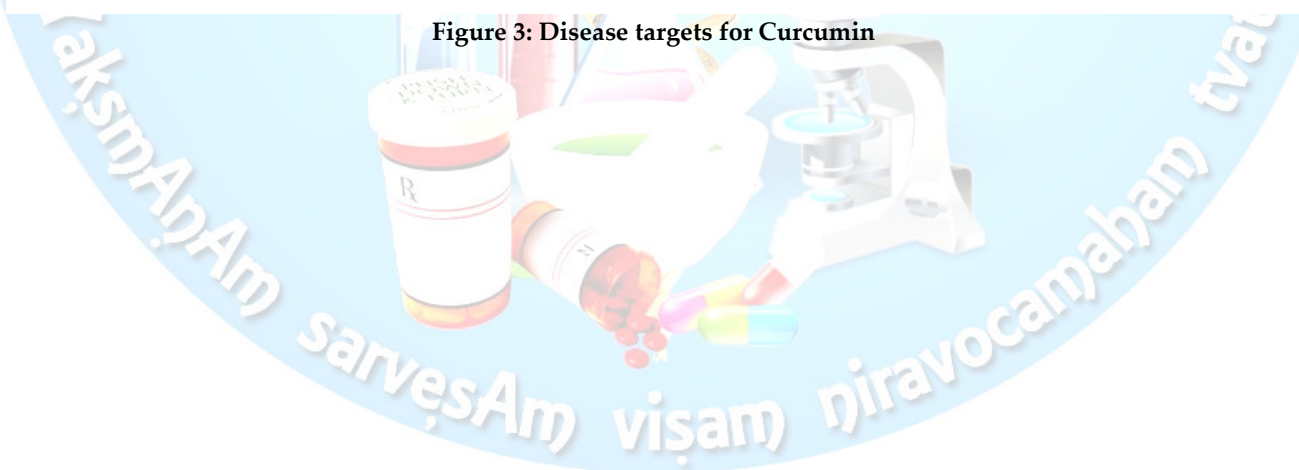


Figure 3: Disease targets for Curcumin



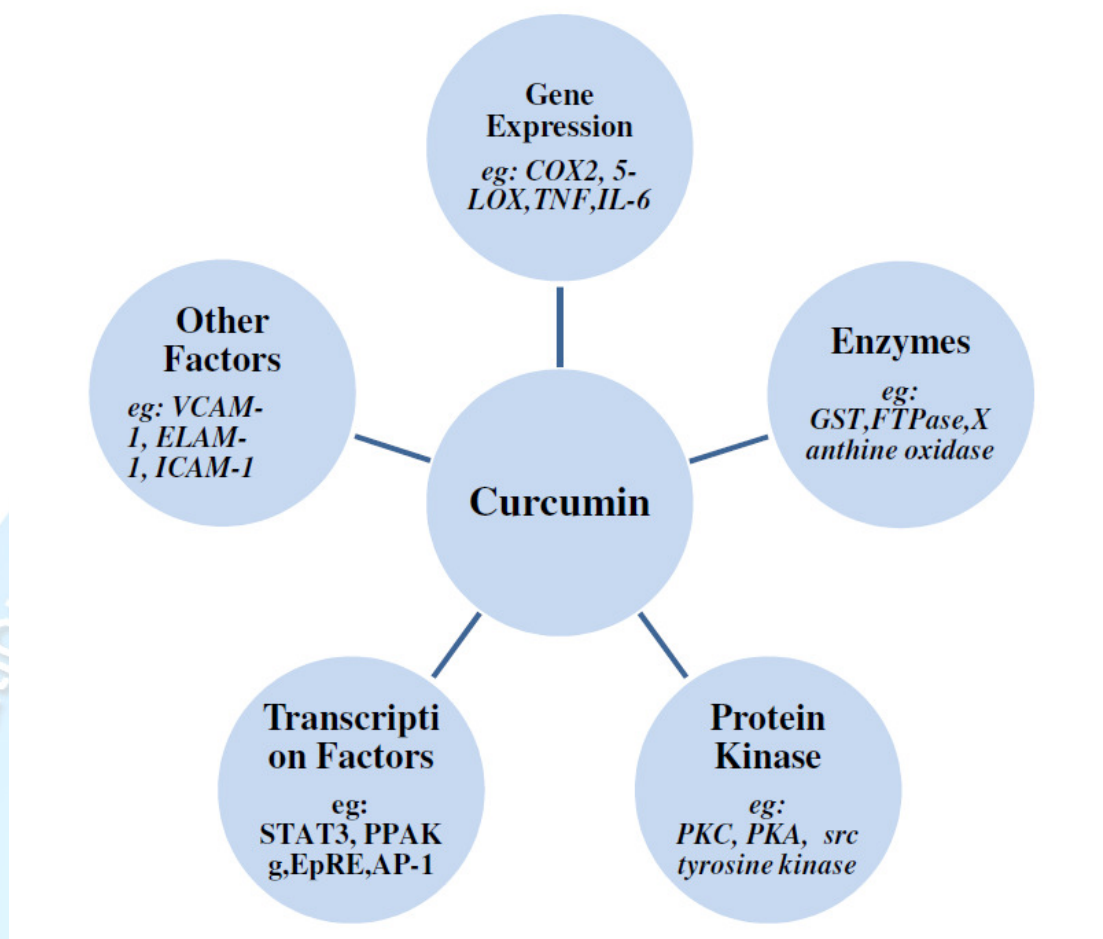


Figure 4: Molecular Targets for Curcumin

Medicinal Claims:

Antioxidant property¹³⁻¹⁴: Many studies shown that Curcumin is very potent Antioxidant effect. Curcumin inhibits the lipid peroxidation and prevents the oxidation of Haemoglobin. Curcumin is 10 times more Antioxidant effect than the other Vitamins.

Skin Diseases¹⁵: Curcumin is more effective in the cure of skin diseases like Psoriasis, carcinogenesis, dermatitis and scleroderma. Many studies and reports show that curcumin is more effective in Wound healing and Play vital role in muscle regeneration in trauma and accident

Anticancer Property¹⁶⁻¹⁷: Recent studies suggest that curcumin has strong anticancer effect. Anticancer effect may be due to inhibitory effect on tumor promotion, angiogenesis, invasion, tumor promotion and metastasis¹⁶. Curcumin has been shown to control the wide variety of tumour cell like B-cell and T-cell, colon delivery, breast cancer, neck and head cancer, Leukemia by different mechanisms of action including action on protein kinase, gene expression, transcription factors, enzymes and other some factors¹

Diabetes¹⁸: Curcumin have potential to decrease the blood sugar, glycosylated haemoglobin and polyol pathway in diabetic albino rats. It also reduced the oxidative stress. Investigations disclosed the influence of dietary curcumin progression experimentally lower diabetes induced by cholesterol feeding in the rat¹⁸.

Rheumatoid Arthritis:

Curcumin have also shown effect in the treatment of anti-rheumatic and anti-arthritic effect, through the inhibition of COX2, inflammatory cytokines and Tumor necrosis factor (TNF)¹⁹.

Cystic fibrosis:

Cystic fibrosis is common disease in the white population due to the cause of mutations in the cystic fibrosis transmembrane conductance regulator gene²⁰. Experimental studies have proved that curcumin have curative effect for Cystic fibrosis

Alzheimer's Disease:

Curcumin inhibits the oxidative inflammation, amyloid accumulation and cognitive deficits²¹.

Alcohol-Induced Liver Injury :

Curcumin inhibits the activation of NF-kappaB that participates in pathogenesis of alcoholic liver disease (ALD). Curcumin have potential to block endotoxin-mediated activation of NF-kB and suppression of expression of cytokines, chemokines, COX-2, and iNOS in Kupffer cells.²²

Stress Effect:

Curcumin is very potent inducer of Redox sensitive and

hemoxy genase-1 proteins which protects against stress. It suppresses the expression of NRF2. Curcumin is major constituent used by Chinese in the traditional medicine²³.

Other effects:

Curcumin was found to be potent and selective inhibitor of many diseases. Curcumin also inhibit the multi drug resistance therapy. It also used in treatment of Pancreatitis. Curcumin also protect the endotoxin shock ²⁴.

Table No. 1 Curcumin patents

Sr No.	Publication No	Inventors	Title	Reference No
1	US8772265 B2	Philippe Neven, Didier Sertheyn, Jacques Delarge, Robert Kiss, Veronique Mathieu, Didier Cataldo, Natacha Rocks	Water soluble curcumin compositions for use in anti-cancer and anti-inflammatory therapy	25
2	US7883728 B2	Benny Antony	Composition to enhance the bioavailability of curcumin	26
3	EP0839037B1	Vladimir Badmaev, Muhammed Majeed, R. Rajendran	Bioprotectant Composition, Method Of Use And extraction Process Of Curcuminoids	27
4	US6224877 B1	Vilas Gajanan Gaikar, Deepak Vijay Dandekar	Process for extraction of curcuminoids from curcuma species	28
5	US5861415A	Majeed Muhammed, Badmaev Vladimir, Rajendran R	Bioprotectant composition, method of use and extraction process of curcuminoids	29

List of Clinical Trials on Curcumin³⁰⁻³³

1. Curcumin/Piperine - IND study Approved: IND#61,872 - Food & Drug Administration Office of Drug Evaluation I, Oncology Drug Products
2. The effects of Curcuminoids on aberrant crypt foci in t IND# 51,685 - UMDNJ- Robert Wood Johnson Medical School, New Je Institute
3. Pilot study of curcuminoids with or without BioPerine® multiple myeloma: IND# 67,963 -MD Anderson Cancer Center, University of Texas
4. Prevention and intervention of Alzheimer's disease with Curcumin - University of California, Los Angeles
5. Phase IIa prevention study of C3 Complex® curcuminoids increased risk for breast cancer, MD Anderson Cancer Center, University of Texas
6. Phase II prevention study with C3 Complex® in patient colorectal cancer stage I-III, Lincoln Medical and Mental Health Center, Bronx, NY
7. Phase I trial of C3 Complex® and preoperative patient advanced esophageal or gastroesophageal carcinoma, MD Anderson Cancer Center, University of Texas.
8. Metabolic studies and chemopreventive studies - University of Leicester, UK
9. Curcuminoids in patients with Lichen planus: IND#65 - University of California

Table No. 2 Sources and site of action of natural analogs of curcumin³¹⁻³³

Sr No	Analog	Source	Target
1	6-Gingerol	Ginger (<i>Zingiber officinale</i> Roscoe)	TNF, NF- κ B, AP-1, COX2, ODC, iNOS, p38MAPK, antifungal
2	6-Paradol	Ginger (<i>Zingiber officinale</i> Roscoe)	Caspase activation
3	Cassumunin A&B	Ginger (<i>Zingiber cassumunar</i>)	Antioxidant
4	Diarylheptanoids	Ginger (<i>Zingiber spp.</i>)	PGE2 and LT
5	Shogaol	Ginger (<i>Zingiber officinale</i> Roscoe)	Helicobacter pylori
6	Galanals A&B	Zingiber (<i>Zingiber mioga</i> Roscoe)	Caspase 3, bcl2

Table No. 3 Curcumin based Marketed Formulation :

Curcumin based formulation are marketed in many countries including the India, Japan, Thailand, China, turkey, United States, South Africa, Nepal, and Pakistan , Korea in different form such as capsules, tablets, ointments, energy drinks, soaps, and cosmetics .

Sr no	Formulation	Brand Name	Type	Function	Business Type
1	Capsules	Curcumin 500 Mg	Herbal Supplements	Antioxidant	Manufacturer, Trading Company, Delhi India
		Turmeric Curcumin Vegetarian Capsules 500mg	Herbal Supplements	Natural Oxidant	Manufacturer, Trading Company , Mumbai, India
2	Beauty Cream	Vicco Turmeric Cream	Skin cream	For Beautifull and Healthy skin	Vicco Laboratories 78, Farmland, Ramdaspath, Nagpur 440010, Maharashtra, India
		Vicco turmeric Cream	Shaving cream Base	Antiseptic	Vicco Laboratories 78, Farmland, Ramdaspath, Nagpur 440010, Maharashtra, India
		Vicco Turmeric WSO Cream	Skin Cream	For glowing & radiant Skin	
3	Gummy Candy	CANDY TABLET	Herbal Tablet	For Flavour	Alka Company (phu Aka) Ul.Limanowskiego 19/13 poznan-wielkopolska Poland
5	Turmeric soap	Neem& Turmeric Soap	Herbal Soap	Cleanses & Purifies Skin	Himalaya Herbals
		Ayurvedic Turmeric Soap	Herbal Soap	Softness & Beautifies	Hemani live Natural
6	Medicinal Cream	Curcumin Active Fast relief	Herbal ointment	Help relieves Joint and Inflammation	Advanced Ortho molecular Research

CONCLUSION:

The medicinal Properties of Curcumin Longa have been well known to mankind for ages. Modern science and recent experimental investigations has provided a scientific basis to number of reports claiming medicinal effects of these polyphenols. Drug candidate taken at higher dose poses side effects when taken orally but Curcumin at higher dose dose not show adverse effects, even taken high dose. Curcumin and its analogs have ability to interact with multiple targets and may show clinical significance for plethora of diseases. Experimental studies and clinical investigations have disclosed that curcumin exhibits activities against cancer, cardiovascular diseases and diabetes. Curcumin also shown therapeutic effects against alzheimer's disease, multiple sclerosis and cataract formation.

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