

Pharmacological Activities of Curcuma Longa: A Review

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ABSTRACT:

Turmeric (*Curcuma longa*) is widely cultivated in India and its neighbouring countries and is also used in the household of the Indian sub continent as a spice. It has been found documented that turmeric has been used as a conventional medicine to cure numerous disease such as cold and cough, diabetes, hepatic disorder etc. Now the researchers from all over the world have done numerous work to discover the therapeutic benefits of turmeric and its various extracts. Curcumin being its prime chemical compound has various therapeutic activities including anti-inflammatory, antioxidant, antimutagenic, antidiabetic, antibacterial, hepatoprotective, expectorant and anticancerous activity. The main motive of this article is give an over view on the the various pharmacological activities of turmeric.

KEY WORDS: Turmeric, Curcumin, Therapeutic activity, Spices

INTRODUCTION:

Herbs, Plant and plant product has been used by humans to cure various disease since time immemorial. India and its neighbouring countries being in the sub tropical region is enriched with numerous medicinal and aromatic flora which is used as a medicinal plant by the people living here since ancient times. Rigveda is a book written between 4500-1600 has the documentation of plant being used as medicinal purpose.[1]. *Curcuma longa* named as Haridra has also found its mention and extensive use in the book called Dravyaguna sustra which is also known as the Material medica of India. Turmeric is an auspicious commodity in the Indian household is used in many rituals also[2]. In Ayurveda too curing potential of Turmeric is well documented[3]

TRADITIONAL USE OF TURMERIC:

Turmeric is used in Basti of UP to cure cough and cold. A semi solid preparation is used by the tribals of West Bengal to cure body pain. The maidens of Assam apply the paste to cure infection and increase skin beauty. It is also used to cure dysentery in cattle.[7]

PHARMACOLOGICAL ACTIVITIES:

Curcuma longa is found to have various medicinal activities. The rhizomes part of the plant has got most of its pharmacological activities and is widely used as an anti diabetic[8-10], hypolipidemic[8-11], anti-inflammatory[10,11], anti-diarrhoea[9], hepatoprotective[8,9] and anti-asthmatic[10]. It is also widely used in cosmetic products[2]. The various pharmacological activities of Turmeric are discussed below.

1.GASTROINTESTINAL DISORDER:

The fresh extract of turmeric is believed to have anthelmintic property[12]. In an experiment done on rats showed that curcumin reduces the production of inflammatory cytokines and thus curing gastric injury caused by NSAID therapy. And it was also found that it reduces mucosal damage[13]. Turmeric extract tablets when administered in the body it was found that it reduces abdominal pain and discomfort[14]. It was also found that curcumin extract when introduced in male mice with liver damage, it cures the liver damage by reducing liver inflammation[15].

2.RESPIRATORY DISEASES:

The fresh extract of the rhizomes is prescribed in bronchitis. Boiled haridra with milk is administered orally in cough. Its decoction is used in throat infection and other throat related problems[11]. It also has anti asthmatic action due to its chemicals including tumerons, curcumanoid etc.[16]. Fumes of turmeric is used is prescribed asthma[17].

3.ANTI-INFLAMMATORY EFFECT:

Phospholipase, lipooxygenase, COX-2, leukotrienes, thromboxane, prostaglandins, nitric oxide, collagenase, elastase, hyaluronidase, MCP-1, interferon-inducible protein, tumor necrosis factor, and interleukin-12 are the example of some chemical which are inhibited by Curcumin[18]. The chemical compound found in Turmeric has proven to be more anti-inflammatory effect[19]. Curcumin appears to have anti inflammatory effect due to suppression of pro inflammatory cytokines[20].

4.ANTI-DIABETIC:

The combination of turmeric with amla and honey is found to be helpful in curing diabetes[21]. The ingestion of turmeric showed that there is an increase in insulin level in blood (postprandial) but did not affect the glucose level of blood, suggesting that turmeric might have induced insulin secretion[22]. The curcuminoid present in turmeric prevents lipid per-oxidation by maintaining the essential enzymes required for it[23]. The fact that powder of turmeric can be used as an effective anti-diabetic agent was proven in a scientific study[24]. The acetone extract also reduces blood glucose level[25].

5. CARDIOVASCULAR DISEASES:

Turmeric is filled with various kind of anti oxidants which do not degrade on the application of heat unlike other anti oxidants. These anti oxidants present in turmeric protect the degradation of cholesterol and thus helping in atherosclerosis. These antioxidant prove to prevent free radical reaction similar to that of vitamin E and C. A study done on animals show the these anti oxidants present in turmeric lower the level of cholesterol and other triglycerides which cause various cardiovascular diseases[26].

In a study conducted in America two group of mice were selected and both of the group were fed with average American diet except one group was fed turmeric with the diet. This experiment was conducted for four months and in the end it was found that the group of mice which were fed with turmeric had 20 percent less blockage of arteries then the other group[26]. This effect was also seen on rabbits[27]

6. HEPATOPROTECTIVE EFFECT:

The powder of turmeric is effective in curing jaundice[11]. A tri-mixture of turmeric, amla and gairika is used to cure jaundice[28]. The anti-inflammatory activity of curcumin present in extract of turmeric shows hepatoprotective activity due to its free radical scavenging ability. It shows enhanced healing of hepatocytes by decreasing inflammation in them. The ethanolic extract when administered orally showed hepatoprotective effect which was dose dependent. Apart from these it also contain volatile oils which shows anti inflammatory effect[29].

1 NEUROPROTECTIVE EFFECT:

The volatile oil present in turmeric shows Neuro-protective activity in ischaemia by reducing the oxydative stress. The mitrochondrial collapse seen in ischaemia is seen to be significantly reduced by the turmeric oil. This proves that the volatile oil present in turmeric has the potential of neuroprotective activity[30].

2 ALZHEIMER'S DISEASE:

The plaque deposition seen in Alzheimer's disease is reduced significantly in the aged mice having such a deposition of plaque by the administration of curcumin to them. It also reduces the number of cell damaged by oxydative stress. The reason of such therapeutic activity is the wonderful capability of curcumin as anti inflammatory and anti-oxidant agent[31]

3 CHEMOPROTECTIVE ACTIVITY:

The curcumin can be used in the nutraceutical because of its property of activating DDR(DNA Damage Response) which can be used and applied in the treatment of prostate cancer[32]. The curcumin is capable of curing cell exposed to bile acid for longer duration[33]. These effects of curcumin is proven and tested in cell culture on animals and on humans too[34]

4 ANTI-CANCER ACTIVITY

Mutagenesis, oncogene expression, cell cycle regulation, apoptosis, tumorigenesis and metastasis are the various ways through which the main ingredient of turmeric viz curcumin shows anti cancer activity. It also shows anti proliferating activity in many type of cancers. Apart from these it also suppress a large number of growth factor receptors and other molecule involved in tumour growth[35]. Curcumin imparts anti cancer activity by altering the cell cycle of the tumor cell[36]. Curcumin has the potential showing chemotherapy of cancer, also it is well established that curcumin is well tolerated in humans. Curcumin can be used in lungs cancer[37]

5 ANTI-ALLERGIC EFFECT:

Curcumin reduces or suppresses the histamine release and also deregulate the mast cell in stomach of rats. Curcumin inhibited compound 48/80-induced systemic anaphylaxis *in vitro* and anti-DNP immunoglobulin E (IgE) mediated passive cutaneous anaphylactoid response *in vivo*. It was thus proved that it has the capability of preventing mast cell dependent allergic reaction.

6 ANTI-DERMATOPHYTIC ACTIVITY:

Curcumin has the ability to protect human skin against harmful UV rays by the virtue of its antimutagen, antioxidant, free radical scavenging, anti-inflammatory and anti-carcinogenic properties. Apart from this the leaves of the plant has shown promising anti fungal activity against fungus found on the human skin[39]

7 ANTI DRUG RESISTANT ACTIVITY:

The Curcumin is a potent drug resistance preventer. It exhibits novel ability to prevent the up regulation of P-glycoprotein and its mRNA induced by adriamycin (ADM). The prevention capacity is also functionally associated with the elevated intracellular drug accumulation and parallel enhanced ADM cytotoxicity [40].

DISCUSSION

Curcuminoids (a mixture of curcumin, bisdemethoxycurcumin and demethoxycurcumin) share vital pharmacological properties possessed by turmeric, a well known curry spice, considered useful in Alzheimer's disease (AD).

The aim of this study was to evaluate if curcuminoids possess acetylcholinesterase (AChE) inhibitory and memory enhancing activities. The in-vitro and ex-vivo models of AChE inhibitory activity were used along with Morris water maze test to study the effect on memory in rats.

Curcuminoids inhibited AChE in the in-vitro assay with IC₅₀ value of 19.67, bisdemethoxycurcumin 16.84, demethoxycurcumin 33.14 and curcumin 67.69 μ M. In the ex-vivo AChE assay, curcuminoids and its individual components except curcumin showed dose-dependent (3–10 mg/kg) inhibition in frontal cortex and hippocampus.

When studied for their effect on memory at a fixed dose (10 mg/kg), all compounds showed significant ($p < 0.001$) and comparable effect in scopolamine-induced amnesia. These data indicate that curcuminoids and all individual components except curcumin possess pronounced AChE inhibitory activity.

Curcumin was relatively weak in the in-vitro assay and without effect in the ex-vivo AChE model, while equally effective in memory enhancing effect, suggestive of additional mechanism(s) involved.

The crude extract of turmeric (Cl.Cr), relaxed the spontaneous and K^+ (80 mM)-induced contractions in isolated rabbit jejunum as well as shifted the $CaCl_2$ concentration-response curves. In rabbit tracheal preparation, Cl.Cr inhibited carbachol and K^+ -induced contractions. In anesthetized rats, Cl.Cr produced variable responses on blood pressure with a mixture of weak hypertensive and hypotensive actions. In rabbit aorta, Cl.Cr caused a weak vasoconstrictor and a vasodilator effect on K^+ and phenylephrine-induced contractions.

In guinea-pig atria, Cl.Cr inhibited spontaneous rate and force of contractions at 14–24 times higher concentrations. Activity directed fractionation revealed that the vasodilator and vasoconstrictor activities are widely distributed in the plant with no clear separation into the polar or nonpolar fractions. When used for comparison, both curcumin and verapamil caused similar inhibitory effects in all smooth muscle preparations with relatively more effect against K^+ -induced contractions and that both were devoid of any vasoconstrictor effect and curcumin had no effect on atria.

These data suggest that the inhibitory effects of Cl.Cr are mediated primarily through calcium channel blockade, though additional mechanisms cannot be ruled out and this study forms the basis for the traditional use of turmeric in hyperactive states of the gut and airways. Furthermore, curcumin, the main active principle, does not share all effects of turmeric.

CONCLUSION

Turmeric — and especially its most active compound, curcumin — have many scientifically proven health benefits, such as the potential to improve heart health and prevent against Alzheimer's and cancer.

It's a potent anti-inflammatory and antioxidant. It may also help improve symptoms of depression and arthritis.

So, this article shows the impact of turmeric in the treatment of various diseases and its related symptoms.

Many small to large diseases or illnesses could be cured with the help of *Curcuma longa*.

REFERENCE

1. Agrawal S (2007) Herbal Drug technology, Universities press (India) Private Limited, Hyderabad, India 1.
2. Paranjpe P (2001) Herbs for Beauty. (1stedn), Chaukhambha Sanskrit Pratishtan, Delhi, India 95-96.
4. Sharma PV (2000) Namarupajnanam. (1stedn), SatyapriyaPrakashan, Varanasi, India 195-196.
5. <https://en.wikipedia.org/wiki/Turmeric>
6. http://www.indianetzone.com/41/history_turmeric.htm
7. Ahmed SR, Siddiq M (2009) Vedic Plants Medicinal and Other uses, Chaukhambha Orientalia, Varanasi, India 70.
8. Sastry JLN (2005) Illustrated Dravyaguna Vijnana. (2ndedn), Chaukhambha Orientalia, Varanasi, India 513-518.
9. Sharma PV (2006) DravyaGuna Vijnana, Chaukhambha Bharti Academy, Varanasi, India 1: 162-166.
10. Chunekar KC (2010) Editor Bhavpraakash Nighantu of BhavaMisra. Chaukhambha Bharti Academy, Varanasi: 110.
11. Pandey GS (2002) Dravyaguna Vijnana (2ndedn), Krishnadas Academy, Varanasi, India 1: 737-746.
12. Dhiman AK (2004) Common Drug Plants and Ayurvedic Remedies. (1stedn), Reference Press, New Delhi, India 286-287.
13. Thong-Ngam D, Choochuai S, Patumraj S, Chayanupatkul M, Klaikeaw N (2012) Curcumin prevents indomethacin-induced gastropathy in rats. World J Gastroenterol 18: 1479-1484.
14. Rahimi R, Abdollahi M (2012) Herbal medicines for the management of irritable bowel syndrome: A comprehensive review. World J Gastroenterol 18: 589-560.
15. Somanawat K, Thong-Ngam D, Klaikeaw N (2013) Curcumin attenuated paracetamol overdose induced hepatitis. World J Gastroenterol 19: 1962-1967.
16. Mali R, Dhake A (2011) A review on herbal antiasthmatics. Orient Pharm Exp Med 11: 77-90.
17. Acharya YT (1994) CharakaSamhitha of Agnivesh with the Ayurveda Dipika commentary (4thedn), Chaukhambha Sanskrit Samsthan, Varanasi, India 536.

18. Chainani N (2003) Safety and Anti-Inflammatory Activity of Curcumin: A Component of Turmeric (*Curcuma longa*). *J Altern Complement Med* 9: 161- 168.
19. Ravindran J (2010) Bisdemethylcurcumin and structurally related Hispolon analogues of curcumin exhibit enhanced pro-oxidant, anti-proliferative and anti-inflammatory activities in vitro. *Biochem Pharmacol* 79: 1658-1666.
20. Jacob A, Wu R, Zhou M, Wang P (2007) Mechanism of the Anti- inflammatory effect of Curcumin: PPAR- γ Activation, *PPAR Research*.
21. Acharya YT (1994) *CharakaSamhitha of Agnivesh with the Ayurveda Dipika commentary* (4th edn), Chaukambha Sanskrit Samstha, Varanasi, India 447.
22. Wickenberg J, Ingemansson S, Hlebowicz J (2010) Effects of *Curcuma longa* (turmeric) on postprandial plasma glucose and insulin in healthy subjects. *Nutr J* 9: 43.
23. Faizal IP, Suresh S, Satheesh Kumar R, Augusti KT (2009) A study on the hypoglycemic and hypolipidemic effects of an ayurvedic drug rajanyamalakadi in diabetic patients. *Indian Journal of Clinical Biochemistry* 24: 82-87.
24. Rai PK, Jaiswal D, Mehta S, Rai DK, Sharma B, et al. (2010) Effect of *curcuma longa* freeze dried rhizome powder with milk in STZ induced diabetic rats. *Indian J Clin Biochem* 25: 175-181.
25. Ponnusamy S, Ravindran R, Zinjarde S, Bhargava S, Ameeta R (2011) Evaluation of Traditional Indian Antidiabetic Medicinal Plants for Human Pancreatic Amylase Inhibitory Effect In Vitro Evidence-Based. *Complementary and Alternative Medicine* 10.
26. <http://www.life123.com/health/mens-health/heart-health/turmeric-forcardiovascular-disease.html>.
27. http://www.montanaim.com/pubs/Turmeric_article.pdf.
28. Tripathi B (2009) *AshtangaHridayam of Srimadvagbhata*. (1st edn), Chaukambha Sanskrit Pratishtan, Delhi, India 767 .
29. Salama SM, Alrashdi AS, Ismail S, Alkiyumi SS, Abdulla MA, et al. (2013) Hepatoprotective effect of ethanolic extract of *Curcuma longa* on thioacetamide induced liver cirrhosis in rats. *BMC Complementary and Alternative Medicine* 13: 56.
30. Dohare P, Garg P, Sharma U, Jagannathan NR, Ray M (2008) Neuroprotective efficacy and therapeutic window of curcuma oil: in rat embolic stroke model. *BMC Complementary and Alternative Medicine* 8: 55.
31. Rao R, Descamps O, John V, Bredesen DE (2012) Ayurvedic medicinal plants for Alzheimer's disease: a review. *Alzheimer's Res Ther* 4: 22.

32. Horie S (2012) Chemoprevention of Prostate Cancer: Soy Isoflavones and Curcumin. *Korean J Urol* 53: 665-672.
33. Bower M, Aiyer H, Li Y, Martin R (2010) Chemoprotective effects of curcumin in esophageal epithelial cells exposed to bile acids. *World J Gastroenterol* 16: 4152-4158.
34. Park J, Contreas C (2010) Anti-carcinogenic properties of curcumin on colorectal cancer. *World J Gastrointest Oncology* 2: 169-176.
35. Wilken R (2011) Curcumin: A review of anti-cancer properties and therapeutic activity in head and neck squamous cell carcinoma. *Mol Cancer* 10: 12.
36. Sa G, Das T (2008) Anti cancer effects of curcumin: cycle of life and death. *Cell Div* 3: 14
37. Ye M, Li Y, Yin H, Zhang J (2012) Curcumin: Updated Molecular Mechanisms and Intervention Targets in Human Lung Cancer. *Int J MolSci* 13: 3959-3978.
38. Yun-Ho C, Guang-Hai Y, Ok Hee C, Chang Ho S (2010) Inhibitory effects of curcumin on passive cutaneous anaphylactoid response and compound 48/80-induced mast cell activation. *Anat Cell Biol* 43: 36-43.
39. Binic I, Lazarevic V, Ljubenovic M, Mojsa J, Sokolovic D (2013) Skin Ageing: Natural Weapons and Strategies. *Evid Based Complement Alternat Med*.
40. Xu D, Tian W, Shen H (2011) Curcumin Prevents Induced Drug Resistance: A Novel Function? *Chin J Cancer Res* 2: 218-223.