

A Review on Medicinal and Pharmacological Actions of Turmeric

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Abstract: The Indian subcontinent is home to vast cultivation of the spice turmeric (*Curcuma longa* Linn). The turmeric plant has been used in traditional medicine as a treatment for a number of illnesses, such as diabetes, hepatic disorders, and cough. The pharmacological effects of turmeric and its derivatives have been the subject of substantial research over the last few decades. Turmeric's primary chemical constituent, curcumin, has been shown to have a variety of beneficial physiological effects, including those for treating cancer, diabetes, hepatoprotection, expectoration, and inflammation. This review provides an updated look at turmeric's pharmacological properties, its extracts, and potential medical uses, along with an assessment of their safety.

Keywords: Turmeric; Haridra; Curcuma Longa Linn; Medicinal Plant; Dravyaguna.

I. INTRODUCTION

Indian medicinal plants are regarded as a rich source of several pharmacologically active principles and chemicals, which are frequently employed in homemade treatments for a variety of illnesses [1][3]. In India, the Rigveda, which was composed between 4500 and 1600 BC, has the earliest reference to the use of therapeutic plants [4]. One such therapeutic plant, turmeric (Haridra), is well-explained in Indian material medicine (Dravyaguna Sastra). Hindu women apply this lucky beauty spot to their foreheads every day. Hindu customs require that the bride be covered in a paste made of turmeric. The therapeutic benefits of turmeric have been extensively studied in Ayurveda and are discussed in DashemaniLekhanya (emaciating), Kusthagna (anti-dermatosis), and Visaghna (anti-poisonous) [5]. In North-East and Central India, black turmeric (*C. caesia*) is a natural plant. In the Himalayan root highlands, the North Hill Forest in Sikkim, and the Papi hills of the East Godavari, it is also sporadic to find. Due to its alleged medical benefits, Black Turmeric's rhizomes are highly significant economically [2][6]. The rhizomes are used to cure a variety of conditions, including inflammation, gonorrheal discharges, leprosy, asthma, cancer, epilepsy, fever, wounds, vomiting, and menstrual disorders [6]. They also function as a smooth muscle relaxant and an anthelmintic. Nearly all *Curcuma* species have antioxidant activity, and clinical trials have already been conducted on their pharmacological benefits and potential future applications [7].

History of Turmeric:



Fig 1: Turmeric

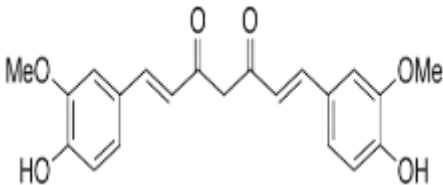
A successful treatment for jaundice is referred to as haridra in Sanskrit. It is regarded as one of the oldest spices and has been used extensively in Ayurvedic treatment for thousands of years in the western and southern regions of India. Because of this, it is also said that this spice is indigenous to India and is hence known as "Indian saffron." Since it originated in India, turmeric spread rapidly over the world, arriving in China in 700 A.D., East Africa in 800 A.D., and West Africa in 1200 A.D. Turmeric was brought to Europe by Arab traders in the 13th century, as is also known. Turmeric captivated Marco Polo during one of his many fabled trips to India via the Silk Route to the point where he described it as a vegetable with qualities similar to saffron but not saffron itself[2].

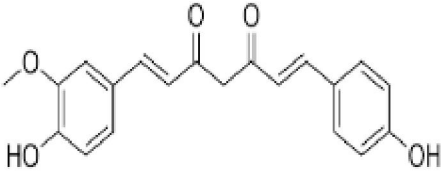
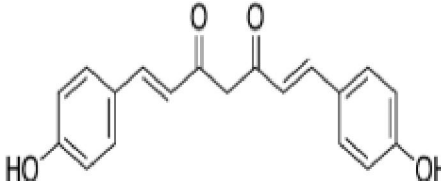
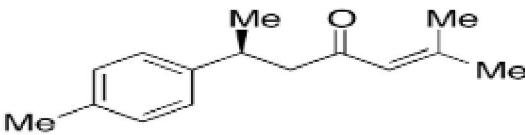
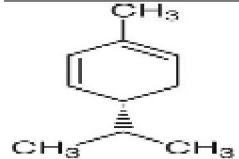
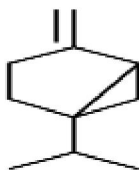
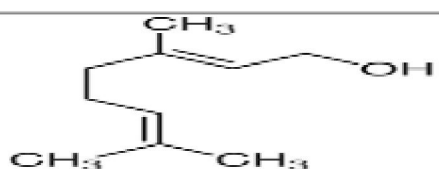
Taxonomical Classification and Chemical Constituents:

Table 1: Taxonomical Classification of turmeric [39]

Sr, No.	Kingdom	Plantae
1	Subkingdom	Tracheobionta
2	Superdivision	Spermatophyta
3	Division	Magnoliophyta
4	Subclass	Zingiberidae
5	Order	Zingiberales
6	Family	Zingiberaceae
7	Genus	Curcuma
8	Species	longa
9	Scientific name	Curcuma longa

Table 2: Structure of chemical constituents present in turmeric[39]

Phytoconstituents	Structure
Curcumin I	

CurcuminII (demethoxycurcumin)	
CurcuminIII (bis-demthoxycurcumin)	
Ar-tumerone	
α -Phellandrene	
Sabinene	
Geraniol	

Longa Linn. (Haridra) a plant from genus Curcuma:

The plants of the genus Curcuma that belong to the family Scitaminae are particularly significant for their therapeutic potentials among plants that are recognised to have medicinal use [9]. There are several significant species of the genus Curcuma that grow in various regions of the world, including Curcuma longa Linn. (Haridra), Curcuma aromaticaSalisb. (Vana Haridra), Curcuma amadaRoxb. (AmaragandhiHaridra), Curcuma angustifolia Roxb. (Kali Haridra), and Curcuma zedoariaRose (Zedoary). The tall herb Curcuma longa Linn, also known as "Haldi" in Hindi, is grown throughout India's tropical and other regions. In Indian households, curcuma longa Linn is regularly used as a medicinal plant to treat a variety of diseases [10].



Fig 2: Haridra Curcuma Longa

Pharmacological Actions:

Curcuma longa Linn has been credited with a number of medicinal qualities. Medical professionals have employed rhizome of haridra as a medicinal agent with anti-diabetic, hypolipidemic, anti-inflammatory, anti-diarrheal, hepatoprotective, anti-asthmatic, and anti-cancerous properties. Cosmetology frequently makes use of haridra. Its numerous medical therapeutic applications are covered in the section that follows.

Medicinal Uses:

1. Gastrointestinal Disorder:

The bioactive components of the rhizome are what give rise to its medicinal benefits. The anti-oxidative, anti-inflammatory, wound-healing, hypoglycemic, anti-coagulant, and anti-microbial effects of bioactive substances like curcuminoids [11]. Antioxidant and free radical scavenging properties are displayed by curcuminoids [12]. Curcumin and two related dimethoxy chemicals, dimethoxy curcumin and bisdemethoxycurcumin, are responsible for the majority of the bioactive components in the rhizomes. Widely present in plants, flavonoids and phenolic compounds have been shown to have a variety of biological effects, including antioxidant, free radical scavenging, anti-inflammatory, and anti-carcinogenic properties [13].

2. Respiratory Disorders:

In cases of bronchitis, fresh rhizome juice is used. Boil Haridra in milk and combine with jiggery before giving it to patients with rhinitis and cough [10]. Rhizome decoction is used for gargling in cases of catarrhal cough, painful throat, and throat infection. A piece of rhizome is also offered to be chewed after being slightly burned [14]. *Curcuma longa*'s chemical components, such as tumerones, curcuminoids, curcumin, and tetrahydro curcumin, have an anti-asthmatic effect. Fumes of Haridradidhumvarti (fumes wick) are administered for asthma and congestion [15].

3. Inflammatory Disorders:

Inflammation-related molecules such as phospholipase, lipooxygenase, COX-2, leukotrienes, thromboxane, prostaglandins, nitric oxide, collagenase, elastase, hyaluronidase, MCP-1, interferon-inducible protein, tumour necrosis factor, and interleukin-12 have all been shown to be inhibited by curcumin [16]. Studies have demonstrated that bisdemethyl curcumin (BDC) has greater anti-inflammatory activity as shown by the reduction of TNF-induced NF- κ B activation, greater anti-proliferative activity, and greater ability to produce reactive oxygen species (ROS) [17]. Hispolon analogues, which differ from curcumin by one aromatic unit, also shown improved anti-inflammatory and anti-proliferative properties [18]. Curcumin, an anti-inflammatory substance, appears to have a positive impact on sepsis through the activation of PPAR-, which inhibits the development and release of pro-inflammatory cytokines like TNF- α [19].

4. **Anti-inflammatory effect:** One example of a molecule that curcumin inhibits includes phospholipase, lipoxygenase, COX-2, leukotrienes, thromboxane, prostaglandins, nitric oxide, collagenase, elastase, hyaluronidase, MCP-1, interferon-inducible protein, tumour necrosis factor, and interleukin-12[20]. The molecule in turmeric has been shown to have a stronger anti-inflammatory impact. Due to the inhibition of pro-inflammatory cytokines, curcumin seems to have an anti-inflammatory impact[21].
5. **Anti-diabetic:**
It has been discovered that the combination of turmeric, amla, and honey is effective in treating diabetes [22]. The use of turmeric revealed an increase in postprandial blood insulin levels while having no effect on blood glucose levels, indicating that turmeric may have triggered insulin secretion. The curcuminoid in turmeric inhibits lipid peroxidation by keeping the vital enzymes needed for it active [23]. A scientific investigation has demonstrated the effectiveness of turmeric powder as a diabetes treatment. Additionally, the acetone extract lowers blood glucose levels [23].
6. **Cardiovascular Disease:**
Unlike other anti-oxidants, turmeric has a variety of anti-oxidants that do not break down when heated [24]. These anti-oxidants in turmeric assist prevent atherosclerosis by preventing cholesterol from degrading. Similar to vitamin E and C, these antioxidants demonstrate that free radical reaction is prevented[25]. An animal study demonstrates that the anti-oxidants in turmeric reduce the levels of cholesterol and other triglycerides, which are known to cause a variety of cardiovascular diseases[26]. Two groups of mice were chosen for a study carried out in the United States, and both groups were fed an average American diet with the exception of one group that also received turmeric along with the meal. In the end, it was discovered that the group of mice fed turmeric had 20% fewer blocked arteries than the control group after the four-month experiment. Rabbits were also subject to this impact [27].
7. **Hepatoprotective Effect:**
Jaundice can be cured by using turmeric powder. Jaundice is treated using a tri-mixture of gairika , amla, and turmeric[28]. Due to its capacity to scavenge free radicals, curcumin, a component of turmeric extract, has anti-inflammatory properties as well as hepatoprotective properties[29]. By reducing their inflammation, it demonstrates improved hepatocyte repair. The ethanolic extract has a dose-dependent hepatoprotective effect when taken orally. Apart from these it also contains volatile oils which shows anti-inflammatory [30].
8. **Neuroprotective Activity:**
By reducing nitrosative and oxidative stress, curcuma oil dramatically lessens the negative effects of ischemia [31]. Ischemia causes the mitochondrial membrane potential to collapse, cytochrome c to be released, the Bax: Bcl-2 ratio to change, and then caspases are activated, which causes the induction of apoptosis[32]. Curcuma oil dramatically counteracts these effects. There is evidence to support Curcuma oil's strong efficacy as a neuroprotective, and it has a great therapeutic window for preventing ischemic brain injury [33].
9. **Alzheimer's Disease:**
When curcumin was given to elderly mice with advanced plaque deposits like those of Alzheimer's disease, the amount of plaque formation was reduced [34]. It lessened oxidative harm and corrected the amyloid pathology in a transgenic mice model of Alzheimer's disease. The potent antioxidant and anti-inflammatory capabilities of curcumin also reduced the inflammatory and oxidative signs of Alzheimer's disease [35].
10. **Chemoprotective Activity:**
The therapeutic use of these nutraceuticals in the chemoprevention of prostate cancer is made possible and justified by the activation of the DDR (DNA damage response) by curcumin [36]. When esophageal epithelial cells are exposed to bile acids, curcumin has chemoprotective properties; it can prevent bile acid increase of COX-

2 gene expression and reverse bile acid suppression of SOD-1 gene expression. These chemopreventive qualities of curcumin have been proven in studies on human subjects, animal models, and cell cultures [10].

11. Anti-allergic Activity:

The histamine release from rat peritoneal mast cells (RPMCs) caused by compound 48/80 was inhibited by curcumin [37]. In vitro and in vivo, compound 48/80-induced systemic anaphylaxis was reduced by curcumin, as was the anti-DNP IgE-mediated passive cutaneous anaphylactoid reaction. Both generalised and particular mast cell-dependent allergic responses can be inhibited by curcumin [10][37].

Traditional Uses of Turmeric:

- It is a natural antiseptic and antibacterial agent, useful in disinfecting cuts and burns.
- When combined with cauliflower, it has shown to prevent prostate cancer and stop the growth of existing prostate cancer.
- Prevented breast cancer from spreading to the lungs in mice.
- May prevent melanoma and cause existing melanoma cells to commit suicide.
- Reduces the risk of childhood leukemia.
- Is a natural liver detoxifier.
- May prevent and slow the progression of Alzheimer's disease by removing amyloid plaque buildup in the brain.
- May prevent metastases from occurring in many different forms of cancer.
- It is a potent natural anti-inflammatory that works as well as many anti-inflammatory drugs but without the side effects.
- Has shown promise in slowing the progression of multiple sclerosis in mice [8].

II. CONCLUSION

Numerous scientifically validated health advantages of turmeric, in particular its most active component curcumin, include the potential to improve heart health and protect against Alzheimer's and cancer. It works well as an antioxidant and anti-inflammatory. Additionally, it might lessen arthritis and depression symptoms. The impact of turmeric in treating numerous ailments and the symptoms that go along with them is demonstrated in this article. With the use of *Curcuma longa*, numerous little to large diseases or illnesses could be treated.

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