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REVIEW PAPER

A brief review of a properties and mechanism of action of turmeric (C*urcuma longa*)

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ABSTRACT

Traditionally, turmeric has been used from many centuries in ayurvedic medicines. The main focus of this review is to provide the information about the turmeric its types its active constituents, mechanism of its action, its effects and side effects and its traditional uses. The use of turmeric is about 4000 years to the Vedic culture in India. Mostly the main ingredient of turmeric curcumin is to be used as antioxidant, anti-inflammatory, antimicrobial, gastrointestinal activity, immunity enhancer activity and anti-cancer activity. For the future aspects to control the various diseases, including inflammatory disorders, carcinogenesis, HIV/AIDS, diabetes, oxidative stress – induced pathogenesis and a lot more effect.

Keywords: - Turmeric, Curcuma longa, ayurvedic medicine, Curcumin

INTRODUCTION

TURMERIC

Turmeric has also been used for centuries in Ayurvedic medicine, which integrates the medicinal properties of herbs with food. This extraordinary herb has found its way into the spotlight in the west and rest of globe, because of its wide range of medicinal benefits. Use of turmeric dates back nearly 4000 years to the Vedic culture in India. It is extensively used in Ayurveda, Unani and Siddha medicine as home remedy for various diseases [1,2].

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Turmeric a native of South-East Asia is used as a food additive (spice), preservative and colouring agent in Asian countries including China, Bangladesh and South East Asia. It is primarily cultivated in China, Taiwan, Sri Lanka, Bangladesh, Burma (Myanmar), Nigeria, Australia, West Indies, Peru, Jamaica and some other Caribbean and Latin American countries [3].

Chemical Composition of Turmeric: Also known as 'Haridra' or 'Haldi', turmeric contains protein (6.3%), fat (5.1%), minerals (3.5%), carbohydrates (69.4%) and moisture (23.1%). The essential oil (5-8%) obtained by

steam distillation of rhizomes has α-phellanderene (1%), sabiene (0.6%), cineol (1%), borneol (0.5%), zingiberene (25%) and sesquiterpines (53%) [4]. Curcumin is the principal curcuminoid of turmeric. The other two are desmethoxycurcumin and bis desmethoxycurcumin. Curcumin gives yellow colour to turmeric and is now recognized as being responsible for most of the therapeutic effects. It is estimated that 2-5% of turmeric is curcumin. Curcumin was first isolated which is known for its from turmeric in 1815 and the structure was delineated in 1910 as diferuloylmethane [5].

Most currently available preparation of curcumin contains approximately 77% diferuloylmethane, 18% desmethoxycurcumin and 5% bis-desmethoxycurcumin. Curcumin is hydrophobic in nature and frequently soluble in dismethylsulfoxide, acetone, ethanol and oils. It has absorption maxima around 425nm. When exposed to acidic conditions, the colour of turmeric/curcumin turns from yellow to deep red, and the form in which it is used in various religious ceremonies [6].

It is used widely as a natural cosmetic to apply on the skin for beauty enhancement. The Kasturi Manjal is generally avoided in cooking because if its bitter taste. The powder made from the root of this Turmeric can be easily sourced from any herbal vendors in India and its color is very close to the common Turmeric used for cooking.

Second variety, is the popular one used in Curry Powder which is widely used for cooking purposes. The main ingredient in most of the curry powders is the Turmeric produced from the *Curcumin longa* variety and is prepared by boiling the roots in water and then drying them to make the powder.

Third one, which is close to the Manjal in color, but of round elongated shape, like a miniature form of an umbrella (Kuda means umbrella), it is used in ceremonies and rituals and is considered very sacred and people keep this at home as part of the divine images and worship it because of its divine energy.

Fourth variety Turmeric is known Kari Manjal or Black Turmeric which is a rare variety and the roots are slightly black in colour. Many Ayurvedic medicines are prepared by this variety of Turmeric.

Fifth category of Turmeric is known as Mara Manjal or Tree manjal which is a kind if vine and extremely useful in preparing some very special medicines. This variety of Turmeric is fast disappearing from Western Ghats [7].

CURCUMIN (*CURCUMIN LONGA*)

Curcumin is the principal curcuminoid of the popular Indian spice turmeric, which is a member of the ginger family (*Zingiberaceae*). The other two curcuminoids are

desmethoxycurcumin and bis-desmethoxycurcumin. The curcuminoids are polyphenols and are responsible for the yellow color of turmeric. Curcumin can exist in at least two tautomeric forms, keto and enol. The enol form is more energetically stable in the solid phase and in solution. Curcumin can be used for boron quantification in the so-called curcumin method. It reacts with boric acid forming a red colored compound, known as rosocyanine. Curcumin is brightly yellow colored and may be used as a food coloring. As a food additive, its E number is E100 [8].

ACTIVE CONSTITUENT

The active constituents of turmeric are the flavonoid curcumin (diferuloylmethane) and various volatile oils, including tumerone, atlantone, and zingiberone. Other constituents include sugars, proteins, and resins. The best-researched active constituent is curcumin, which comprises 0.3–5.4 percent of raw turmeric [9].

PHARMACOKINETIC

Pharmacokinetic studies in animals have demonstrated that 40-85 percent of an oral dose of curcumin passes through the gastrointestinal tract unchanged, with most of the absorbed flavonoid being metabolized in the intestinal mucosa and liver. Due to its low rate of absorption, curcumin is often formulated with bromelain for increased absorption and enhanced anti-inflammatory effect [10].

PROPERTIES OF CURCUMIN

Curcumin has antioxidant, anti-inflammatory, antiviral and antifungal actions. Studies have shown that curcumin is not toxic to humans. Curcumin exerts anti-inflammatory activity by inhibition of a number of different molecules that play an important role in inflammation. Turmeric is effective in reducing post-surgical inflammation. Turmeric helps to prevent atherosclerosis by reducing the formation of bloods clumps. Curcumin inhibits the growth of *Helicobacter pylori*, which causes gastric ulcers and has been linked with gastric cancers. Curcumin can bind with heavy metals such as cadmium and lead, thereby reducing the toxicity of these heavy metals. This property of curcumin explains its protective action to the brain. Curcumin acts as an inhibitor for cyclooxygenase, 5-lipoxygenase and glutathione *S*-transferase. It is a common spice, known mostly for its use in Indian dishes as a common ingredient in curries and other ethnic meals. Turmeric has also been used for centuries in Ayurvedic medicine, which integrates the medicinal properties of herbs with food. This extraordinary herb has found its way into the spotlight in the west because of its wide range of medicinal benefits. Turmeric is a potent antioxidant [11].

Curcumin, its main active constituent, is as powerful and antioxidant as vitamins C, E and Beta-Carotene, making turmeric usage a consumer choice for cancer prevention, liver protection and premature aging. Several published studies also show that turmeric inhibits the growth of several different types of cancer cells. In addition, turmeric is a powerful anti-inflammatory, easing conditions such as bursitis, arthritis and back pain. Turmeric's anti-inflammatory action is likely due to a combination of three different properties [12].

First, turmeric lowers the production of inflammation-inducing histamine. Secondly, it increases and prolongs the action of the body's natural anti-inflammatory adrenal hormone, cortisol, and finally, turmeric improves circulation, thereby flushing toxins out of small joints where cellular wastes and inflammatory compounds are frequently trapped. Research has also confirmed the digestive benefits of turmeric. Turmeric acts as a cholagogue, stimulating bile production, thus, increasing the bodies' ability to digest fats, improving digestion and eliminating toxins from the liver [13].

MECHANISM OF ACTION OF CURCUMIN

1. ANTIOXIDANT EFFECTS- Water and fat soluble extracts of turmeric and its curcumin component exhibit strong antioxidant activity, comparable to vitamins C and E. A study of ischemia in the feline heart demonstrated that Curcumin pretreatment decreased ischemia-induced changes in the heart. An *in vitro* study measuring the effect of curcumin on endothelial heme oxygenase-1, an inducible stress protein, was conducted utilizing bovine aortic endothelial cells. Incubation (18 hours) with curcumin resulted in enhanced cellular resistance to oxidative damage [14].

2. ANTI- INFLAMMATORY EFFECTS- The volatile oils and curcumin of *Curcuma longa* exhibit potent anti-inflammatory effects. Oral administration of curcumin in instances of acute inflammation was found to be as effective as cortisone or phenylbutazone, and one-half as effective in cases of chronic inflammation. In rats with Freund's adjuvant-induced arthritis, oral administration of *Curcuma longa* significantly reduced inflammatory swelling compared to controls. In inhibited monkeys, curcumin neutrophil aggregation associated with inflammation. C. longa's anti-inflammatory properties may be attributed to its ability to inhibit both biosynthesis of inflammatory prostaglandins from arachidonic acid, and neutrophil function

during inflammatory states. Curcumin may also be applied topically to counteract inflammation and irritation associated with inflammatory skin conditions and allergies, although care must be used to prevent staining of clothing from the yellow pigment [15].

3. ANTIMICROBIAL EFFECTS - Turmeric extract and the essential oil of *Curcuma longa* inhibit the growth of a variety of bacteria, parasites, and pathogenic fungi. A study of chicks infected with the caecal parasite Eimera maxima demonstrated that diets supplemented with 1 percent turmeric resulted in a reduction in small intestinal lesion scores and improved weight gain. Another animal study, in which guinea pigs were infected with either dermatophytes, pathogenic molds, or yeast, found that topically applied turmeric oil inhibited dermatophytes and pathogenic fungi, but neither curcumin nor turmeric oil affected the yeast isolates. Improvements in lesions were observed in the dermatophyte and fungi infected guinea pigs, and at seven days post-turmeric application the lesions disappeared. Curcumin has also been found to have moderate activity against *Plasmodium falciparum* and *Leishmania* major organisms [16].

4. GASTROINTESTINAL EFFECTS - Constituents of *Curcuma longa* exert several protective effects on the gastrointestinal tract. Sodium curcuminate inhibited intestinal spasm and p-tolymethylcarbinol, a turmeric component, increased gastrin, secretin, bicarbonate, and pancreatic enzyme secretion. Turmeric has also been shown to inhibit ulcer formation caused by stress, alcohol, indomethacin, pyloric ligation, and reserpine, significantly increasing gastric wall mucus in rats subjected to these gastrointestinal insults [17].

5. CURCUMIN ENHANCE IMMUNITY - Curcumin can also help the body fight off cancer should some cells escape apoptosis. When researchers looked at the lining of the intestine after ingestion of curcumin, they found that CD4+ T-helper and B type immune cells were greater in number. In addition to this localized immune stimulation, curcumin also enhances immunity in general. Researchers in India have documented increased antibodies and more immune action in mice given Curcumin [18].

TRADITIONAL USES OF CURCUMIN

COSMETIC USES- Turmeric juice is perhaps the most common form of the herb in medical use, but it can also be mixed into topical salves and creams. The essential oil of turmeric is also a powerful health agent.

- **Teeth whitening:** While it is known to leave stubborn yellow stains on clothes, it surprisingly helps in

removing the stains from teeth when mixed with coconut oil and baking soda.

- **Soap:** This amazing anti-inflammatory and skin whitening agent is used in herbal soaps.
- **Sunburn remedy:** It can also be mixed with yogurt or with aloe vera gel as a natural skin lightener or sunburn soother.
- **Wounds:** Turmeric paste can be applied to heal cuts and wounds.
- **Face mask:** Turmeric face masks have been used since ancient times as they improve skin luster and prevent acne. It can be mixed with yogurt, glycerine, honey, aloe vera, or vitamin E.
- **Skin moisturizer:** Turmeric mixed with olive or coconut oil forms a natural skin emollient [19].

CULINARY USES- The herb also makes it a popular ingredient in soups, sauces, curries, meat dishes, biscuits, rice preparations, and as a general spice flavoring for dozens of other cultural dishes and specialties.

- **Smoothies:** It can be added to smoothies as it gives them a uniquely sweet taste, something similar to pina colada, along with health benefits.
- **Milk:** Warm milk mixed with a teaspoon of the herb provides relief from fever, cold, and acts as an excellent natural sedative.
- **Tea:** Mix 1 teaspoon of turmeric with warm water to make the tea. This tea offers health benefits and also helps in ensuring radiant skin [19].

In certain cases, excessive amounts of curcumin consumed in a medicinal capacity have caused heart irregularities. Also, it may slow blood clotting by increasing the effects of anti-clotting medicines. Therefore, people on anticoagulant or blood thinning medication must avoid turmeric. Always speak to a medical professional before adding this powerful substance to your diet or supplement regimen, and remember – everything should be taken in moderation.

CONCLUSION

It is a natural yellow pigment, *Curcuma Longa*. It is a natural molecule and used to deliver a host of health guarding effects in a modern society. For the last few years, huge work has been done in the biological effects, solubility, and pharmacological action of a Curcuma Longa. So the crude drug has a mostly used in medicinal applications, clinical applications can be more effective research work in a bioactivity, mechanism of action, pharmacokinetic and toxicity studies. Curcumin is a riskless, antioxidant, spice having a wide spectrum of biological

functions. All of these studies showing the effects of turmeric and its constituents specially curcumin. Due to its usage, biological safety, properties of curcumin, mechanism action of curcumin combined with its cost and efficacy. For the future aspects to control the various diseases, including inflammatory disorders, carcinogenesis, HIV/AIDS, diabetes, oxidative stress induced pathogenesis and a lot more effect.

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