A PRESENT ASSESSMENT AND DETAILED ANALYSIS OF CURCUMIN'S PHARMACOLOGICAL EFFECTS

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ABSTRACT: The root of turmeric, naturally termed turmeric or Curcuma longa Linn, originates in temperate and subtropical area. Across the globe. Turmeric is rich in nutrients. Curcumin is responsible for the majority of the actions linked with turmeric, according to extensive study over the last 50 years. Turmeric contains antioxidants, anti-inflammatory compounds, anti-coagulant and anti-diabetic effects antimicrobial, anti-ulcer, wound healing, and anti-fertility, anti-arthritis, anti-Alzheimer, anti-Parkinson, anti-cancerous, anti-HIV, anti- angiogenesis properties. It is useful in diabetes. Turmeric powder is commonly used to add colour and flavour to meals and is also used in traditional Indian medicine to cure many ailments. Turmeric appears to provide considerably more beyond just a yellow pigment for Indian curries because to its chemical constituents, curcumin and curcuminoids. In mediaeval Indian medicine, turmeric extract is widely used to alleviate a broad range of illnesses in addition to adding colouration along with taste to meals.

KEY WORDS: curcumin, Zingiberaceae, anti-mutagenic, food preserving agent, 2-hydroxymethyl anthraquinone.

INTRODUCTION- Turmeric (Curcuma longa) is an annual plant of the Zingiberaceae family. Its roots are used in food preparation. The turmeric plant's rhizome is often washed, cooked, and dried to produce a yellow powder for therapeutic purposes. Turmeric, derived from dried Curcuma longa, is responsible for the yellow colour of curry powder. Turmeric has been used for its flavour and colour in food, as well as in Chinese and Ayurvedic medicine [1]. Turmeric is traditionally used in Ayurvedic medicine to strengthen and warm the body. India has a long history of medicinal plant use. Turmeric contains curcumin, a compound with anti-inflammatory, antioxidant, anti-mutagenic, and antibacterial effects. The everlasting floral plant, native to south Asia and Indian subcontinent, thrives at degrees ranging from 20 to 30 °C (68 to 86 °F) with high annual rainfall [2].

In India, turmeric, or Curcuma longa, is widely utilized as spices, food preserving agent, and colouring agent. Turmeric, also known as the 'KITCHEN STAR', is a popular spice among Indians, including homemakers and Himalayan hermits alike [3]. Long-term usage of turmeric, Tulsi, and trifala is similar to a short-term Pancha Karma therapy. Curcumin(turmeric) has antioxidant properties and protects against free radical damage. Curcumin also has anti-cancerous effects and prevents cancer. It suppresses an enzyme called as topoisomerase, which is crucial for cancer [4].

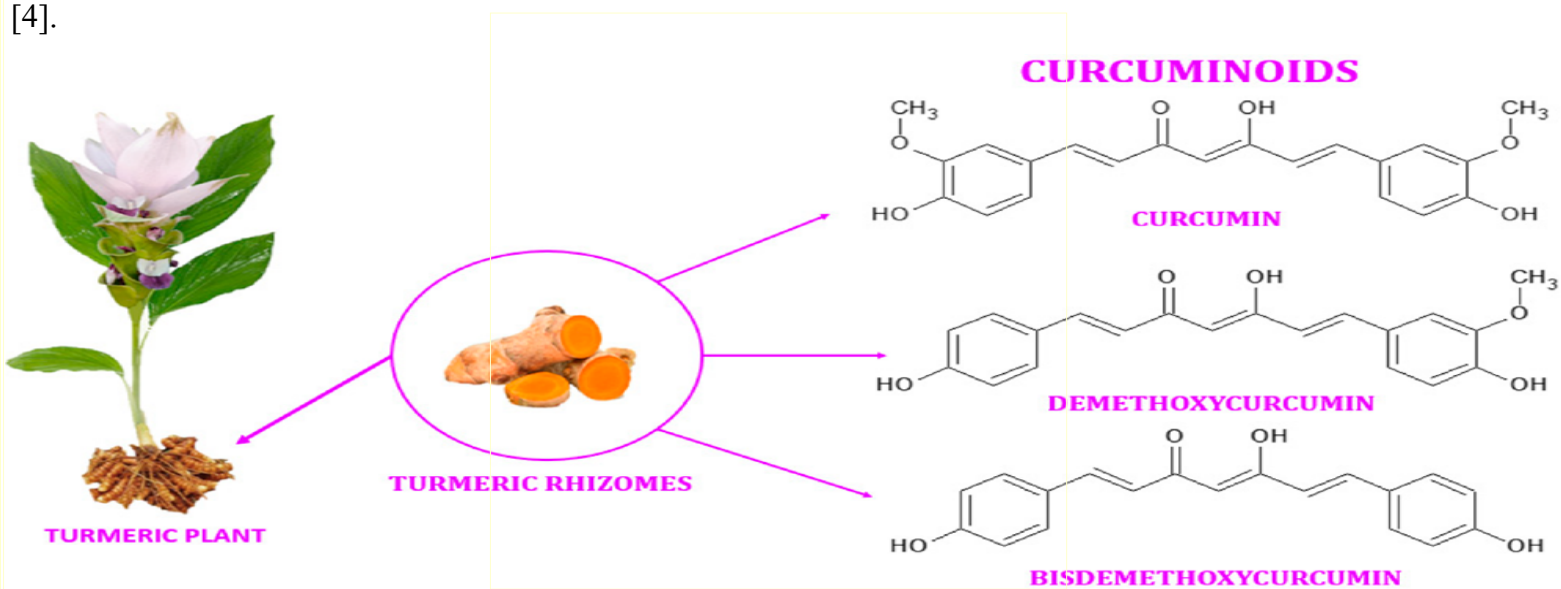


Fig. 1

Table. 1 CLASSIFICATION ACCORDING TO TAXONOMY [5]

Scientific Name	Curcuma longa
Kingdom	Plantae
Sub-kingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Lilliopsida- monocotyledons
Subclass	Zingiberidae
Order	Zingiberales
Genus	Curcuma L. curcuma
Species	Curcuma longa L

TURMERIC'S HISTORY:-Turmeric has been utilized as an ingredient in cuisine and holy symbol for about 6000 years in India's Vedic civilization [6]. Marco Polo (1280 AD) describes curcumin as Indian ginger that was utilized for dyeing clothes. For over thousands of years, turmeric has been utilized in India for medicinal, aesthetics, food preparation, as well as dyeing. It is referenced in the Artharva-Veda of India. For more than 2000 years, Buddhist monks have used turmeric as a colour for their robes. For over thousands of years turmeric is used medicinally, particularly for the intestines, abdomen, and liver. It is used for stimulation and purification, as well as anti-biotic, anti-viral, and analgesic properties [7]. This natural remedy is beneficial for females as it strengthens the reproductive system and relieves menstruation blockage [8]. In the mid-1870s, researchers observed that bases caused curcumin root powder to become reddish brown. The identification resulted in the creation of curcumin paper for testing basicity [9].

Table. 2 Various names of turmeric in different language

Entry	Language	Name	Entry	Language	Name
1	Arabic	Kurkum	21	Kannada	Arishina
2	Armenian	Toormerik, Turmerig	22	Korean	Kolkuma, Tomerik
3	Assamese	Halodhi	23	Malayalam	Manjal
4	Bengali	Halud	24	Marathi	Halad
5	Bulgarian	Kurkuma	25	Nepali	Haldi, Hardi
6	Burmese	Hsanwen, Sanwin	26	Norwegian	Gurkemeie
7	Chinese	Wat gam	27	Portuguese	Acafrao da India
8	Dutch	Kurkuma, Tarmeriek	28	Punjabi	Haldi
9	English	Indian saffron	29	Russian	Kurkumy
10	Farsi	Zardchubeh	30	Sanskrit	Ameshta, haridra
11	French	Safran des Indes	31	Spanish	Curcuma
12	German	Indischer safran	32	Swedish	Gurkmeja
13	Greek	Kourkoumi	33	Tamil	Manjal
14	Gujrati	Halad	34	Telugu	Haridra, Pasupu
15	Hindi	Haldi	35	Thai	Kha min chan
16	Hungarian	Kurkuma	36	Tibetan	Gaser, Sga ser
17	Icelandic	Turmerik	37	Turkish	Hint safrani
18	Indonesian	Kunyit	38	Ukrainian	Kurkuma
19	Italian	Curcuma	39	Urdu	Haldi, Zard chub
20	Japanese	Ukon	40	Vietnamese	Botnghe, Uatkim

CULTIVATION

Soil: Turmeric production's soil should be fertile and porous. Soil that has a somewhat greater sandy concentration seem ideal. turmeric grows in a variety of soil types, including dark and light ones. This plant thrives in watered and rain-fed locations of horizons ranging from a dark, and reddish to rigid clayey soils. Turmeric may be cultivated in a variety of tropical settings, from below the surface level to 1500 millimetres above sea level, alongside temperatures ranging from 20 to 35 degrees Celsius and an annual rainfall of 1500 mm or more, either rain-fed or watered [10].

Climate: Turmeric thrives in degrees ranging from 20°C to 30°C and requires high precipitation throughout the year. Every plant reach to a height of one meter and are tall
lengthy, rectangular leaflets. Turmeric, being a tropical plant, grows across both tropical and subtropical regions. Turmeric, being a tropical plant, grows across both tropical and subtropical regions [11].

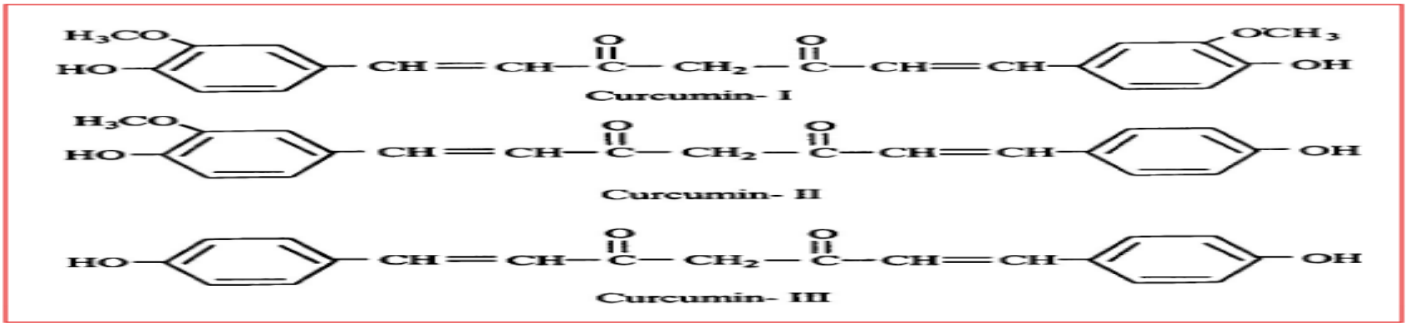
Irrigation: Turmeric's irrigation frequency varies according on soil and climate conditions. Watering is recommended for moderate soil based on rainfall [12].

Storage: Turmeric's rhizomes for germination are frequently stored in shaded areas and adequately conditioned shelters, wrapped in curcumin leaf. Seeds, roots can also be preserved in holes with soot [13].

Harvesting: According to the type, yield is available for harvesting seven to nine month following sowing in the first three months. Earlier types develop in seven to eight month a period of time middle kinds in eight to nine months, while latter variants take nine months to mature as detail shown in cultivation of turmeric [14].

Fig. 2 cultivation of turmeric

Table. 3 Phytoconstituents [Plant-based constituents] [15-18]

Sr. No.	Phytoconstituents of turmeric
1	**1,8-**cineole, 4-hydroxybisabola-2, 2-bornanol, and 2-hydroxymethyl anthraquinone
2	Alpha-atlantone, Alphapinene, Alpha terpineol, Ar-turmerone & Arabinose constitute the molecules that make up 10-diene-9-one, 4-methoxy-5-hydroxybiosabola, and 4-hydroxy-cinnamoyl-(Feruloyl)-methane.
3	chromium, cineole, innamic acid, cuminyl alcohol, calcium, carbrylic acid, caryophyllene, curcumene, curcumenol, curcumin, curdione, cobalt, and copper. Borneol, boron, bis-desmethoxycurcumin, bisabolene, and caffeic acid. 
4	Ash, azulene, betacarotene, beta-pinene, bis-(para-hydroxycinnamoyl)-methane, ascorbic acid, and beta-sesquiphellandrene.
5	Phosphorus, Protocatechuic acid, Procurcumadiol, L-beta-curcumene, Limonene, Manganese, Niacin, Nickel, norbixin, P-coumaric acid, P-methoxycinnamic acid, Pcymene, Ptolymethylcarbinol, and Monodesmethoxycurcumin.
6	Guaiacol, Isoborneol, L-alphacurcumene, Eugenol, Epiprocurcumenol, Eucalyptol, Germacrone, Germacrone13-al, and alpha-atlantone
7	The polysaccharides A, B, C, and D stand acidic.
8	Highly volatile oil (4.2%) is made up of ar-curcumene, germacrone, curcumene, arturmerone, and turmerone.
9	Further chemicals: Turmeric contain protein (6.3%), fat (5.1%), minerals (3.5%), carbohydrates (69.4%), and moisture (13.1%). Curcumin (diferuloylmethane), a phenolic diketone consisting of curcumin I (94%), curcumin II (6%) and curcumin III (0.3%), is responsible for the yellow color.
10	Further chemical components include magnesium, beta sitosterol, campesterol, cholesterol, and copper/ zinc. There are also fatty acids and metals including iron, manganese, potassium, sodium, and magnesium.

APPROACHES OF CURCUMIN SEPARATION-

Curcumin initially isolated by Vogel and Pelletierin who first described the rhizomes of C. longa in 1815. Vogel Jr. refined it in 1842. After decades of research, Curcumin's framework was reported by Milobedeska *et al.* in 1910. Curcumin was successfully synthesised by Lampe and Milobedeska in 1913. It was chromatographically separated and quantified by Srinvansen in 1953. An essential step in removing the biologically active substance from the matrix of the plant extracting the curcumin. Inaccessible chemicals are left behind throughout the extraction procedure when particular mixtures were utilised through the line with predefined process. It is possible to extract curcumin by both traditional and cutting-edge methods. Many researchers have used novel techniques for extraction like ultrasonography to aid in the extracting procedure, extraction using a microwave, extraction using enzymes, extraction using supercritical fluid, and pressurised the removal of liquids in place of traditional methods for extraction like extraction of solvent and extraction of Soxhlet because they need less period of time, Energy, cooling water, and organic solvents [20].

Table. 4 Techniques, approaches, and circumstances regarding obtaining the ingredient curcumin omega-3 fatty acids [21-22]

Approaches / Methods	Circumstances along with Concepts	Source of Extraction
S.A.S. stands for Antisolvent agent Supercritical Solution	Carbon dioxide becomes supercritical.	Dried root systems from both China and India, as well as readily accessible saffron liquefied extraction
Vortex-aided deep eutectic solvent (D.E.S.)	Emulsification liquid-liquid micro -extraction	Turmeric liquid extract obtained commercially
Liquid-liquid microextraction	Aqueous two-phase extraction with imidazolium and ultrasound	Dried rhizomes obtained from the market and power obtained economically
Ultrasound-assisted ionic liquid dispersion	Liquid micro-extraction	A commercial mixture of curcuminoids
Environment-responsive long-chain acid (C7-C14)	Supramolecular extraction	Power obtained commercially
Microwave-assisted extraction	Microwave energy for analyte partitioning	Power obtained commercially
Microwave-assisted extraction	Microwave energy for analyte partitioning	

Fig. 3

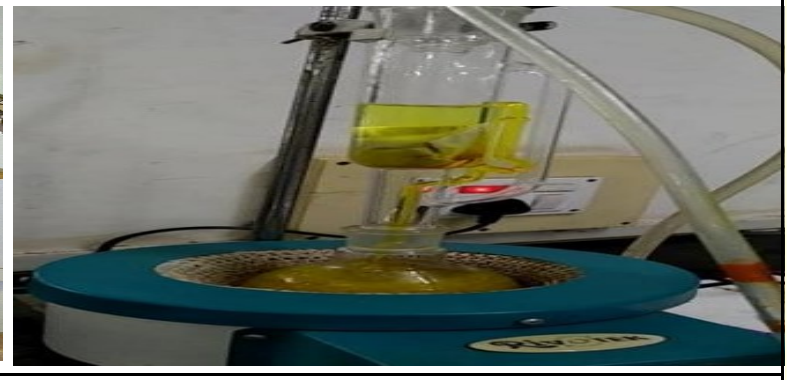


Fig. 4

Fig.5 Extraction process

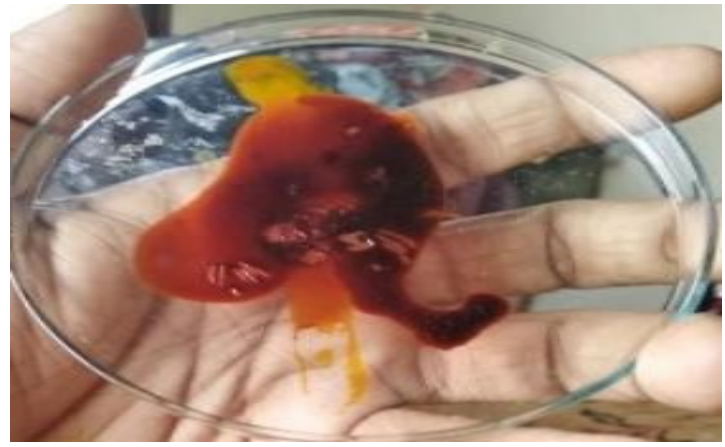


Fig. 6 Extract Isolated

Chemistry of Curcumin

Differentiuloylme-
thane, another name for curcumin, is a polyphenol related to the diarylheptanoids group and has the IUPAC name (1 E,6E).4-hydroxy-3-methoxyphenyl-1,7-bis-1,6 heptadi-
ene3,5dione, has the chemical formula C21H20O6 and a molecular weight of 368.39 g/mol [28].The structure of this symmetrical molecule shows two phenyl rings that have been replaced with a hydroxy gro up in the para position and a methoxy group in the ortho position.

It is simultaneously a polyphenol and a polyketide because the two aromatic rings are joined by a seven-carbon chain that contains an alpha-beta unsaturated diketone component [23]. Ke-
toenol tautomerism is exhibited by the Diketo group, which existed 100% in the enol form in the solid state and pred ominated as an enol in alkaline aqueous solutions. In contrast, the keto form predominates in acidic and neutral solut ions, with the enol accounting for only roughly 30% of all curcumin in the latter, as seen in Fig. 7 [24].

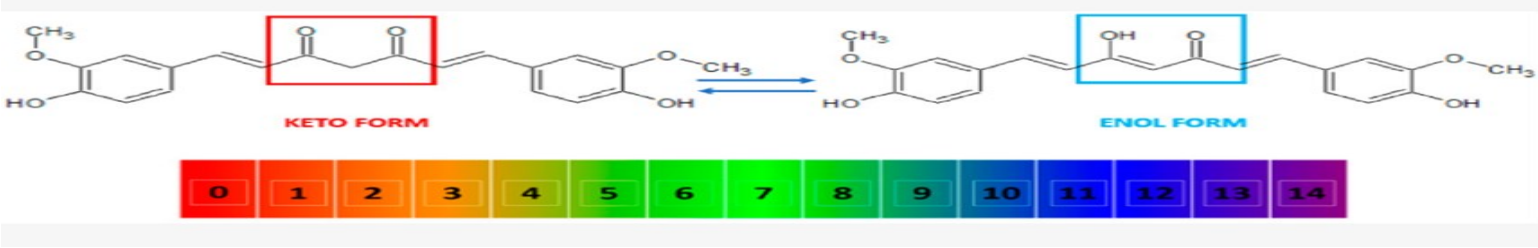


Fig. 7

Table. 5 The Vitamin Content of Turmeric [25]

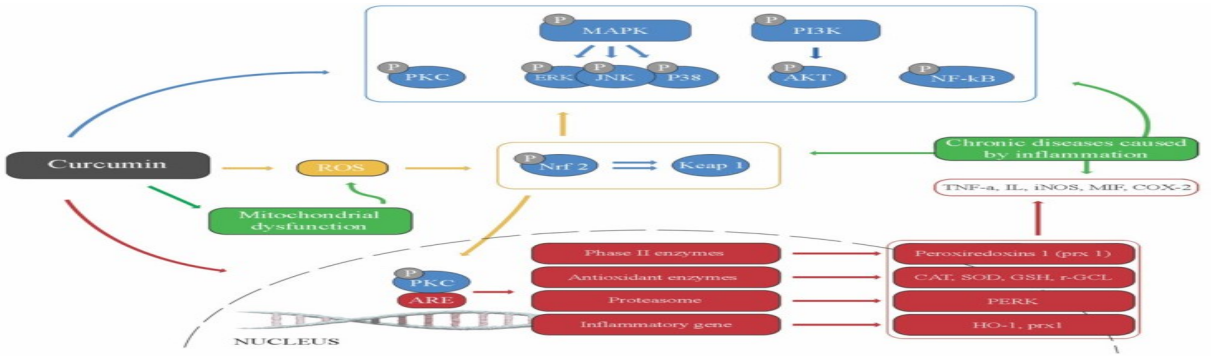
Ingredients	Value (per table spoon) (14g)
Water	1.6g
Calories	47.8g
Cholesterol	0mg
Protein	3.0g
Fat	11.2
Carbohydrates	33.6g
MINERALS	
Calcium	24.8mg
Phosphorus	36.2mg
Iron	5.6mg
Zinc	0.6mg
Magnesium	26.0mg
Potassium	340mg
Sodium	5.2mgss
Vitamins	
Thiamine	0.0mg
Riboflavin	0.0mg
Vitamin C	3.4mg
Vitamin A	0.0IU
Folate	5.2mcg
Choline	6.6mg

Table. 6 The nutrients in each 100g of (turmeric) saffron [26]

Calories 354kcal	Dietary Fiber 21g	Vitamin C 25.9mg	Vit. B2 (Riboflavin 0.233mg
Energy Value 1481kj	Sugars 3g	Iron 41.42mg	Vitamin E 3.1mg
Total Fat 9.88mg	Sodium 38mg	Calcium 183mg	Vit. B3 (Niacin) 5.14mg
Protein 8g	Potassium 2525mg	Copper 0.603mg	Vitamin B6 1.8mg
Carbohydrates 65g	Zinc 4.35mg	Magnesium 193mg	Vit. B1 (Thiamine) 0.152mg

Curcumin, Turmeric, & Fitness: Curcumin has a broad spectrum of natural actions as shown in fig.1 and has many medicinal uses [27-32].

Using turmeric to treat dental issues	• **Curcumin water**, it is a fast remedy for sore lips which is prepared by boiling two dried guava leaves, 5 grams of turmeric powder, and two cloves in two hundred grams of water. • To reduce pain and suffering, crushed and roasted curcumin is applied to aching teeth. • The gums and tooth enamel get stronger when roasted curcumin pieces and bishop's weed seed powder is applied & cleaned. • Using a paste consisting of one teaspoon turmeric, one tablespoon sodium chloride, along with one teaspoon mustard oil frequently relieves periodontitis and gingivitis. Twice daily, apply this paste to your gums and teeth.
Using Turmeric for Cosmetics	• Cosmetology uses curcumin extensively. On their wedding night, Indian ladies and grooms alike are covered with turmeric. It smooths, reduces inflammation, treats, and prevents skin conditions including pimples, acne, blackheads, and blemishes. • all while giving the skin a gorgeous golden shine. s
Using Turmeric which lowers stomach acid GIT effect	• The use of turmeric may cause some medications to work differently, producing more stomach acid. • Esomeprazole (Nexium) • Lansoprazole (Prev acid) • Ranitidine (Zantac) • Cimetidine (Tagamet)
Using Turmeric as antiviral agent	• As an antiviral agent, curcumin is also very essential. It inhibits the transcription of the BamH fragment z left frame 1 protein, which is a major activator of the Epstein-Barr virus in RajiDRLUC cells. • It additionally hinders the expression of the HIV gene, which is triggered by UV light. Plants are of scientific interest because they are a rich source of phytochemicals with a variety of biological fun ctions, including antiviral qualities.
Using Turmeric as Anticancer Agent	• One alternative cancer treatment that is being advocated is turmeric. Turmeric contains a compound called curcumin, which may be able to kill cancer cells in some types of cancer. However, more research is required. Many Asian nations grow turmeric as a spice. • Curcumin's protein targets in tumour cells.
Using Turmeric as Anti-fungal agent	• The regulating fungal aspect of turmeric and curcumin associated fungi and spoiling agents. Curcumin intensity is a key factor in preventing the growth of fungi. • In plant tissue culture, turmeric powder at concentrations of 0.8 and 1.0 g/L has demonstrated strong inhibitory activity against fungal infections. Antifungal activity against Candida albicans and Cryptococcus neoformans was shown by the turmeric methanol extract, with minimum inhibitory concentrations (MIC) of 128 and 256 µg/mL, respectively.
Using as Anti-inflammatory agents	• The combination of curcumin and the aromatic oils in the turmeric plant results in powerful anti-inflammatory benefits. • Half of curcumin can be used to treat chronic inflammation when taken orally. demonstrated to be equally effective in treating the acute inflammatory response as cortisone or phenylbutazone. • Rheumatic symptoms are often associated with inflammatory changes in the joints. It addresses the fundamental causes of inflammation as well as its pathological changes. • One of curcuminoids' characteristics is its capacity to inhibit a wide range of molecules, such as phospholipases, leukotrienes, prostaglandins, thromboxane, nitric oxide elastase, hyaluronidase, collagenase, interleukin-12, TNF, and interferon inducible protein. • Pro-inflammatory transcription factors (AP-1 and NF-ĸB) are inhibited. • Lower pro-inflammatory cytokines (TNFɑ, MIP-1a, MCP-1, CRP, PGE2, IL-1b, IL-2, IL-6, IL-8, and IL-2). Reduce the activity of certain enzymes, such as COX-2, 5-lipoxygenase, and -5 Block the production of nitric oxide synthase (NOS) enzymes by inhibiting pathways and mitogen-activated protein kinases (MAPK).

	
Using as Hepato-protective agent	• The main causes of turmeric's hepatoprotective and reno-protective effects, which are similar to those of silymarin, are its antioxidant characteristics and ability to inhibit the synthesis of pro-inflammatory cytokines (3)–5. • Turmeric's hepatoprotective qualities have been shown in animal studies against a number of hepatotoxic insults, including carbon tetrachloride (TCE), Aspergillus aflatoxin, galactosamine, and acetaminophen (paracetamol). • In rats with acute and subacute liver injury brought on by $CCl4$, it has been demonstrated that giving curcumin considerably decreased liver damage in test animals as compared to controls. • Turmeric extract is very which, when tested on ducklings, reduces the generation of fungal aflatoxin by 90% harbouring an Aspergillus parasitises infection. • It is feasible to prevent and cure cholelithiasis because of the curcumin salt sodium curcuminate, furthermore has choleretic effects via raising.

CONCLUSION-A detailed review of the scientific literature indicates that Curcuma longa, a herbal remedy with a wide range of pharmacological properties, is considered a panacea. As a result of its diverse chemical composition, this plant is considered a multipurpose medicinal herb. Therefore, it is clear that in order to combat the ailments, a great deal of research is required to ascertain their potential for cure.

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