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Review Article

A REVIEW - *CURCUMA LONGA* (*HARIDRA*): EMERGING AS MAGICAL HERB FROM TRADITIONS TO THE PHARMACEUTICAL INDUSTRIES

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KEYWORDS: *Haridra*, *Curcuma longa,* Indian Saffron, Phyto-constituents.

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ABSTRACT

Haridra is a potent medicinal herb used traditionally since ancient times for the treatment of various skin disorders, liver disorders and respiratory disorders and are well documented in Ayurvedic literatures. This is again revalidated by recent researches done on the biological and pharmacological actions like anti-inflammatory, antioxidant, anti diabetic, antibacterial, hepatoprotective, expectorant, anti cancerous, anti mutagenic, anti melanogenic, free radical scavenging properties of phytoconstituents of *Curcuma longa* like *curcumin, curcuminoids* etc. Due to high potency and therapeutic value of drug its demand is increasing in pharmaceutical industries for preparation of various formulations containing *Curcuma longa* or its constituents. Cultivation of drug on large scale is done for trading as India is one of the main trading center of *Curcuma longa* (Indian Saffron) and its various varieties are available in market.

This review focuses on these potent pharmacological properties with macroscopic and microscopic features of both cured and uncured available rhizomes of *Haridra* in market with nutritional value and its wide range of use in cosmeceutical and nutraceutical industry which proves it as arising magical herb in pharmaceutical industry for preparation of formulations used in various diseases.

INTRODUCTION

In the present era, with fast and changing lifestyle many new disorders arises and pharmaceutical industries are growing at rapid rate to meet the herbal market demand, herbs and crude drugs. Man has been using plants and herbs for treating various disease since immemorial times[1]. In India, the earliest mention of medicinal plants is to be found in Rig Veda which is of4500- 1600 B.C. [2] *Haridra* is one of those herbs whose demand is raising day by day by pharmaceutical industry due to its multiple pharmacological activities. It is enriched with many useful phytoconstituents which are responsible for its efficacy.

Haridra in Tradition

Haridra is a well known traditional herb of India and China since thousands of year ago. It is also used as coloring agent for textile since ancient times due to its bright golden yellow color. Indian saffron another name is given to turmeric and as a spice is extensively used in Indian and Chinese cuisine as a flavouring agent and condiment. Also used in cuisine of Ethopia, Thailand and in South-East Asia. In India, it is used in religious ceremony as an auspicious paste used over whole body before marriage rituals or as auspicious beauty spot daily applied on forehead by Hindu females, or as *Uptaan* by women or as drug for medical treatment of skin disorders, wounds, infection, stress and depression etc. As a folklore medicine, its uses has been documented in both Indian and Chinese cultures. In India, Rhizome is used to treat cough and cold in the Siddharthnagar district of U.P. The paste of rhizome is applied over whole body to treat body pain by tribes of Jhalda, Parulia District, West Bengal. Tribal women of Assam apply paste of fresh rhizome on the skin to protect it from infection and enhance the complexion. Rhizome of this plant along with other ingredients is given to cattle to treat loose stools.[3, 4]

In both Ayurvedic and traditional Chinese medicine, turmeric is considered a bitter, arid, stomachic, expectorant, appetizer and a carminative. Unani practitioners also use turmeric to expel phlegm or *Kapha*, as well as to open blood vessels in order to improve blood circulation. It can be incorporated into foods, including rice and bean dishes, to improve digestion and reduce gas and bloating. [5]

Distribution- Trading

It is native of Southern Asia and is grown widely throughout the warmer areas of Indian subcontinent. Indian turmeric is consider best in the world. India is the largest producer of turmeric about 90% of total production along with its consumption and export. Other countries are China, Pakistan, Peru, Bangladesh and Taiwan.[6, 7]

In India, the major producers are the states of Orissa, Andhra Pradesh, Maharashtra, Tamil Nadu, Kerala, Assam, Bihar and West Bengal. "Erode", city from Tamil Nadu (Yellow City /Turmeric City/ Textile City) is the world's largest producer and trading center. The city "Sangli " from Maharashtra is second largest and major trading center of turmeric. Turmeric grown in Kerala is called Alleppey Finger Turmeric (AFT) and is considered best in term of quality.[8, 9]

Turmeric in major states of India as follows:[10]

Tamil Nadu : 18%
Orissa : 7%
West Bengal : 4%
Karnataka : 4%
Gujarat : 2%
Maharashtra: 2%
Kerala: 2%

Varieties and Cultivation

Commercial varieties distinguished by name of locality in which they are grown like in Assam *Deshipatani* (have better color and flavor). In Chennai *Chinna nedan* (grows fast and have sweet aroma) *perum.* In Mumbai, two varieties one hard and bright colored while other is soft, larger and lighter in color. [11]

The famous varieties available in market are

Haldi, China scented, Thodopuza, Red streaked, Alleppy, Patna etc.[11]

Other Species

Plants of genus Curcuma belongs to Zingiberaceae/ Scitaminae family and is known for their high therapeutic potentials.

Curcuma longa Linn. (*Haridra*)
Curcuma aromatica Salisb. (*Vana Haridra*)
Curcuma amada Roxb. (*Amragandhi Haridra*)
Curcuma angustifolia Roxb.
Curcuma caesia Roxb. (*Kali Haridra*)
Curcuma zedoaria Rosc. (Zedoary)

are known important species among the hundred species seen in different parts of the world

Other species of curcuma like *Curcuma angustifolia, Curcuma leucorhiza, Curcuma amada etc.* have pale colored rhizomes, these are utilized in India for production of starch, which is known as "East Indian Arrowroot". [12]

Soil for Cultivation

Turmeric can grown from sea level to an altitude of 1220 meters but sensitive to atmospheric temperature. Hot and moist climate with liberal water supply and well drained soil is must. Gravel, clayey and stony soil is not suitable for growing it. It grows on loose soil, loamy or alluvial in rotation with other crops as it is soil exhausting crop. For high yield, deep filth and heavy manuring is required. For planting, properly ripened and healthy growing bud fingers of corm are used.[12, 13]

Planting Season - Harvesting

Season of planting varies from April to August in North-West like in Kumaun, Garhwal region. It varies from February to July in Bhagalpur, March to April in Rajasthan, June or July in Chennai. Towards end of May in Gujarat. Before plantation, land is prepared to a fine filth by cross ploughing and harrowing and light irrigation is done. Plants thrives well in partially shaded area. Under rainy condition yield is low as compared with irrigated field. Harvesting is done after 8months of planting when lower leaves turn pale and stems are dried.[14]

Post- Harvesting Processing

The fingers and rhizomes are boiled separately for 30-40 minutes until froth and white fumes appear. They are then drained and dried in the sun for 10-15 days, until they become dry and hard. They are then cleaned and polished mechanically in a drum rotated by hand or by power. Curing of rhizomes is essential for both development of attractive yellow color and characteristic aroma. Unless cured rhizomes lacks both features.[15]

Vernacular Names: [16]

Eng. Turmeric
Hindi. *Haldi, Halda, Hadee*
Beng. *Halud*
Guj. *Haldar, Halada*
Kan. *Arisina*
Mal. *Marmal, Manjal, Marinalu, Paccamannal, Varattumannal.*
Mar. *Halad*
Punj. *Haldi, Halja, Haldar*
Tamil. *Mancal, Manjal*
Tel. *Pasupu*
Kon.Halad
Oriya. *Haladi*
Kash.-*Lidar*
Arabic. *Kurkum, Zarsud, Uruk-es- suff,*
Per- Serd- Chubah, Zard Chobah, Daroserda

Botanical Description

Tall herbs, root stock ovoid, tubers thick cylindrical light yellow in color inside. Leaves up to 50 × 8cm, oblong lanceolate, apex –acuminate, base tapering. Petiole as long as the blade. Peduncle hidden by the sheathing petiole. Spikes 10-15cm long. Corolla white tube funnel shaped, flowering bracts pale green, bracts of coma tingled with pink.[16]

Rhizome – Macroscopical Characters[16]

Both cured and uncured turmeric differ in external morphology.

Uncured turmeric

Globular pieces with finger like off-shoots are separated before marketing. Young rhizome are waxy yellow in colour and demarcated into nodal and region. Scale leaves are present at nodal region while rest is smooth. At inter nodal region outer cork is thrown into

wrinkles. Tubular projection give rise to fiber like root and conical apical bud at end. Internal color of rhizome is tanned brown.

Cured turmeric

Cylindrical (finger like 6cm long) or oval, oblong and pyriform shaped pieces (bulbs of almost same thickness) are found in market. Rhizome's outer color is palish to spotted pale in color. Rhizome solid internally and smooth or rough externally.[16]

Microscopic Characters

The transverse slightly sections from both cured and uncured turmeric resembles to a large extent differ only with intact cork and nature of starch. Intact cork and independent starch grains present in the uncured samples. Broken cork present at many places and gelatinized lumps of starch in cured one rhizome.

Rhizome consist of outer zone of cork then cortex, an endodermis ring covering vascular bundles. Vascular bundles are scattered throughout the section in outer and inner cortex. Vascular bundles are arranged along a circle under endodermoid ring which encloses central medulla with scattered vascular bundles. vascular bundles are similar in nature both in inner and outer cortex. Cortex filled with starch grains and yellow colored pigment (curcumin) and calcium oxalate in some samples. [16]

NUTRITIOAL VALUE[17]

138% of Vitamin B-6 (pyridoxine)
32% of Niacin
43% of Vitamin C
21% of Vitamin E
54% of Potassium
517% of Iron
340% of Manganese
40% of Zinc
But 0% cholesterol.

In 100gm of turmeric provides 53% of dietary fiber, (% of Recommended Daily Allowance, RDA per 100g)

Moisture 13.1 %
Protein 6.3 %
Fat 5.1 %
Minerals 3.5 %
Fibre 2.6 % per 100 grams.
Carbohydrates 69.4 % per 100 gms edible portion.

It also contains calcium, phosphorous, carotene, thiamine and niacin. Its calorific value is 349.

Synonyms

In different lexicons of Ayurveda, various synonyms are given like Rajani, Nisha, Gauri, Krimighna, Yoshitpirya, Kanchani, Varavarnini, Haldi, Hattavilasin, Haridra. [15]

Table 1: Properties in Ayurvedic Literature:[18-24]

Literature	*Rasa*	*Guna*	*Veeyya*	*Vipaka*	*Karma*
Dhanvantri Nighantu	*Tikta*	*Ruksa*	*Usnaa*	*Katu*	*Kandu, Kusta, Vranhanti, Deehavarnya-Vidhayni Vishodhini, Krimihara*
Kaiyadev Nighantu	*Tikta*	*Ruksa*	*Usnaa*		*Vranya, Twak- Dosha Vishajeet, Sothajeet, Pandu Kapha-Pitta Har*
Raaj Nighantu	*Katu Tikta*		*Usnaa*		*Kapha Vikar, Vata Vikar, Rakta Vikar, Kushta Kandu-Vradna Hanti, Deha Varnya Vidhayni*
Guanaratan-Mala	*Katu-Tikta Rasa*	*Ruksha*	*Usnaa*		*Kapha-Pitta Nasaka, Vranyaosh Twak Vikar Rakta –Dosha Soph-Vikara, Pandu, Vrana-Vikara*

Properties and action of *Haridra* in database of CCRAS [15]

Rasa : *Tikta, Katu*

Guna : *Ruksha, laghu*

Virya : *Ushna*

Vipaka : *Katu*

Doshaghnata: *Tridoshashamak*

Rogaghnata: *Shotha, Vedana, Vrana, Shwasa, Aruchi, Vibandha, Kamala, Jalodara, Krimi, Pandu, Kasa, Pratishyaya, Shukrameha, Prameha, Kandu, Shittapitta, Kushta.*

Karma: *Kaphapittanut, Vishaghna, Varnya, Kusthaghna, Krimighna, Kandughana, Pramehanashaka, Raktaprasadana, Raktvardhaka, Raktastambhana, Vranaropana, Anulomana, Pittarechaka, Shwasahara, Mootrasangrahaniya, Mootravirajaniya.*

Action and Uses

The rhizomes are bitter, acrid, emollient, anodyne, anti-inflammatory, depurative, appetiser, carminative, laxative, diuretic, expectorant, haematinic, styptic, alexeteric, febrifuge, ophthalmic and tonic. They are useful in inflammation, ulcer, wounds, leprosy, skin disease, pruritis, allergic conditions and discolouration of skin, anorexia, dyspepsia, helminthiasis, strangury, cough, asthma, bronchitis, hiccough, anaemia, haemoptysis, jaundice, conjunctivitis, general debility and diabetes.[25]

Chemical constituents: as per database of CCRAS

The major chemical constituents are curcuminoids (apprx.6%) the yellow coloring principle curcumin constitutes 50-60%, essential oil (2-7%)with high content of bisabolane derivatives. The minor component include desmethoxycurcumin, bidesmethoxy-curcumin, dihydrocurcumin, phytosterols, fatty acid, polysaccharides.[26]

Pharmacological Properties and Action

For the last few decades, extensive works have been done to establish the pharmacological actions of Turmeric and its extracts. Various researches and phytochemical studies proves the therapeutic efficacy of turmeric. This is the reason behind increasing demand in pharmaceutical industry for preparation of formulations, drugs and cosmetic products. Newer techniques for extraction of different active principles also facilitate its more wide and extensive use in pharmaceutical industries.[25]

Anti-inflammatory action

The laboratory studies have identified a number of different molecules involved in inflammation that are inhibited by curcumin including phospholipase, lipooxygenase, cyclooxygenase-2, leukotrienes, thromboxane, prostaglandins, nitric oxide, collagenase, elastase,

hyaluronidase, monocyte chemoattractant protein-1 (MCP-1), interferon-inducible protein, tumor necrosis factor (TNF), and interleukin-12 (IL-12).The essential oil, containing ar-termerone, as a major component is known to possess anti-inflammatory activity. Ar-termerone is anti-mutagenic in nature and anti-platelet activator. It potentiates antioxidant activity of curcuminoids. Studies on the toxicity and anti-inflammatory properties of curcumin have included *in vitro*, animal and human studies.[26-31]

Hepatoprotective action

The ethanolic extract of rhizome contain the flavonoid, curcumin and various volatile oils, including tumerone, atlantone, and zingiberene.

It shows a significant hepatoprotective effect when orally administrated. The protective effect is dose - dependent. Turmeric due to direct antioxidant and free radical scavenging activity, indirectly augment I Curcumin down-regulate the inflammatory effects and fibrogenesis of liver. [32-34]

Anti-diabetic action

In Ayurvedic literature, powder of *Haridra* is advised in diabetes along with *Amlaki churna* and honey. It proves to be better dietary supplement of high potential when used with milk. Curcuminoids lower lipid peroxidation by maintaining the activities of antioxidant enzymes like superoxidedismutase, catalase and glutathione peroxidase at higher level. *Curcuma longa* contains curcuminoids, glycosides, terpenoides and flavanoids. Maximal inhibition of Human Pancreatic Amylase (HPA) was obtained from isopropanol extract and acetone extract which reduces starch hydrolysis. [35]

Antiallergic action

Glycosides of curcumin (bis-demethoxy-curcumin and tetrahydrocurcumin) works in allergic reactions by inhibiting the release of histamine. The anti-oxidative activities were assessed by measurement of cell-free or cellular radical scavenging. All compounds but diglycosides or bisdemethoxycurcumin analogs distinctly exert anti-oxidative effects. Compounds with potent radical scavenging activities cause decrease in histamine release but with non-potent radical scavenging activities also inhibited histamine release. Curcumin has an ability to inhibit nonspecific and specific mast cell-dependent allergic reactions.[36]

Anti-carcinogenic property

Curcumin has been found to possess anticancer activities via its effect on a variety of biological pathways involved in mutagenesis, oncogene expression, cell cycle regulation, apoptosis, tumorigenesis and metastasis. Its anti-tumor activity in cancer cells by altering the deregulated cell-cycle via cyclin-dependent, p53-dependent and p53-independent pathways. [37]

Cardio protective action

The antioxidants in turmeric also prevent damage to cholesterol, thereby helping to protect against atherosclerosis. In fact, the ability of the antioxidants in turmeric to decrease free radicals is similar to that in vitamins C and E. Since the antioxidant activities of turmeric are not degraded by heat (unlike most vitamins), even using the spice in cooking provides benefits. Animal studies show that curcumin lowers cholesterol and triglycerides and circulates. In recent study of atherosclerosis shows, mice were fed diet (turmeric mixed in their food) have 20 % less blockage of the arteries than the mice fed diet without turmeric. In another study, several risk factors for the disease were improved including decrease in cholesterol, triglycerides and free-radical damage.[38-39]

Protective role in skin diseases

Curcumin possess the ability to protect the skin from harmful UV-induced effects by displaying antioxidant, free radical scavenging, anti-inflammatory, antimutagen and anti-carcinogenic properties. [40-41]

Antifungal action

Curcuma longa leaves proves a good antifungal agent against human pathogenic fungi various *in vitro* and in vivo viz, strong fungicidal action, long shelf-life, its tolerability of heavy inoculum density, thermo stability, broad range of antidermatophytic activity and absence of any adverse effect.[42]

Protective role in Alzheimer's disease

It reduced oxidative damage and reversed the amyloid pathology in an Alzheimer's disease transgenic mouse. Curcumin's powerful antioxidant and anti-inflammatory properties reduces Alzheimer's disease symptoms. [43]

Classical Medicinal Uses

1. In diabetes, *Haridra* powder mixed with honey should be taken with *Amalaka* juice. (CS. Ci.6/26, SS.Ci-11/8, AS.Ci.14/5, A.H.Ci.-12/5)
2. In Anaemia, *Haridra* mixed with *Triphala, Ghee* and honey. (SS.U-44/17)
3. In Jaundice, *Haridradi ghrita* (CS. Ci. 16/53) and *Haridra*, red ochre and *Amalaki* collyrium.
4. In cough, Powder with *Vasa* juice and milk. (SB.4/333)
5. In Bronchial Asthma, Ash of *Haridra* with honey. (SB.4/375)
6. Inhale smoke of *Haridra* wick. (CS.Ci.17/77)
7. In Calculus, *Haridra* and jaggery in equal parts with sour gruel gravels pass away. (BS.asmari-45)
8. In piles, Paste of *Haridra* powder mixed with latex of *Snuhi* or *Pippali* should be applied. (CS.Ci-14/52)
9. In *Vatavyadhi,* Fine powder put in oil for 3hours then oil is extracted. It alleviates *Vata* disorders.
10. In Freckles, Paste of *Haridra* and *Rakta chandan* with buffalo's milk should be applied on face. It removes the dark shade. (RRS.24/45)

CONCLUSION

C*urcuma longa (Haridra)* is one of the best herbal medicine which can be used as a single drug therapy in many disease not only in present era but since ancient times. As a folklore medicine *Haridra* is used for the treatment of cough, cold, allergy and various skin disorders. *Haridra* is known as Indian Saffron, used as spice in Indian and Chinese cuisine and traditionally used in auspicious occasions. In Ayurveda, its uses are well documented for treatment of respiratory disorders like asthma, allergy as well as for liver disorders, anorexia, rheumatism, diabetic wounds, cough and sinusitis. Recent researches revalidate the traditional uses by proving the wide range of biological and pharmacological action on various system in vitro and vivo. Hence it can be used for the preparation of various formulations for the treatment of inflammation, wound and microbial infections alone or associated with conditions like diabetes, tumor and cancerous growth. *Haridra* have high therapeutic value in disease related to cardiovascular system, respiratory system and skin. The pharmaceutical industries are attracted towards the potency of drug and various formulations containing active phytoconstituent of *Haridra,* (curcuminoids and curcumin mainly) are in today's drug market. It is one of the basic constituent of cosmeceutical products due to its anti- melanogenic, anti-oxidative and free radical scavenging profile added with anti-inflammatory and anti-tumor activity and is also used as a nutraceutical product in some disease like diabetes, skin allergy or hepatic disorder etc. To meet the rising demand, *Haridra* is cultivated in India and trading is done on large scale. Various varieties are also available according to locality. This review will help to reveal the uses and action of *Haridra* described in literature as well as in recent researches to validate the traditional uses. This knowledge promotes the pharmaceutical industries for preparation of formulations having active phytoconstituent of it in the field of cosmeceutical or nutraceutical.

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