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A REVIEW ON *CURCUMA LONGA* EFFECT ON HUMAN HEALTH.

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ABSTRACT.
Since centuries ago turmeric (also known as *Curcuma longa*) is widely utilized as a spice, food colorant, and preservative in India, China, and South-East Asia. Turmeric belongs in the Zingiberaceae family and is a spice derived from the root of the *Curcuma longa* plant. Thus, curcumin (also known as curcuminoids or phenolic compounds) is the active ingredient in turmeric powder or turmeric essential oils. Curcumin is the phytochemical derived from the bulb of the plant *Curcuma longa* and is the major component of turmeric. The herb has been used for thousands of years. It aids in the management of oxidative and inflammatory conditions, metabolic syndrome, arthritis, It may also help in the management of exercise-induced inflammation and muscle soreness, thus enhancing recovery and performance in active people. Most of these benefits can be attributed to its antioxidant and anti-inflammatory effects.

KEYWORDS:- Curcuma, Turmeric, Osteoarthritis, Dietary supplement, Rhizome, curcumin.

INTRODUCTION.
Turmeric Synonyms: C. Domestica Valeton
Family: Zingiberaceae
Common name: Curcuma; haldi; Indian Saffron
Drug name: *Curcuma longa* e rhizoma
Botanical drug use: Rhizome (often erroneously called a, 'root')

HISTORY
Turmeric is a rhizome that is a member of the ginger family zingiberaceae native to southeast asia, and it has been used in india as a medicinal plant for over 6,000 years. Known as “the golden spice” and the “spice of life,” the name derives from the medieval latin terramerita or “meritorious earth,” a term used in early commerce to describe the powdered form. For centuries, turmeric has been utilized as a food preservative, coloring agent, and cosmetic, and in wound healing and religious rituals.1 ayurvedic medicine found applications for turmeric in respiratory, liver, and inflammatory illnesses, and in diabetic wound care. Ancient hindu medicine applied it topically for sprains and swelling, and traditional chinese medicine administered turmeric for abdominal pain. Europeans were first introduced to the benefits of turmeric in the 13th century by marco polo.

CHEMISTRY
Turmeric is comprised of three curcuminoids as well as volatile oils (tumerone, atlantone, and zingiberone), sugars, proteins, and resin. The three curcuminoids are curcumin (*Curcuma longa*), responsible for the vibrant yellow color and therapeutic effects of turmeric (77%), demethoxycurcumin (17%) and bidemethoxycurcumin (3%). Curcumin itself constitutes 2–5% of the ground turmeric powder and was isolated in 1815 by Vogel and Pelletier. A crystalline form was produced in 1870, and decades later, in 1935, the first study of the role of turmeric in human disease was published. In this experiment, subjects received an intravenous solution containing curcumin, which produced rapid gallbladder emptying, suggesting a potential benefit of curcumin in treating subacute, recurrent, or chronic cholecystitis. Curcumin is a polyphenol derivative that is lipophilic and thus insoluble in water at acidic and neutral pH, and soluble in acetone, methanol, and ethanol.Another unique property of curcumin is that it is rapidly decolorized by ultraviolet light exposure, and biological specimens require protection from light.

Fig. 1 *Curcuma longa*

Fig. 2 Plant of Turmeric

BIOAVAILABILITY

Curcumin's low aqueous solubility reduces its oral bioavailability. Interestingly, there is also low bioavailability with intravenous administration. Poor gut absorption, high rate of metabolism, and high systemic elimination all affect bioavailability. However, studies have shown that using higher oral doses of curcumin results in appropriate levels of curcumin necessary for clinical activity. Coadministration with piperine, an extract of black pepper or with lecithin can enhance solubility, and the former can increase plasma bioavailability by up to 2000%.Many other strategies have been innovated to increase oral availability, including use of nano/microparticles, solid dispersions, polymeric micelles, nanosuspensions, lipid-based nanocarriers, cyclodextrins, conjugates, and polymorphs. Mechanisms that can enhance bioavailability include increasing the intestinal stability of curcumin, changing the route of administration, and allowing for co-administration with other adjuvants.10 Studies show that solid lipid particles, micellar systems, or hydrophilic nanoparticles can increase the concentration up to 15-20 fold.12 A synthetic, nanoparticle complex, water-dispersible form of curcumin attained a higher bioavailability after one dose.

BIOLOGICAL EFFECTS

Curcumin has been described as a highly pleiotropic molecule with numerous biologic targets and mechanisms of actions. It is involved in modulation of enzymatic activity, growth factor receptors, cofactors, and other molecules. Through these mechanisms, it exhibits antimicrobial, antioxidant, antiinflammatory, antirheumatic, and antidiabetic effects, as well as anti-proliferative and antineoplastic effects. It has also demonstrated hepatoprotective, nephroprotective, neuroprotective, and cardioprotective properties. These characteristics provide the foundation for its therapeutic uses and the rationale for clinical trials[1]

C. longa (turmeric) Turmeric is a widely used spice and coloring/flavoring agent that comes from the root of the plant C. longa .a member of the *Zingaberacea* family . The FDA classified turmeric among substances 'generally recognized as safe'. In Ayurveda, turmeric has been used for various medicinal conditions including rhinitis, wound healing, common cold, skin infections, liver and urinary tract diseases and as a 'blood purifier' . Turmeric was found to be effective even when given by different routes including topical, oral or by inhalation, dependent on the intended use. The major constituent of turmeric is curcumin (diferuloylmethane), which constitutes up to 90% of total curcuminoid content, with demethoxy-curcumin and bis-demethoxycurcumin comprising the remainder.In animal studies, oral administration of curcumin to rats decreased the levels of inflammatory glycoprotein, Gp A 72, with a reduction in paw inflammation. Curcumin has also been shown to inhibit the carrageenin-induced paw edema in mice and rats, with an ED50 dose 48 and 100.2 mg kg-1.respectively.In a double-blinded crossover clinical trial of 18 patients with RA given curcumin (1200 mg day--1)for 2 weeks followed by 300 mg day-1 of phenylbutazone for another 2 weeks, respondents showed a significant improvement in morning stiffness, walking time and reduction in joint swelling.

Table no. 1 Biological activity of turmeric and its compound

Sr. No	Compound/extract	Biological activity	Reference
1	Turmeric powder	Antitumor, Ant protozoan Anti inflammatory and Wound-healing	Gujral et al., (1953)
2	Methylcurcumin	Anti protozoan	Gomes et al., (2002)
3	Demethoxycurcumin and Bisdemethoxycurcumin	Antioxidant	Unnikrishnan et al., (1995)
4	Volatile oil	Anti-inflammatory, Antibacterial, Antifungal	Chandra et al., (1972)
5	Curcumin	Antibacterial, Anti protozoan, Antiviral, Antitumor and Antioxidant	Lutomski et al., (1974)

Mechanism of Action :- Curcumin is a non-toxic dietary pigment in turmeric and is potent inhibitor of the common transcription factor NF-kB in several cell types. Other studies have shown that curcumin inhibits/modulates upstream pathways of the arachidonic acid cascade (COX-2 and LOX) by inhibiting the catalytic activities of phospholipases A2, Cg1 and D in various cell lines. In human chondrocytes, curcumin significantly inhibited MMP-3 and MMP-13 gene expression by inhibiting the JNK, AP-1 and NF-kB pathways. Other studies have shown that curcumin blocks LPS and interferong-induced production of NO and TNF-

a in vitro by inhibiting the activation of NF-kB and AP-1 [reviewed in Curcumin also inhibited the incorporation of arachidonic acid into membrane lipids, PGE2 production, leukotriene B4 and leukotriene C4 synthesis, as well as the secretion of collagenase, elastase and hyaluronidase by macrophages Furthermore, IL-1b-induced upregulation of MMP-3 was inhibited by curcumin in a time-dependent manner. In addition, IL-1b-induced decrease in type II collagen synthesis was also blocked by curcumin treatment. Based on the data obtained it was concluded that curcumin antagonizes crucial catabolic effects of IL-1b signaling that are known to contribute to the pathogenesis of OA. Although not conclusive, but these data clearly show the necessity of additional studies to develop and use optimized doses in randomized, placebo controlled clinical trials to confirm or refute the reported efficacy of the use of curcumin in OA and RA.[2]

MEDICINAL AND PHARMACOLOGICAL PROPERTIES OF TURMERIC

Osteoarthritis

Dietary supplements, including herbal products, have also been examined for treatment of osteoarthritis. Several dietary supplements (eg, glucosamine, glucosamine with chondroitin, devil's claw, S-adenosyl-l-methionine) have demonstrated efficacy compared to placebo and active controls, while others (eg., methylsulfonylmethane) have not.4 One additional product that has been evaluated and used for treatment of osteoarthritis is curcuma. Curcuma (also known as curcumin or turmeric) is an active constituent that is derived from the rhizome of turmeric (*Curcuma longa* or Curcuma domestica). It is a yellow substance commonly used as food coloring and as an ingredient in curry. Curcuma has a long history of being used in complementary and alternative medicine, and is commonly taken for a variety for health conditions such as arthritis, gastrointestinal complaints, respiratory infections, and even cancer. There is some evidence that shows curcuma has anti-inflammatory, antithrombotic, antioxidant, and antimicrobial activities. The exact mechanism of action associated with curcumin is not fully understood. The anti-inflammatory effects of curcumin are believed to be a result of inhibiting pro-inflammatory signals such as prostaglandins, leukotrienes, and cyclooxygenase-2. One major limitation to curcumin is that it has very low bioavailability. Several formulations, such as nanoemulsion encapsulation polylactic-co-glycolic acid encapsulation, liposomes encapsulation, cyclodextrin encapsulation, and curcumin-piperine nanoparticles, have been developed to increase the bioavailability of oral curcumin.[3]

Antioxidant

Antioxidant and anti-inflammatory properties are the two primary mechanisms that explain the majority of the effects of curcumin on the various conditions discussed in this review .Curcumin has been shown to improve systemic markers of oxidative stress .There is evidence that it can increase serum activities of antioxidants such as superoxide dismutase (SOD) .A recent systematic review and meta-analysis of randomized control data related to the efficacy of supplementation with purified curcuminoids on oxidative stress parameters—indicated a significant effect of curcuminoids supplementation on all investigated parameters of oxidative stress including plasma activities of SOD and catalase, as well as serum concentrations of glutathione peroxidase (GSH) and lipid peroxides [23]. It is noteworthy to point out that all of the studies included in the meta-analysis utilized some sort of formulation to overcome bioavailability challenges, and four out of the six used piperine. Curcumin's effect on free radicals is carried out by several different mechanisms. It can scavenge different forms of free radicals, such as reactive oxygen and nitrogen species (ROS and RNS, respectively) it can modulate the activity of GSH, catalase, and SOD enzymes active in the neutralization of free radicals .also, it can inhibit ROS-generating enzymes such as lipoxygenase/cyclooxygenase and xanthine hydrogenase/oxidase. In addition, curcumin is a lipophilic compound, which makes it an efficient scavenger of peroxyl radicals, therefore, like vitamin E, curcumin is also considered as a chain-breaking antioxidant [4]

Management of Obesity

People who would like to lose a couple of pounds or treat obesity and other similar condition can take benefits of turmeric powder which can be very helpful in keeping one's ideal body weight. The component in turmeric helps in boosting the flow of bile which is an essential element in the process of breaking down of dietary fats.

Controlling Diabetes

Turmeric boosts glucose control and augments the effects of the medications which are used in the treatment of diabeties. It also lowers the body's resistance to insulin which can prevent Type-2 diabeties from developing.

Skin Treatments

Turmeric has lots of benefits for the skin including speeding up the process of healing wounds, calming pores on the face to reduce acne. Since it has antioxidant and- inflammatory properties, which is really use full for treating skin problems.[5]

Anti-inflammatory properties

Oral administration of curcumin in instances of acute inflammation was found to be as effective as cortisone or phenylbutazone. Oral administration of *Curcuma longa* significantly reduced inflammatory swelling . 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. Curcuminoids also inhibit LOX, COX, phospholipases, leukotrienes, prostaglandins, thromboxane, nitric oxide elastase, hyaluronidase, collagenase, monocyte chemoattractant protein-1, interferon inducible protein, TNF and interleukin-12. They also decrease prostaglandin formation and inhibit leukotriene biosynthesis via the lipoxygenase pathway. An RCT investigated the effect of a combination of 480mg curcumin and 20mg quercetin (per capsule) on delayed graft rejection (DGR) in 43 kidney transplant patients. Of 39 participants who completed the study, two of 14 in the control group experienced DGR compared to zero in either treatment group. Early function (significantly decreased serum creatinine 48 hours post-transplant) was achieved in 43% of subjects in the control group, 71% of those in the lowdose treatment group. Since the amount of quercetin in the compound was minimal, the majority of benefit is thought to be due to curcumin's anti-inflammatory

and antioxidant activity. Likely mechanisms for improved early function of transplanted kidneys include induction of the hemeoxygenase enzyme, and proinflammatory cytokines, and scavenging of free radicals associated with tissue damage.

Antimicrobial properties
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 turmeric resulted in a reduction in small intestinal lesion scores and improved weight gain. Another study, in which guinea pigs were infected with eitherdermatophytes, pathogenic molds, or yeast, found that topically applied turmeric oil inhibited dermatophytes and pathogenic fungi. 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

Gastrointestinal disorders
Curcumin's anti-inflammatory properties and therapeutic benefit have been demonstrated for a variety of gastrointestinal disorders, including dyspepsia, Helicobacter pylori infection, peptic ulcer, irritable bowel syndrome, Crohn's disease, and ulcerative colitis.[8]

Alzheimer's disease:
Curcumin when fed to aged mice with advanced plaque deposits similar to those of Alzheimer's disease, curcumin reduced the amount of plaque deposition. It reduced oxidative damage and reversed the amyloid pathology in an Alzheimer's disease transgenic mouse. Alzheimer's disease symptoms characterized by inflammation and oxidation were also eased by curcumin's powerful antioxidant and anti-inflammatory properties

Antidermatophytic activity:
Fresh juice of rhizome of Haridra is used as antiparastic in many skin affections. Its rhizome powder mixed with cow's urine is taken internally in itching and dermatitis. *Curcuma longa* L. leaves have good promise as an antifungal agent that could be used as a therapeutic remedy against human pathogenic fungi on account of its various in vitro and in vivo antifungal properties, 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 effects. Curcumin obtained from the turmeric rhizome (*Curcuma longa*) have shown to possess the ability to protect the skin from harmful UV-induced effects by displaying antimutagen, antioxidant, free radical scavenging, anti-inflammatory and anti-carcinogenic properties

Hepatoprotective:
The powder of the rhizome mixed with amla juice is used in jaundice Corriliyum (Anjana) with Haridra, Red ochre (Gairika), and Amalaki (Emblica officinalis) cures jaundice .Curcumin, the most common antioxidant constituent of *Curcuma longa* rhizome extract, was reported to enhance apoptosis of damaged hepatocytes which might be the protective mechanism whereby curcumin down-regulated inflammatory effects and fibrogenesis of the liver. The ethanolic extract of *Curcuma longa* rhizomes showed a significant hepatoprotective effect when orally administrated in doses of 250 mg/kg and 500 mg/kg, and the protective effect was dose-dependent. The main constituents of *Curcuma longa* rhizome ethanolic extract are the flavonoid curcumin and various volatile oils, including tumerone, atlantone, and zingiberene. The hepatoprotective effects of turmeric and curcumin might be due to direct antioxidant and free radical scavenging mechanisms, as well as the ability to indirectly augment glutathione levels, thereby aiding in hepatic detoxification. The volatile oils and curcumin of *Curcuma longa* exhibit potent antiinflammatory effects[7]

As a Mouthwash:
A clinical trial conducted by Mali et al.,2012 stated that 0.1% turmeric can be used as an effective mouthwash due to its anti-plaque, anti-microbial and anti-inflammatory properties. Another study by Nagpal et.al.Another study by Waghmare et al., 2011 stated that turmeric mouthwash prepared by dissolving 10 mg of curcumin extract in 100 ml of distilled water and 0.005% of flavouring agent peppermint oil with pH adjusted to 4 is found to be as effective as most widely used chlorhexidine mouthwash.

As an Analgesic:
Turmeric oil contains sesquiterpenes which has anti-inflammatory action.Jacob et al., (2014) conducted a study to evaluate the anti-inflammatory and analgesic property of turmeric oil and fish oil in comparison to aspirin.He concluded that turmeric oil and fish oil both possess optimum analgesic activity. Numerous animal studies and reviews (Johnet al., 2009; Susan et al;Sangita et al., 2017) have been carried out to study the analgesic property of curcumin and have concluded that curcumin can be considered as an safe and effective analgesic with less side effects compared to the commercially available NSAID's.

Adverse Effects of Turmeric: Although turmeric and its active ingredient Curcumin is considered a safe herbal medicine for both systemic and dental problems, consuming a high quantity can possess few side effects. Turmeric contains 2% oxalate, hence at high doses can lead to kidney stone formation (**Tang et al., 2008**). Commercially available turmeric powders contain high levels of contaminated fillers with can lead to lead exposure in children (**Gleason et al., 2014**) as well as allergy in patients (**Parvathy et al., 2015**).Other side effects reported include gastric irritation, low blood sugar in diabetic patients, nausea, gall bladder problems and diarrhoea.[8]

SUMMARY

Turmeric is a rhizome that is a member of the family zingiberaceae native to southeast asia, and it has been used in india as a medicinal plant for over 6,000 years. Turmeric belongs in the Zingiberaceae family and is a spice derived from the root of the *Curcuma longa* plant. Turmeric is comprised of three curcuminoids as well as volatile oils (tumerone, atlantone, and zingiberone), sugars, proteins, and resin. The three curcuminoids are curcumin (*Curcuma longa*), responsible for the vibrant yellow color and therapeutic effects of turmeric (77%), demethoxycurcumin (17%) and bidemethoxycurcumin (3%). Curcumin's low aqueous solubility reduces its oral bioavailability. Interestingly, there is also low bioavailability with intravenous administration. Many other strategies have been innovated to increase oral availability, including use of nano/microparticles, solid dispersions, polymeric micelles, nanosuspensions, lipid-based nanocarriers, cyclodextrins, conjugates, and polymorphs. antimicrobial, antioxidant, antiinflammatory, antirheumatic, and antidiabetic effects, as well as anti-proliferative and antineoplastic effects.

CONCLUSION

The herb Turmeric has been used for thousands of years. It aids in the management of oxidative and inflammatory conditions, metabolic syndrome, arthritis, It may also help in the management of exercise-induced inflammation and muscle soreness, thus enhancing recovery and performance in active people. Most of these benefits can be attributed to its antioxidant and anti-inflammatory effects.It has also demonstrated hepatoprotective, nephroprotective, neuroprotective, and cardioprotective properties. These characteristics provide the foundation for its therapeutic uses and the rationale for clinical trials. Many other medicinal and pharmacological properties of turmeric used for Human. In Ayurveda, turmeric has been used for various medicinal conditions including rhinitis, wound healing, common cold, skin infections, liver and urinary tract diseases and as a 'blood purifier' . Turmeric was found to be effective even when given by different routes including topical, oral or by inhalation, dependent on the intended use.

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