ROLE OF TURMERIC IN MANAGEMENT OF DIFFERENT NON-COMMUNICABLE DISEASES

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ABSTRACT

Turmeric (Curcuma longa) is extensively used as a spice and grown widely throughout Indian subcontinent. Turmeric plant has been used in traditional medicine as a remedy for various diseases including cough, diabetes and hepatic disorders. For the last few decades, extensive works have been done to establish the pharmacological actions of Turmeric and its extracts. The active components in turmeric i.e., Curcumin, possess a broad spectrum of biological activities with various beneficial properties including anti-inflammatory, antioxidant, anti-mutagenic, anti-diabetic, antibacterial, hepato-protective, expectorant and anti-cancerous pharmacological activities. The continuous and daily exposure of curcumin may lead to changes in the absorptive capacity of mucosa of small intestine. Curcumin may have potential as a therapeutic agent in diseases such as inflammatory bowel disease, pancreatitis, as well as certain types of cancer. Because of curcumin’s rapid plasma clearance and conjugation, its therapeutic usefulness has been somewhat limited, leading researchers to investigate the benefits of complexing curcumin with other substances.
to increase systemic bioavailability. This review gives emphasis mainly on the pharmacological activities of the Turmeric, its extracts and plausible medicinal applications of Turmeric.

KEYWORDS: Curcumin, Absorption, Biological activities, Pharmacological actions, Therapeutic agent.

INTRODUCTION
Man has been using herbs and plant products for combating diseases since times immemorial [Acharya 1994]. The Indian subcontinent is enriched with a variety of flora- both aromatic and medicinal plants that have been greatly utilized as a source of many drugs in the Indian traditional medicine system. In India, the earliest mention of the use of medicinal plants is to be found in Rigveda which was written between 4500-1600 BC [Agrawal 2007]. Turmeric (Haridra) is one such medicinal plant [Aggarwal et al 2003, Kumar et al 2012] explained extensively in Indian and Chinese Ayurvedic medicine from the ancient material medica (Dravyaguna Sastra). Turmeric (the common name for *Curcumalonga*) is basically the rhizome (2.5-7.0 cm in length and 2.5 cm in diameter with small tuber branching off) or underground stem of ginger like bright yellow plant has been broadly used as a spice. The plant is an herbaceous perrineal, about 60-90 cm in height with a short stem tufted leaf. Its flowers which appear from the end of spring until the middle session are yellow in color, between 10-15 cm in length and they group together in dense spikes like manner [Lal 2012]. The whole turmeric rhizome has actually rough, segmented skin but it becomes yellowish-brown with a dull orange interior that looks bright yellow when powdered. The earthy herb of the Sun with the orange-yellow rhizome was regarded as the “herb of the Sun” by the people of the Vedic period. The ancients regarded turmeric as the Oushadhi, the most outstanding, healing herb [Jager 1997] above allas. It was prescribed for the treatment of many medical problems starting from constipation to skin diseases. Still it is applied to a wide range of medicinal complications like the digestive aid, treatment for fever, inflammation [Barbara et al 2001], wounds, menstrual insufficiency, cramping, infections, dysentery, arthritis, injuries, trauma, jaundice and other liver problems [Camilleri 2001]. In Unani, turmeric is considered to be safest herb of choice for all blood disorders as it acts as purifiers, stimulates and builds blood. On the other hand, turmeric is an auspicious beauty spot regarded by the Hindus females; it is applied daily on the forehead. The application of turmeric paste on the bride is an essential procedure of Hindu rituals [Paranjpe 2001]. It has at least 6000 years of
documented history of its use as medicinal as well as in many socio-religious practices of the people in the Indian subcontinent. Traditionally, turmeric has been used topically to heal and reduce bleeding associated with bruises, sprains, leech bites and inflamed joints. Therefore, considering its role in medicinal [Ansari et al 2013, Bundy et al 2004, Chunekar 2010] as well as in socio-cultural and cooking purpose, turmeric is known as the “golden spice” as well as the “spice of life.” It is cultivated most extensively in India, followed by Bangladesh, China, Thailand, Cambodia, Malaysia, Indonesia, and Philippines. It is also grown in a small scale in most tropical regions in Africa, America, and also in Pacific Ocean Islands.

METHODOLOGY
Electronic search has been carried out using the databases viz. Google, Google Scholar, Pub Med for the study. The search was restricted for a period of 28 years ranging from 1986 to 2014. The search terms included turmeric, curcumin and its anticancer, anti-diabetic, cardiovascular and, gastrointestinal effects, anti-inflammatory properties of turmeric. Duplication was avoided by excluding review of multiple copies of the same article in several databases.

Findings
Active Principles in Turmeric: It has been found in many studies that the medicinal part of turmeric is its rhizome, the underground stem that looks more like a root due to its thick appearance. Rhizome of turmeric contains a variety of natural compounds naming curcumin (diferuloylmethane), demethoxycurcumin, and bisdemethoxycurcumin. Among them its primary active constituent is flavonoid curcumin (diferuloyl methane), first identified in 1910 by Lampe and Milobedzka [Lampe 1913] comprising 0.3-5.4% of raw turmeric, responsible for the plant’s yellow coloration. Turmeric also contains volatile oils (tumerone, atlantone, and zingiberone), sugars, proteins, and resins as well. The curcuminoid complex is also known as Indian saffron [National Toxicology Program 1993, Priyadarsini 2014]. Curcumin is a lipophilic polyphenol that is insoluble in water [Aggarwal 2003] but is quite stable in the acidic pH of the stomach. Curcumin has been attributed numerous pharmacological activities it is shown to have the anti-inflammatory [Chunekar 2010, Pandey 2002] properties and also acts as an alternative analgesic, anti-asthmatic [Chunekar 2010], antibacterial, anti-diarrhoeal [Sharma 2006], antitumor, antioxidant, antispasmodic, antisepic, anti-diabetic [Sastry 2005, Sharma 2006, Chunekar 2010], astringent, carminative, hypolipidemic [Pandey 2002], hepatoprotective [Sastry 2005] digestive, and diuretics [Kumar 2012]. Thus in ayurveda
medicine, curcumin is used for the treatment of various respiratory conditions including asthma, bronchial hyperactivity, allergy, anorexia, rheumatism, diabetic wound, runny nose, cough and sinusitis. In traditional Chinese medicine, it is used to treat diseases associated with abdominal pain and in ancient Hindu medicine; it was also used to treat sprain and swellings caused by injury. In addition, turmeric also contains essential oils, which can be obtained by the steam distillation.

Anti-Inflammatory Properties of CurCumins: Phytochemical like curcumin that exert a strong anti-inflammatory effect is anticipated to have some degree of chemo preventive activity.

Gastrointestinal Conditions: Curcumin’s anti-inflammatory properties and therapeutic benefit have been demonstrated for a variety of gastrointestinal conditions, including dyspepsia, Helicobacter pylori infection, peptic ulcer, irritable bowel syndrome, Crohn’s disease, and ulcerative colitis. The fresh juice of turmeric is considered to be anthelmintic [Dhiman 2004]. It has been found in animal model studies that the Curcumin in turmeric acts through nuclear factor (NF)-κB inhibition and it reduces the production of adhesion molecules and inflammatory cytokines, resulting in the amelioration of gastric injury in NSAIDs-induced gastropathy in rats. It also improves gastric mucosal damage and decreases in leukocyte adhesions, and intercellular adhesion molecule 1 and tumor necrosis factor (TNF)-α production after curcumin administration [Thong-Ngam 2012].

Irritable bowel syndrome: Irritable bowel syndrome (IBS) is the most common gastrointestinal problem. Symptoms include abdominal pain, bloating, altered bowel habits, and increased stool frequency [Camilleri 2001], low-grade inflammation of the intestinal mucosa [Barbara 2002]. It was found in an eight-week pilot study that 72 mg and 144 mg of standardized turmeric extract when administered to a group of 102 and 105 IBS patients respectively. Abdominal pain and discomfort scores of the patients were found to be reduced by 22 percent in the 72-mg group and 25 percent in the 144-mg group [Bundy 2004].

Inflammatory Bowel Disease: Crohn’s disease (CD) and ulcerative colitis (UC) are the two primary forms of inflammatory bowel disease (IBD). The primary difference between the two is nature and location of inflammatory changes in the gastrointestinal tract. CD can affect any part of the gastrointestinal tract and affects the entire bowel wall. In contrast, UC is restricted to the colon and the rectum and disease is confined to the intestinal epithelium. Although both diseases may present with abdominal pain, vomiting, diarrhea, bloody stools, weight
loss, and secondary sequelae such as arthritis, pyodermagangrenosum, and primary sclerosing cholangitis (Inflammatory bowel disease 2009). In this regard Holt et al conducted a pilot study to examine the effect of curcumin therapy in 10 patients with IBD [Holt 2005] and it has been found from the results of the study that patients treated with curcumin had significantly improved IBD.

Role of Curcumin in Cancer Treatment: 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 [Duggi 2013], tumorigenesis and metastasis. Curcumin has shown anti-proliferative effect in multiple cancers including colorectal, pancreatic, gastric, prostate, hepatic, breast, oral cancers, and leukemia, and it acts as an inhibitor of the transcription factor NF-B and downstream gene products (including c-myc, Bcl-2, COX- 2, NOS, Cyclin D1, TNF-a, interleukins and MMP-9). Curcumin has shown to inhibit carcinogenesis in a number of cancers at various stages - initiation, promotion, and progression. During initiation and promotion, curcumin modulates transcription factors controlling phase I and II detoxification of carcinogens [Garg 2008, Wilken 2011] down-regulates proinflammatory cytokines, free radical-activated transcription factors, and arachidonic acid metabolism via cyclooxygenase and lipoxygenase pathways; and scavenges free radicals [Hong et al 2004]. In the promotion and progression stages of carcinogenesis curcumin decreases frequency and size of tumors and induces apoptosis via suppression of NF-κB and AP-1 in several cancer types.

Turmeric as Hepatoprotective: Hepatoprotective effect of turmeric is mainly due to its antioxidant properties, as well as its ability to decrease the formation of pro-inflammatory cytokines. Curcumin, the most common antioxidant constituent of Curcuma longa rhizome extract, was reported to enhance apoptosis of damaged hepatocytes and down-regulated inflammatory effects and fibrogenesis of the liver. It has been found in studies that the ethanolic extract of Curcuma Longa containing flavonoid curcumin, various volatile oils including tumerone, atlantone, and zingiberene showed a dose dependent significant hepatoprotective effect when administrated orally in doses of 250 mg/kg and 500 mg/kg [Salama et al 2013].

Diabetes Mellitus: Diabetes is a clinical condition related with a number of adverse health outcomes and cognition is one of them. Cognitive impairment develops with pre-diabetes and dementia is a complication of diabetes. Cognitive abilities such as planning, problem solving,
and reasoning are the critical part of Working Memory (WM) collectively defined as short-term mental storage and manipulation of different operations. Natural products like turmeric and cinnamon may ameliorate the risk of dementia and its aromatic content may induce neural stem cell proliferation [Ansari 2013, Hucklenbroich et al 2014]. Since cinnamon has mild anti-hyperglycaemic properties, and may reduce the risk of neurodegeneration through inhibition of neurofibrillary tangle formation and promotion of their disassembly [Qin et al 2010, Peterson et al 2009], and therefore might have some role in reducing hyperglycaemia. It has also been found in animal studies that curcumin reduced oxidative damage and reversed the amyloid pathology in a transgenic mouse developing Alzheimer’s disease, characterized by inflammation and oxidation through its powerful antioxidant and anti-inflammatory properties [Rao et al 2012].

It has been found in studies that turmeric rhizome powder is very useful in Madhumeha (diabetes mellitus) [Acharya 1994], ingestion of 6 g *Curcuma longa* containing curcuminoids, glycosides, terpenoids, and flavonoids may have an positive effect on insulin secretion [Wickenberg et al 2010] increased postprandial serum insulin levels, but did not seem to affect plasma glucose levels in healthy subjects indicating that it could be used as an effective and safe anti-diabetic dietary supplement of high potential [Rai et al 2010]. Curcuminoids, the active components in the rhizome of turmeric plant having antioxidant property [Faizal et al 2009] seems to lower lipid peroxidation by maintaining the activities of antioxidant enzymes like superoxide dismutase, catalase and glutathione peroxidase at higher levels. *Curcuma longa* isopropanol extract containing Human Pancreatic Amylase (HPA) obtained with acetone extract is known to cause reduction in starch hydrolysis leading to lowered glucose levels [Ponnusamy et al 2011]. A randomized, placebo-controlled 8-week study on randomized 72 patients with type 2diabetes received either 300mg curcumin twice daily or 10mg of atorvastatin daily or placebo revealed that there was a significant improvement in endothelial function in both the atorvastatin and the curcumin groups whereas no improvements were seen in the placebo group.

Respiratory Disorders: Turmeric is widely used in respiratory disorders since ancient times. It is anti-inflammatory as well as anti-purulent in nature and it is very effective in the treatment of bronchial asthma (Duggi 2013). A fume of Haridradi dhumvarti (fumes wick) is given [Acharya 1994] in asthma and congestion. Mainly, the chemical constituents of Turmeric i.e., Tumerones, curcuminoids, Curcumin and tetrahydrocurcumin has an anti-asthmatic action
Sometimes it has been seen that boiled Haridra in milk and mixed with jaggery given internally in rhinitis and cough. The piece of slightly burnt rhizome is also given for chewing [Pandey 2002] in cold and cough. Decoction of rhizome is also used for gargle in catarrhal cough, sore throat, and throat infection.

Cardiovascular Effects: It has been proven in studies that turmeric has protective effects on the cardiovascular system by lowering cholesterol and triglyceride levels, decreasing susceptibility of low density lipoprotein (LDL) to lipid peroxidation which can lead to atherosclerotic lesions and inhibiting platelet aggregation [Srivastava et al 1986]. Inhibition of platelet aggregation by C. longa constituents is thought to be via potentiation of prostacyclin synthesis and inhibition of thromboxane synthesis. Thus, turmeric can prevent coronary problems and heart diseases. Turmeric extract’s effect on cholesterol levels may be due to decreased cholesterol uptake in the intestines and increased conversion of cholesterol to bile acids in the liver. Actually the antioxidants in turmeric prevent damage to cholesterol, thereby helping to protect against atherosclerosis. It has been reported it studies that the levels of serum and liver cholesterol decreased to one-half, while cholesterol-fed rats were treated with curcumin. Age-related cardiovascular decline in postmenopausal women is characterized by increased left ventricular after load, vascular dysfunction and hypertension.

DISCUSSION

Turmeric (Haridra) is explained extensively and well documented for its therapeutic efficacy in Indian material medica. The genus of this plant is Curcuma. Haridra is belonging to Scitaminae family. Haridra is widely used in cosmetology as well. In GIT disorders, it is considered to be best anti-helmintic and useful in IBS. In Respiratory disorders like bronchitis, rhinitis, and sore throat and cough, Haridra is said to be the best herb [Krup et al 2013]. Acharya Charaka has explained Haridradi dhumvarti (fumes wick) in the condition like asthma and congestion. Haridra has already been proven clinically for its anti-diabetic activity. It is observed to decrease several risk factors like cholesterol, triglycerides, and free-radical damage. It has been found in studies that the powder of the rhizome mixed with amla juice is useful in jaundice. Turmeric extract and the essential oil inhibit the growth of a variety of bacteria, parasites and pathogenic fungi. The oil of turmeric exhibited potent anti-trypsin and anti-hyaluronidase activity [Jaggi 2012]. Constituents of turmeric affect Alzheimer’s disease [Lim et al 2001]. Its constituents can induce radioprotection [Thresiamma et al 1996] and inhibit proliferation of vascular smooth muscle cell [Huang et al
Turmeric extract reduces the incidence of cholesterol gall bladder stone formation [Hussain et al 1992]. In many of the research works Curcumin in Haridra is observed as a best anti-inflammatory agent [Karthikeyan et al 2009]. The ethanolic extract of Curcuma Longa rhizomes has significant hepatoprotective effect when orally administrated. It is ought to be one of the best anti-oxidant. Curcuma oil believed to reduce the ill effect of ischemia by attenuating nitrosative and oxidative stress. Induction of apoptosis in sequential fashion was reverse significantly by Curcuma oil. There is an evidence for the high efficacy of Curcuma oil as a neuroprotective. Curcumin has demonstrated the chemopreventive properties in cell cultures, animal models and human investigations. Curcumin is considered to possess anti-cancer activities via its effect on a variety of biological pathways involved in mutagenesis, oncogene expression, cell cycle regulation, apoptosis, tumorigenesis and metastasis. It has also shown antiproliferative effect in multiple cancers. Curcumin is used to inhibit systemic anaphylaxis in vitro and anti-DNP immunoglobulin E (IgE) - mediated passive cutaneous anaphylactoid response in vivo. Curcumin is a potent drug resistance preventer [Shoba et al 1998, Jurenka 2009]. It exhibits novel ability to prevent the up-regulation of P-glycoprotein and its mRNA. Curcumin is known for its synergic effect as anti-cancer agent. Curcuma longa rhizome is used as a Folk medicine in U.P., Bihar and West Bengal for cough, cold, and loose stools. The efficacy of Haridra is well known worldwide as a curative as well as preventive measure.

CONCLUSION
In the light of present review, it can be concluded that the Turmeric (Haridra) has a lot of potentials when it comes to its medicinal usage. Turmeric is the household spice for diverse cuisines in all parts of India since many centuries. Generally the rhizome powder of Turmeric is used as a spice all over India but only a few people are aware of its therapeutic properties. Turmeric is regarded as one of the best drug in many diseases like Diabetes, Skin diseases etc, which is in use since ages owing to its multiple pharmacological activities. Turmeric is enriched with many useful phytoconstituents which are responsible for its efficacy. Curcumin is one such phytoconstituent, a nutraceutical substance with numerous pharmacological activities proven experimentally and clinically. It has been established that turmeric possesses Antiinflammatory, Anti-allergic, Anti-oxidant, Anti-hyperglycaemic and Anti-cancer properties. Results from completed clinical trials are encouraging and trials currently being conducted for both inflammatory conditions and cancer should clarify curcumin’s value as a therapeutic agent and confirm some of the mechanisms responsible for its efficacy. Till date
many researches have been carried out on the medicinal effects of Turmeric, this review will give a new impetus to utilize turmeric in various disorders.

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