CURCUMA LONGA: TURMERIC: HALDI

Turmeric is a member of the Curcuma botanical group; botanical name is Curcuma longa which is of Zingiberaceae family. Turmeric is widely grown both as a kitchen spice and for its medicinal uses. Curcuma longa is perennial plants native to southern Asia. It is warm, humid climates and thrive only in temperatures above 60°F (29.8°C) India, Sri Lanka, the East Indies, Fiji, and Queensland (Australia) all have climates that are conducive to growing turmeric.

BOTANICAL DESCRIPTION

Macroscopic- Rhizomes ovate, oblong or round or cylindrical, often short branched (long turmeric), former about half as broad as long, latter 2-5 cm long and about 1-1.8 cm thick externally yellowish to yellowish-brown with root scars and annulations of leaf bases; fracture horny, fractured surface orange to reddish brown; central cylinder twice as broad as cortex; odour and taste characteristic.

Microscopic- Transverse section of rhizome shows epidermis with thick-walled, cubical cells of various dimensions; cortex characterised by the presence of mostly thin-walled, rounded parenchyma cells scattered collateral vascular bundles; a few layers of cork developed under epidermis and scattered oleo-resin cells with browning; contents; cork generally composed of 4-6 layers of thin-walled, brick-shaped parenchyma; cells of ground tissue contains starch grains of 4-15 in diameter; oil cell with submersed walls containing either orange-yellow globules of volatile oil or amorphous resinous matter, vessels mainly spirally thickened, a few reticulate and annular.

TRADITIONAL MEDICINAL USES

Fresh turmeric rhizome, ground with cow milk and castor oil is applied externally to treat paronychia. To prevent stomach disorders, three to five ml of fresh juice is taken regularly on an empty stomach. Hot water extract of dried rhizome is taken orally for slow lactation as a tonic, carminative for diarrhea dropsy, jaundice and liver diseases. Externally the dried rhizome is used on fresh wounds as a counter-irritant on insect stings to facilitate the scabbing process in chickenpox and smallpox. Turmeric powder mixed with latex of Carthamus tinctorius to taken orally for tonsilitis. Turmeric powder mixed with the juice of Aloe Vera is used externally to treat wounds. The powder mixed with Murraya paniculata paste is used externally for fractured bones. Powder mixed with Helicteres isora and tumeric powder is used externally for cuts and wounds. Hot water extract of tumeric powder is taken orally as a tonic. Tumeric rhizome and calotropis procera root is kept together for 20 days, ground up and a pinch is taken in the morning with milk cream for three days to obtained relief from headache. Datura stramonium and tumeric powder are made into a paste and used externally for pimples. Water extract of dried root mixed with Alangium Salvifolium powder is used externally for wounds and vaginal dischange. Hot water extract of dried rhizome is taken orally as an anti-inflammatory agent in Ayurvedic medicine.

PHYTOCHEMICALS

The yellow pigmented fraction, isolated from the rhizomes, contains the curcumins belonging to the dicinnamoly-methane group. An aromatic oil, turmeric oil, composed of terpene- hydrocarbon-derivatives and sesquiterpenic keetones has also been isolated.

PHARMACOLOGICAL ACTIVITIES AND CLINICAL TRIALS

Allergenic activity

Commercial sample of rhizome powder was active on human adults. Reaction to patch tests occurred most commonly in patients who were regularly exposed to the substance, or who already had dermatitis on the fingertips. Previously unexposed patients had few reactions (i.e., not irritant reactions).

Antibacterial activity

Chloroform ethanol (95%) water and petroleum ether extracts of dried Curcuma longa rhizome at a concentration 250.0 mg/ml agar plate were active on Bacillus subtillis, Escherichia coli, Pseudomanas

aeruginasa and Staphyloccus aureus. Ethanol (95%) extract at a concentration of 10.0 mg/ml was inactive on Corynebacterium diptheriae, Diphlococcus pneumonia, Staphylococcus aureus, Streptococcus viridans, and Streptococcus pyogenes. Water extract at a concentration of 10.0 mg/ml was inactive on Corynebacterium diptheriae and Diplococcus pneumoniae, and produced weak activity on staphylococcus aureus, Streptococcus viridans, and Streptococcus pyogenes. Essential oil for Curcuma longa rhizome, on agar plate was inactive on Bacillus cereus, Escherichia coli, Pseudomonas aerugimosa, and Staphylococcus aureus. Ethanol (95%) extract of rhizome in broth culture was active on Lactobacillus acidophilus and Staphylococcus aureus, equivocal on Escherichia coli and inactive on salmomella typhosa. Undiluted essential oil on agar plate was inactive on Bacilus cereus, Escherichia coli and inactive on Salmonella typhosa. Undiluted essential oil an agar plate was inactive on Bacillus cereus. Escherichia coli, Psedomonas aeruginosa, and Staphylococcus aureus.

Antifungal activity

Chloroform and ethanol (95%) extract of dried rhizome, on agar plate were active and water extract produced weak activity on Epidermophyton floccosum gypseum and Trichophytom rubrum. Essential oil dried rhizome on agar plate at a concentration of 1:100 was active on Trichoderma viride, Aspergillus flavus, Microsporumgypseum, and Trichophyton mentagrophytes. Water extract of dried rhizome at a concentration of 10.0 mg/ml on agar plate was inactive on Microsporum gypseum Phialophora jeanselmei and Piedraia hortae and weakly active on Trichophyton mentagrophytes. Essential oil of dried rhizome on agar plate at a concentration of 1:100 was active on Curvularia oryzae Helminthosporum oryzae, Penicillium corymbiferum, Pencillium javanicum and Penicillum lilcinum. Essential oil on agar plate was equivocal on Aspergillum aegypticus; active on Trichoderma viride and inactive on Penicillum cyclopium. Concentrations of 3000 ppm on agar plate were active on Aspergillus riger. Undiluted essential oil on agar plate was inactive on Penicillium cyclopium, Trichoderma viride and Aspergillus aegyptiacus. Fresh leaf essential oil at a concentration of 5000 ppm on agar plate produced weak activity on Aspergillus flavus.

Antihepatotoxic activity

Ethanol/water (1:1) extracts of dried rhizome in rat-liver cell culture and when administered intraperitoneally to mice was active vs carbon tetrachloride-induced hepatotoxicity. Methanol extract administered intraperitoneally to mice at a dose of 100.0 mg/kg produced weak activity vs carbontetrachloride-induced hepatotoxicity. Methanol extract of dried administered intraperitoneally to mice at a dose of 100.0 mg/kg produced weak activity vs carbon tetrachloride hepatotoxicity. Hot water extract of dried rhizome in cell culture at a concentration of 1.0 mg/plate was active on hepatocytes, measured by leakage of LDH and ASAT. Methanol extract of dried rhizome administered intraperitoneally to rats of both sexes at a dose of 300.0 mg/kg produced weak activity vs alpha-naphthylisothiocyanate-induced hepatotoxicity. Methanol extract administered subcutaneously to rats of both sexes, at a dose of 100.0 mg/kg was inactive vs carbon tetrachloride-induced hepatotoxicity. Methanolinsoluble fraction of dried rhizome administered intragastric to ducklings at a dose of 10.0 mg/animal was active vs aflatoxin B1-induced hepatotoxicity. Mixute to tumeric, fresh garlic, asafoetida, curcumin, ellagic acid, and butyalted hydroxy toluene and butylated hydroxy anisole were used.

Antihypercholesterolemic activity

Ethanol/water (1:1) extract of dried rhizome administered intragastric to rats at dose of 30.0 mg/gm (dry weight of plant), every six hours for 48 hours, was active vs triton-induced hyperchlolesterolemia. Ether and ethanol (95%) extract of rhizome, administered by gastric intubation to rabbit at a dose of 1.0 gm/animal were inactive vs cholesterol-loaded animals.

Antihyperglyceridemia effect

Ethanol/water (1:1) extract of dried rhizome administered intragastric to rats at dose of 30.0 mg/gm (dry weight of plant), every six hours for 48 hours, was active vs triton-induced hyperchlolesterolemia.

Antihyperlipemic activity
Ethanol/water (1:1) extract of dried rhizome administered intragastric to rats at dose of 30.0 mg/gm (dry weight of plant), every six hours for 48 hours, was active vs triton-induced hyperchlolesterolemia. Ether and ethanol (95%) extracts of rhizome, administered by gastric intubation to rabbit at a dose of 1.0 gm/animal were inactive vs cholesterol-loaded animals.

Anti-inflammatory activity
Ethanol (95%) extract of dried rhizome administered intraperitoneally to male rats at a dose of 100.0 mg/kg was active vs granuloma pouch model. Doses 200.0, 400.0 and 800.0 mg/kg were active vs carrageenin-induced pedal edema. A dose of 50.0 mg/kg was inactive vs granuloma pouch model. Water extract at doses of 5, 10, 20, 40 and 80 mg/kg were active vs carrageenin-induced rat pedal edema. A dose of 10.0 mg/kg was inactive vs granuloma pouch model, 25.0 mg/kg was active vs granuloma pouch model, 25.0 mg/kg was active vs carrageenin-induced rat pedal edema.

Antimutagenic activity
Hot water extract of dried rhizome on agar plate at concentrations of 40.0 mg/plate and at the minimum toxic dose were inactive on Salmonella typhimurium TA100, as aflatoxin-B1-induced mutagenesis metabolic activation had no effect on the results. Dried rhizome extract (type of extract not stated on agar plate at a concentration of 50.0 mg/ml was inactive on Salmonella typhimurium TA1535 vs aflatoxin-and mitomycin-induced mutagenesis. Water extract of rhizome at a concentration of 0.33 mg/ml was active on rat-liver-microsomes. The formation of labeled benzo [a] pyrene-DNA adducts was inhibited. Infusion at a concentration of 25.0 mcg/plate on agar plate was active on Salmonella typhimurium TA100.1-methyl-3 nitro-1-nitrosoguanidine-induced mutagenesis was inhibited by 25% there was a 38% inhibition of 4-nitro-D-phenylenediamine-induced mutagenesis of Salmonella typhimurium TA98. Infusion of rhizome administered intragastric to mice at a dose of 3.0 mg/animal was active. The incidence of benzo[a]pyrene-induced forestomach tumors was reduced by 53% by pretreatment with the extract. Intraperitoneal administration of the infusion was active. The formation of benzo[a]pyrene-induced bone marrow micronucleated cells was decreased 40% by pretreatment with the extract. Powdered rhizome at a concentration of 0.033 mg/ml was active on rat-liver-microsomes. Formation of labeled benzo[a]pyrene-DNA adducts was inhibited. Powdered rhizome administered intragastric to rats at a dose of 0.5% of the diet was active. Animals fed the diet for one month before being given 3-methylchoanthrene intraperitoneally, produced urine with reduce mutagenicity on Salmonella typhimurium Strains TA100 and TA98, with or without activation with S9, as assessed by Ames test.

Antioxidant activity
Hexane and methanol extracts of rhizome at concentrations of 0.1% were active. Hexane extract of dried rhizome at a concentration of 0.06% was inactive when tested on lard. The methanol extract was active. Hot water extract of a commercial sample of tuber, at a concentration of 100.0 ng.mcl was active vs protection of DNA against peroxidative injury.

Antitumor activity.
Ethanol (95%) extract administered intraperitoneally to mice at a dose of 100.0 mg/kg was inactive on Sarcoma 180 (ASC), the water extract was active. Hot water extract of dried root administered intraperitoneally to mice at variable dosage levels was active on CA-Ehrlich-Ascites. A mixture of Bufo bufo, Solanum nigrum, Solanum lyratum, Duchesnea indica, Angelica sinensis, Curcuma longa, and Salvia miltiorrhiza was used. Methanol extract of dried rhizome administered intraperitoneally to mice at a dose of 0.03 mg/kg was inactive on LEUK-SN36. A dose of 0.1 gm/kg was active.

Antiulcer activity.
An ethanol extract of turmeric was studied for its ability to inhibit gastric secretion and to protect gastroduodenal mucosa against the injuries caused by pyloric ligation, hypothermic-restraint stress, indomethacin, reserpine and cysteamine administration and cystodestruuctive agents including 80% ethanol, 0.6 M HCl, 0.2 M NaOH and 25% NaCl. An oral dose of 500 mg/kg of the extract produced

significant anti-ulcerogenic activity in rats subjected to hypothermic-restraint stress, pyloruic ligation and indomethacin and reserpine administration. The extract had a highly significant protective effect against cystodestructive agents. The reduction in the intensity of ulceration of cysteamine-induced duodenal ulcers was not found to be statistically significant. Turmeric extract not only increased gastric wall mucus significantly but also restored the non-protein sulfhydryl (NP-SH) content in the glandular stomachs of the rat.

Antiviral activity

Hot water extract of dried rhizome in cell culture was active on vesicular stomatitis virus. The prescription included 10 gm each of Curcuma longa rhizome, Rheum officinale root, Cimicifuga foteid rhizome, Anemarrhena asaphodeloides rhizome, Areca catechu seed, Magnolia officinalis bark, and Scutellaria baicalensis root, also included are 5 gm Amomum tsaoko fruit, together with insects Bombyx mori and Cryptotympana pustulata.

Antiyeast activity

Chloroform, ethanol (95%) and water extract of dried rhizome, on agar plate were inactive on Candida albicans, Cryptococcus neoformans and Saccharomyces cerevisae. Dried oleoresin at a concentration of 500.0 ppm on agar plate was active on Debaryomyces hansenil vs ascospore production. Inactive on Candida lipolytica vs pseudomycelium production; Hansenula anomala vs pseudomycellium and ascospore production; Lodderomyces elongisporus vs pseudomycellium production; Rhodotorula rubra vs pseudomycellium production; Saccharomyces cerevisiae vs pseudomycelium and ascospore inactive on Candida lipolytica, Debaryomyces hansenil, Hansenula anomala, Kloeckera apiculata, Lodderomyces elongisporus, Rhodotorula rubra, Saccharomyces cerevisiae, and Torulopsis glabrata vs biomass production. Water extract of rhizome on agar plate at concentration of 10.0 mg/ml was inactive on candida albicans and candida tropicalis.

Ascaricidal activity

Root essential oil, at a concentration of 0.2% was active. Forty five minutes exposure killed all the worms. A 0.2% piperazine citrate solution required 50 minutes exposure to kill all the worms.

Carcinogenesis inhibition

Dried rhizome powder in the ration of female mice at a dose of 2.0% of the diet/day produced weak activity. Animals were 12 months of age at start of experiment vs DMBA-induced carcinogenesis. A dose of 5.0% of the diet/day was active at 8, 12 and 2 months of age to start the experiment and strongly active at six months of age to start the experiment vs DMBA-induced carcinogenesis. Ethanol (95%) extract of dried rhizome in the ration of female mice at a dose 5.0% of the diet vs benzo(a)pyrene-induced carcinogenesis. A dose of 2.0% was inactive in mice vs benzo(a)pyrene-induced carcinogenesis. Ethanol (95%) extract of rhizome at a dose of 5.0% of the diet in the ration of Syrian hamster was active vs methyl (acetoxymethyl) nitrosamine (DMN-OAC)-induced oral carcinogenesis, synergism with piper betel. Powdered root in the ration of mice at a dose of 2.0% of the diet was active vs Benzo(a)pyrene-induced tumorgenesis. Rhizome in the ration of hamster (Syrian) at a dose of 5.0% of the diet was active vs DMN-OAC-induced oral cacinogenesis. When a combination treatments of betel-leaf extract and tumeric; beta carotene and tumeric; or alpha-tocopherol and tumeric were used the doses were active vs methyl nitrosamine-induced carcinogenesis. A dose of 160.0 mg/per gm of diet was active vs 3'-methyl-4-dimethylaminoazobenzene-induced carcinogenesis. Rhizome in the ration of rats at a concentration of 0.1% of the diet was active vs benzo[a]pyrene-induced carcinogenesis.

Cardiotonic activity

Ethanol/water (1:a) extract of rhizome administered by perfusion was inactive on the heart of the guinea pig.

Cytotoxic activity

Ethanol/water (1:1) extract of rhizome in cell culture at a concentration of 1.0 mg/ml was active on human lymphocytes, human leukemic lymphocytes and Dalton's lymphoma. Ethanol water (1:1) extract of rhizome in cell culture was inactive on CA-9KB, ED >20.0 mcg/ml. Ether and petroleum ether extract of rhizome in cell culture were active on LEUK-L1210, ED50 10.0 and 5.0 mcg/ml respectively. Ether extract of dried rhizome in cell culture was active on hepatoma HTC. Water extract at a concentration of 500.0 mcg/ml produced weak activity on CA-Mammary-MicroalveolarM26592. Petroleum ether extract of dried rhizome in cell culture was active on LEUK-L 1210.ED 1.8 mcg/ml.

Embryotoxic effect

Ethanol (95%) extract of rhizome administered orally to rats at a doses of 100.0 and 200.0 mg/kg produced 70% and 80% inhibition of pregnancy respectively. water extract produced 80% and 100% inhibition respectively, and petroleum ether extract produced 80% and 100% inhibition respectively. Ethanol (95%) water and petroleum ether extracts of rhizome administered orally to rats at doses of 100.0 mg/kg was active.

Gastric secretory inhibition

Water extract at a dose of 132.0 mg/kg and methanol extract at a dose of 155.0 mg/kg of entire plant administered intragastric to rabbits were active. Gastric juice was collected by catheter.

Gastrointestinal disorderes

Powdered dried rhizome taken orally by human adults at a dose of 500.0 mg/person was active. A randomized double-blind study was conducted to examine the efficacy of treating dyspepsia with given extract. Patients were given the dose four times per day after meals and before bed for seven days. Eighty patients were assigned to control or treatment groups. A statistically significant 87% of the group showed improvements, though patient satisfaction ran only 50 and 47%.

Interferon induction stimulation

Hot water extract of dried rhizome administered intragastric to mice at a dose of 0.4 ml/animal for seven days was active. The prescription also included 10 gm each of Curcuma longa rhizome. Rheum officinale root, Cimicifuga foetida rhizome, anemarrhena asaphodeloides rhizome, Areca catechu seed, Magnolia officinalis bark and Scutellaria baicalensis root, also included are 5 gm Amomum tsaoko fruit, together with insects bombyx mori and Cryptotympana pustulata. A dose of 0.6 ml/animal administered intraperitoneally was also active.

Lipid peroxide formation inhibition

Hot water extract of a commercial sample of tuber was active. IC 200.0 ng/mcl. Hot water extract of dried rhizome in cell culture at a concentration of 1.0 mg/plate was inactive on hepatocytes monitored by production of malonaldehyde.

Liver regeneration stimulation

Commercial sample of oleoresin at a concentration of 0.6% of the diet in the ration of male rats was in active. Partially hepatectomized animals were dosed daily for seven days.

Teratogenic activity

Ethanol (95%) water and petroleum ether extracts of rhizome administered orally to female rabbits at doses of 200.0 mg/kg were inactive. Root in the ration of female mice and rats, at a concentration of 0.5% of the diet for seven days, was inactive.

Toxic effect

Commercial sample of oleoresin, at variable dosage levels, in the ration of pigs was active. Animals were fed dietary levels of the oleoresin equal to 60, 296 and 1551 mg/kg/day for 102-109 days. All dose levels showed a significant dose-dependent increase in liver and thyroid weight. A reduction on weight gain and

feed conversion efficiency was observed in the high dose group. The two higher dose groups showed evidence of thyridal hyperplasia, epithelial changes in the urinary bladder and kidney and pericholangitis.

Toxicity assessment (quantitative)

Ethanol (95%) extract of rhizome administered intraperitoneally to mice produced LD 3.98 gm/kg water extract LD 430.0 mg/kg and petroleum ether extract LD 525.0 mg/kg. Ethanol/water (1:1) extract of rhizome administered intraperitoneally to mice produced LD 500.0 mg/kg.

Uterine stimulant effect

Methanol extract of dried rhizome at a concentration of 5.0 mg/ml was inactive on the uterus of rats. Methanol/water (1:1) extract of leaves, at a dose of 10.0 mcg/ml was active on the uterus (unspecified condition) of hamsters.