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Research Article

ACTIVE PRINCIPLES AND MEDIAN LETHAL DOSE OF *CURCUMA LONGA* LINN.

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ABSTRACT
The present study aimed to determine the active principles and median lethal dose (LD_{50}) of *Curcuma longa* (Haldi) by conducting phytochemical and toxicity (acute and chronic) studies. The hydroalcoholic extract (HAE) of haldi was prepared and its extractability was calculated as 35.9%. The chemical tests revealed the presence of many active principles (phytoconstituents) such as alkaloids, glycosides, reducing sugars, tannins, resins, saponins, sterols and fixed oils. For acute toxicity, including median lethal dose (LD_{50}) of *C. longa,* its HAE was administered @ 250, 500 and 1000 mg/kg body weight to female albino rats of groups 2 to 4, respectively. Rats of group 1 were administered with normal saline to serve as control. No mortality in any group of rats was found up to 48 hr, thus this drug has the LD_{50} above 1000 mg/kg. For chronic toxicity of *C. longa* HAE, similar drug dosage schedule was applied in groups 1 to 4 of rats as used for acute toxicity study; however, the drug-extract was given for 3 weeks. During both acute and chronic toxicity studies, *C. longa* HAE @ 1000 mg/kg elicited some gross observational effects like initial excitement, followed by mild depression, dullness, decreased respiration and reduced spontaneous motor activity (SMA). The results suggest that although haldi contains many pharmacologically important active principles but its higher dose (1000 mg/kg) is slightly toxic.
KEYWORDS: Active principles, *Curcuma longa* (Haldi), Median lethal dose, Phytochemical study, Toxicity study.

INTRODUCTION

Extractability of any plant-drug serves as a tool for quality control, and provides an idea regarding the amount of extract present in a definite quantity of drug. Toxicity (acute and chronic) study of a drug gives a preliminary information regarding the useful properties likely to possessed by the drug, and also provides the LD_{50}. Various signs and symptoms during gross observational studies of a drug give an idea regarding the type of drug action and the dosage to be used. Thus, on the basis of general toxicity, the therapeutic dose and route of administration of a drug can also be known[1-2]. The medicinal activities of herbal drugs are due to the presence of different active principles (phytoconstituents), e.g., alkaloids, glycosides, reducing sugars, tannins, saponins, resins, phytosterols, flavonoids, organic acids, essential oils, fixed oils, etc. The active principles can be extracted with different solvents like petroleum ether, alcohol, benzene, chloroform and distilled water. By doing so, the per cent extractability of herbal drugs can be determined[2]. Thus, the present study was done to determine the active principles and LD_{50} of *C. longa* by conducting phytochemical and toxicity (acute and chronic) studies.

Curcuma longa Linn. (Haldi, Turmeric) belongs to the plant family *Zingiberaceae*. Its rhizome (Root or haldi) contains curcumin, zingiberine and curcuminoids. The maximum tolerated dose (MTD) and LD_{50} of the 50% ethanol extract of *C. longa* rhizomes was found to be 250 and 500 mg/kg, intraperitoneally in rat, respectively[3]. Rhizomes are stimulant, carminative, alterative, blood purifier, antiperiodic and tonic. They are also given in sprain, swelling, tumour and liver diseases[4-5]. The rhizomes are also effective in colon, bladder and prostate cancers, intravesical tumour, fibrosarcoma, hepatocellular carcinoma (HCC), oesophagal carcinogenesis, leukaemia, stomach papilloma and solid tumours[6]. The pigment colour called curcumin of haldi has shown antiinflammatory, antitumour and antioxidant properties. Evidences suggest that curcumin can suppress tumour initiation, promotion and metastasis. Pharmacologically, curcumin has been found to be safe and human clinical trials indicated no dose-limiting toxicity when administered at the doses up to 10 g/day[7]. Curcumin (diferuloyl methane), the active principle of *C. longa* is documented with several medicinal properties. It is a well known anticancer agent, and is found to induce apoptosis. It is also a potent antioxidant and antiinflammatory agent. It showed the chemopreventive effect of curcumin against N-nitrosodiethylamine (DENA)/phenobarbital induced-hepatocarcinogenesis in wistar strain male albino rats, as pre- and co-treatment

with curcumin for 14 weeks significantly prevented the biochemical alterations induced by DENA/phenobarbital[8].

MATERIALS AND METHODS

Healthy inbred female albino rats (100-160 g) were kept in colony cages under standard laboratory conditions in the Small Animal House of Govt. NSCB Medical College, Jabalpur. They were fed on standard pellet diet and drinking water *ad libitum.* The experimental designs and protocols received the approval of Institutional Animal Ethics Committee.

C. longa rhizomes were powdered and subjected to hydroalcoholic extraction as per the method used by Pandey[1]. The HAE was prepared with 50% distilled water and 50% ethanol (ethyl alcohol). The per cent extractability of *C. longa* rhizomes was then calculated. The HAE of *C. longa* was analyzed[1-2] for the presence of active principles, viz., alkaloids, glycosides, reducing sugars, tannins, resins, saponins, sterols and fixed oils (Table 1).

To determine the acute toxicity, including LD_{50} of *C. longa,* its HAE was administered orally to the rats as per the methods described earlier[1-2]. To dissolve the extract completely in distilled water, a pinch of *Gum acacia* powder was mixed and the aqueous suspension of extract was prepared. *C. longa* HAE was administered @ 250, 500 and 1000 mg/kg to the rats of groups (each group had 6 animals) 2 to 4, respectively. Rats of group 1 were administered with normal saline to serve as control. The mortality in rats occurred within 48 hr was noted. For chronic toxicity study of *C. longa* HAE, similar drug dosage schedule was applied in groups 1 to 4 of rats as used for acute toxicity study. However, the extract was administered for 3 weeks, and the mortality and gross effects were observed. The gross observational effects observed were the effects on CNS (stimulation or depression), respiration, SMA, posture, gait, secretion, piloerection, tremor and response to stimuli, etc.

RESULTS AND DISCUSSION

Active principles: The extractability of HAE of *C. longa* rhizomes was found to be 35.9%. The extract was yellowish-brown, while its consistency was semiliquid to solid. The higher extractability of *C. longa* in hydroalcohol suggests its sufficient absorption through the gastrointestinal tract. The chemical tests revealed the presence of active principles, viz., alkaloids, glycosides, reducing sugars, tannins, resins, saponins, sterols and fixed oils. The presence of active principles as noted in *C. longa* has also been reported[1-5] in several medicinal plants confirming the results of this study. The reported[4-8] pharmacological properties of *C. longa* may be due to the presence of different active principles.

Toxicity study: During acute toxicity study, *C. longa* HAE caused no mortality in any group of rats up to 48 hr. Hence, the LD_{50} of *C. longa* is more than 1000 mg/kg. Chronic toxicity of *C. longa* was evaluated in different groups of rats as per the doses as given for acute toxicity study. During both acute and chronic toxicity studies, the HAE of *C. longa* rhizomes administered at the dose of 1000 mg/kg elicited some gross observational effects like initial excitement, followed by mild depression, dullness, decreased respiration and reduced SMA. The results suggest that although haldi contains many pharmacologically important active principles but its higher dose (1000 mg/kg) is slightly toxic, and hence the use of *C. longa* HAE at higher dose should not be used. The therapeutic dose of *C. longa* HAE may be limited to 500 mg/kg/day, orally. The acute and chronic toxicity studies with extract provide a great information regarding the useful properties likely to possessed by the extract and also provide the LD_{50}. The signs and symptoms developed during gross observational studies give an idea regarding the type of drug action, and the therapeutic dose and route of administration of drug to be used[1-2]. Several investigators[1-3] screened out many medicinal plants for their phytochemical and pharmacological activities, and they have found similar types of active principles and some gross effects or acute and chronic toxicities of particuluar medicinal plants.

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Table 1: Extractability and active principles of HAE of *Curcuma longa* rhizome

Extractability		**Active principles (phytoconstituents)**	
		Test applied for active principle	**Present/absent**
Part used	Rhizome	For Alkaloids- Wagner's reagent	Present
Solvent used	50% distilled water and 50% ethanol	For Reducing sugars- Benedict's reagent	Present
		For Glycosides- Benedict's reagent	Present
		For Tannins- Ferric chloride	Present
Extractability	35.9%		
		For Resins- Alcohol containing extract in distilled water	Present
Colour of extract	Yellowish- brown		
		For Saponins- Sodium bicarbonate foam test	Present
Consistency of extract	Semiliquid to solid	For Sterols- Ferric chloride	Present
		For Fixed oils- Filter paper	Present

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