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STUDY OF ANTI-LIPIDEMIC EFFECT OF LEMONGRASS (*CYMBOPOGON CITRATUS*) AQUEOUS ROOTS AND FLOWER EXTRACTS ON ALBINO MICE

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ABSTRACT: Purpose/Aim: In the present study, we investigate the antilipidemic effect of the aqueous extract *Cymbopogon citratus.* Background: Lemongrass is an aromatic plant belonging to the Gramineae family. *C. citratus* has been cultivated over many years for medicinal purposes in different countries throughout the world. Earlier in research, it was reported that the elevated cholesterol concentration was significantly lowered in the animals given the plant extract. This reduction was found to be dose-dependent. We attempt to evaluate the antilipidemic effect of aqueous extract of roots and flower of *C. citratus* in mice. **Methods:** Aqueous extract of roots and flower of *Cymbopogon citratus* evaluated for antilipidemic activity in mice. Blood was collected by intracardiac puncture, under mild ether anesthesia, and the total serum cholesterol, HDL, and LDL of treated mice were examined. **Results:** we observed that there is a significant decrease in the cholesterol levels in mice administered with root and flower extracts, there was an increase in HDL level and decrease in the LDL level in groups treated with the extracts. **Conclusion:** In this study, we found that there was a significant decrease in the cholesterol level of *C. citratus* root and flower extract administered group in comparison to the cholesterol-induced group. A better antihypercholesterol activity was observed with root extract.

INTRODUCTION: Aromatic and medicinal plants are still a major part of alternative and traditional medicine in developing countries. Numerous herbal therapies are currently widely used in medicine [1, 2]. *Cymbopogon citratus*, commonly known as lemongrass, is a perennial tropical grass with thin, long leaves, Lemongrass is an aromatic plant belonging to the Gramineae family.

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It is a tall, clumped perennial grass growing to a height of 1 m. *C. citratus* has been cultivated over many years for medicinal purposes in different countries throughout the world. The use of lemongrass was found in folk remedy for coughs, consumption, malaria, ophthalmia, arthritis pneumonia, and vascular disorders. Researchers have found that lemongrass holds antidepressant, antioxidant, antiseptic, astringent, bactericidal, fungicidal, and sedative properties [3].

The chemical composition of the essential oil of *C. citratus* varies according to the geographical origin, the compounds as hydrocarbon terpenes, alcohols, ketones, esters and main aldehydes have constantly been registered [4, 5]. The essential oil (0.2-0.5%, West Indian lemongrass oil) consists of, mainly,

citral [6]. Citral is a mixture of two stereoisomeric monoterpene aldehydes; the trans isomer geranial (40-62%) dominates over the cis isomer (25-38%) [7, 8].

Hypocholesterolemic and Hypolipidemic Effects: Earlier in research, it was reported that the elevated cholesterol concentration was significantly lowered in the animals given the plant extract. This reduction was found to be dose-dependent. This result shows that the extract possesses a hypocholesterolemic potential [9]. A fresh leaf aqueous extract of *C. citratus* administered in normal mice lowered the total cholesterol, triglycerides, low-density lipoproteins, and very low-density lipoprotein dose-dependently while raising the plasma high-density lipoprotein level in the same dose-related fashion, but with no effect on the plasma triglyceride levels [10]. We attempt to evaluate the antilipidemic effect of aqueous extract of roots and flower of *C. citratus* in mice.

MATERIALS AND METHODS:

Plant Material: Roots and flower of lemon grass were collected and authenticated by the Botanist Prof. Jyoti, Department of Botany. A voucher herbarium specimen number QALG/SC/01 was also preserved in the same college. The collected roots and flowers were dried and powdered to coarse consistency in cutter mill. The powder was passed through 40# mesh particle size and stored in an airtight container at room temperature.

Atherogenic Diet and Chemicals:

Experimental Hyperlipidemic Diet: Experimental diet consists of a well-pulverized mixture of cholesterol (2%), cholic acid (1%), peanut oil (10%), sucrose (40%) and normal laboratory diet (47%).

Experimental Hyperlipidemic Agent: A suspension of triton -WR 1339 (SDFine chemicals) in 0.15 M NaCl was used for inducing hyperlipidemia in experimental mice. Lovastatin, Diagnostic kits for estimation were purchased from Merck Diagnostics Ltd. Anesthetic ether and all other chemicals were of analytical grade.

Plant Extract: 2.5 kg of the fresh air-dried, the powdered crude drug of lemon grass roots and flower were extracted with water by adopting simple maceration procedure at room temperature for seven days in a conical flask with occasional shaking and stirring. The extract was filtered and concentrated to dryness at room temperature to avoid the decomposition of the natural metabolites [11]. All the extracts were preserved in a refrigerator until further use. Preliminary phytochemical analysis was carried out in all 4 extracts by different methods of phytochemical analysis [12]. A known volume of extract was suspended in distilled water and was orally administered to the animals by gastric intubation using a force-feeding needle during the experimental period.

Animals: Adult albino mice of Wistar strain (50-100 g) of either sex were procured and housed in the animal house of Al Qassim College of Pharmacy, with 12 h light and 12 h dark cycles. Standard pellets obtained from Veterinary mice feed, Qassim, KSA, were used as a basal diet during the experimental period. The control and experimental animals were provided with food and drinking water *ad libitum*. All the animal experiments were conducted according to the ethical norms approved by the Ethical Committee, Government of KSA, and ethical clearance was granted by the institutional ethical committee in Pharmacy College, KSA.

Preparation of Dose for Dried Extracts: Aqueous extracts (500 mg/kg) of the selected plants were formulated as a suspension in distilled water using Tween-80 as suspending agent. The strength of the suspension was according to the dose administered and was expressed as weight of dried extract [13].

Preparation of Standard Drugs: Lovastatin 10 mg/kg was used as the reference standard drug for evaluating the antihyperlipidemic activity which was made into suspension in distilled water using Tween-80 as a suspending agent.

Acute Oral Toxicity Studies: The acute oral toxicity studies of extracts were carried out as per the KSA ethical guidelines. Administration of the stepwise doses of aqueous extracts of lemon grass from 50 mg/kg up to the dose 5000 mg/kg caused no considerable signs of toxicity in the tested animals. One-tenth of the upper limit dose were selected as the levels for an examination of antihyperlipidemic activity [14].

Diet-Induced Hyperlipidemic Model: The animals were selected, weighed then marked for individual identification. In this model, mice were made hyperlipidemic by the oral administration of atherogenic diet was for 20 days by mixing with regular pellet diet and mice were given free access to the feed *ad libitum*. The mice were then given plant extracts suspended in 0.2% tween 80 at the dose of 500mg/kg b.w once daily in the morning through gastric intubation for 14 consecutive days. During these days, all the groups also received an atherogenic diet in the same dose as given earlier. The control animals received the hyperlipidemic diet and the vehicle. At the end of the treatment period, the animals were used for the study of various biochemical parameters. Blood was collected by intracardiac puncture of mice under ether anesthesia and centrifuged by using centrifuge at 2000 rpm for 30 min to get serum [15].

Triton-Induced Hyperlipidemic Model: Animals were kept for fasting for 24 h and injected a saline solution of Triton WR 1339 at the dose of 400 mg/kg intraperitoneally. The plant extracts, at the dose of 500 mg/kg., were administered orally through gastric intubation, the first dose being given immediately after triton injection and the second dose 20 h later. After 4 h of the second dose, the animals were used for the study of various biochemical parameters. Blood was collected by orbital plexus of mice under ether anesthesia and centrifuged by using centrifuge at 2000 rpm for 30 min to get serum [16].

Experimental Design: Animals were divided into five different groups, with six animals in each group. Group I served as normal control and this group did not receive an atherogenic diet and triton except regular standard pellet diet. Group III was a positive control which was given standard anti-hyperlipidemic drug lovastatin (10 mg/kg/day p.o.). Group II was hyperlipidemic control and this group did not receive any treatment except atherogenic diet in case of diet induced and triton in case of triton induced hyperlipidemia. Group IV hyperlipidemic mice received an extract of *C. citrates* root (500 mg/kg/day, p.o.). Group V hyper lipidemic received an extract of C.citratus flower (500 mg/kg/day, p.o. The treatment period for all these groups was 14 days in atherogenic diet induced hyperlipidemia and 48 h in case of triton-induced hyperlipidemia.

Collection of Blood: Blood was collected by intracardiac puncture, under mild ether anesthesia. The collected samples were centrifuged for 10 min.

Biochemical Analysis: The serum was assayed for total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), using standard protocol method. Serum total cholesterol, triglyceride was estimated by the method of CHOD-PAP and high-density lipoprotein by the method of GPO-PAP. Low density calculated by using Friedewald formula [15, 16].

Statistical Analysis: The results of the study were expressed as mean ± S.E. Data was analyzed by using one-way analysis of variance test (ANOVA) followed by Dunnett's t-test for multiple comparisons. Values with $P<0.05$ were considered as significant [17].

RESULTS:

Antilipidemic Assay: The results showed the anti-lipidemic activity of aqueous extract of roots and flowers of *C. citratus* in mice. **Table 1** shows the serum profile of lipids. As per the Table, we observed that there is a significant decrease in the cholesterol levels in mice administered with root and flower extracts, there was an increase in HDL level and decrease in the LDL level in groups treated with the extracts. Better anti hyper cholesterol activity was observed in Root extract.

TABLE 1: BIOCHEMICAL PARAMETERS OF DIET-INDUCED CHOLESTEROL IN MICE AFTER TREATMENT WITH HERBAL ROOT, AND FLOWER EXTRACTS *C. CITRATUS*

	Mean ± SD					
Group	**Total cholesterol, TC(mg/dl)**	**HDL (mg/dl)**	**LDL (mg/dl)**	**VLDL**	**TC/HDL**	**TC/LDL**
normal	180.1 ± 0.06	20.1 ± 0.7	71.5 ± 0.02	50.2 ± 0.6	9.0 ± .08	2.5 ± 0.1
Cholesterol induced *via* diet	230 ± 0.012	12.4 ± 0.05	103.1 ± 0.04	110 ± 5.2	18.5 ± .24	2.2 ± 0.24
Lovastatin (10mg/kg)	190 ± 0.05 P = 0.000	24.4 ± 0.03 P = 0.003	73.1 ± 0.02 P = 0.001	70.2 ± 0.05 P = 0.00	7.7 ± 1.6	2.6 ± 2.5
Cholesterol diet +	200 ± 0.01	22.1 ± 0.3	70.4 ± 0.05	66.1 ± 0.4	9.09 ± .03	2.8 ± .01

root extract	P = 0.000	P = 0.031	P = 0.001	P = 0.001		
Cholesterol diet +	209 ± 0.02	22.9 ± 0.3	72.5 ± 0.03	72.0 ± 0.5	9.1 ± 0.06	2.9 ± .05
flower extract	P = 0.000	P = 0.038	P = 0.001	P = 0.001		

TABLE 2: BIOCHEMICAL PARAMETERS OF TRITON WR 1339 INDUCED CHOLESTEROL IN MICE AFTER TREATMENT WITH HERBAL ROOT AND FLOWER EXTRACTS OF *C. CITRATUS*

	Mean ± SD					
Group	**Total cholesterol, TC(mg/dl)**	**HDL (mg/dl)**	**LDL (mg/dl)**	**VLDL**	**TC/HDL**	**TC/LDL**
normal	180.1 ± 0.06	20.1 ± 0.7	71.5 ± 0.02	50.2 ± 0.6	9.0 ± .08	2.5 ± 0.1
Triton WR 1339	270 ± 0.012	12.4 ± 0.05	103.1 ± 0.04	110 ± 5.2	21.7 ± .01	2.6 ± .01
Lovastatin	200 ± 0.05	22.4 ± 0.03	73.1 ± 0.02	70.2 ± 0.05	8.9 ± .02	2.7 ± .3
(10mg/kg)	P = 0.000	P = 0.00	P = 0.001	P = 0.001		
Cholesterol + root	210 ± 0.01	19.9 ± 0.3	68.4 ± 0.05	77.1 ± 0.4	10.5 ± .05	3.1 ± .2
extract	P = 0.000	P = 0.031	P = 0.001	P = 0.00		
Cholesterol +	220 ± 0.02	18.5 ± 0.3	78.5 ± 0.03	79.0 ± 0.5	11.8 ± .4	2.8 ± .1
flower extract	P = 0.000	P = 0.038	P = 0.002	P = 0.001		

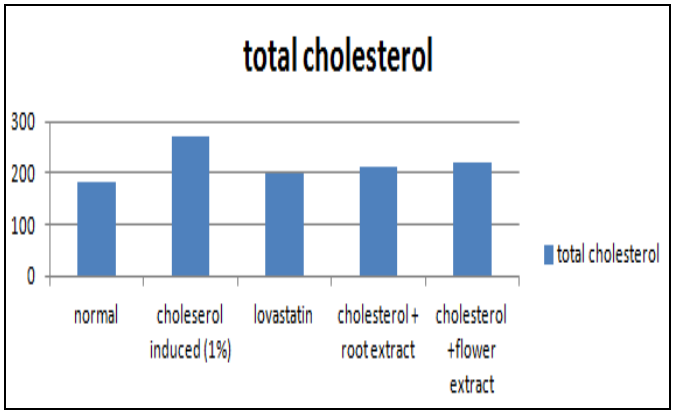

FIG. 1: TOTAL CHOLESTEROL EFFECTS OF AQUEOUS EXTRACT OF ROOTS AND FLOWER OF *C. CITRATUS* OF TRITON WR 1339 INDUCED CHOLESTEROL IN MICE

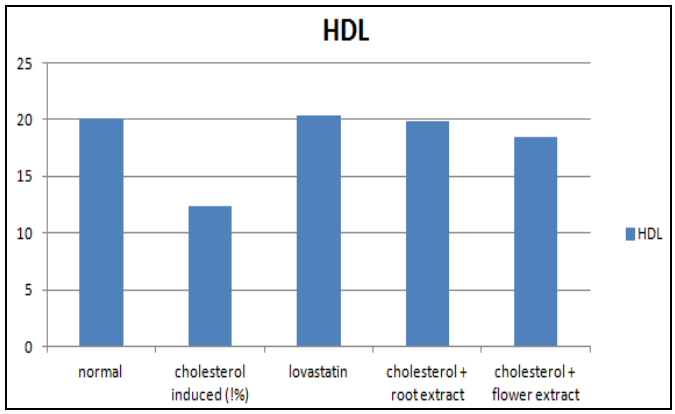

FIG. 2: HDL EFFECTS OF AQUEOUS EXTRACT OF ROOTS AND FLOWER OF *C. CITRATUS* OF TRITON WR 1339 INDUCED CHOLESTEROL IN MICE

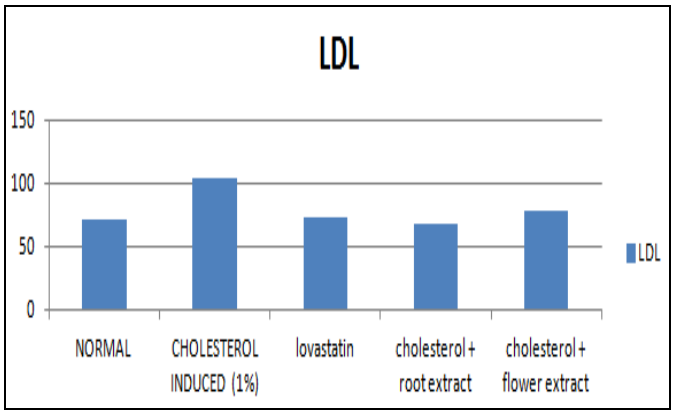

FIG. 3: LDL EFFECTS OF AQUEOUS EXTRACT OF ROOTS AND FLOWER OF *C. CITRATUS* OF TRITON WR 1339 INDUCED CHOLESTEROL IN MICE

DISCUSSION: The increasing obesity and fatty-liver problems are demanding people to consume chemically synthetic antihyperlipidemic drugs that have high side effects. The plant-derived secondary metabolites, such as saponins, sterols, and phenolics, decrease the hyperlipidemia levels, as reported in an earlier work [17]. Plants contain many health-related bioactive compounds, which could effectively control harmful diseases.

Cholesterol is an important building block in cell membranes. It is the main precursor for the biosynthesis of steroid hormones, bile acids, and vitamin D [18]. The abnormal level of cholesterol concentration in the blood is affected by cholesterol synthesis in the liver [19]. However, the high-cholesterol concentration in the blood may increase the risk of atherosclerosis and cardiovascular diseases.

In this study, we found that there was a significant decrease in the cholesterol level of *C. citratus* root and flower extract administered group in comparison to the cholesterol-induced group. The serum profile confirmed that the plant extract possesses an antihypercholesterol activity. A better antihypercholesterol activity was observed with root extract.

CONCLUSION: In this study, we found that there was a significant decrease in the cholesterol level of *C. citratus* root and flower extract administered group in comparison to the cholesterol-induced group. A better antihyperlipidemic activity was observed with root extract.

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CONFLICT OF INTEREST: Nil

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