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*Short communication*

# Hypocholesterolaemic effect of ethanolic extract of fresh leaves of *Cymbopogon citratus* (lemongrass)

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**Hypocholesterolaemic effect of ethanolic extract of fresh leaves of *Cymbopogon citratus* (lemongrass) was investigated using albino rats. Hypercholesterolaemia was induced in the animals by feeding with egg yolk fortified diet for 14 days. The plant extract was administered orally to two groups, doses of 200 and 100 mg/kg body weight respectively for 7 days. Physical activities, food and water intake and body weight increased before the administration of extract. These parameters, however, decreased after administration of extract. The elevated cholesterol concentration were significantly (P<05) lowered in the animals given the plant extract. This reduction was found to be dose dependent. This result shows that the extract possesses hypocholestecolaemic potential. This may explain its efficacy in the management of heart diseases.**

**Key words:** *Cymbopogon citratus* and hypocholesterolemia, rat serum.

## INTRODUCTION

*Cymbopogon citratus* (lemongrass) belonging to the family *Gramineae* (Simon et al., 1984) is a perennial tall grass with rhizomes and densely tufted fibrous roots. The fresh stalks and leaves have green colour and a lemon-like odour. The plant is a native of South India (but present in many parts of the world) growing in dense clumps (Simon et al., 1984). *C. citratus* is used in different parts of the world in the treatment of digestive disorders, fevers, menstrual disorder, rheumatism and other joint pains (Simon et al., 1984). The essential oil of the plant is used for the treatment of skin diseases (Balch and Phyllis, 1990). Traditional medicine practitioners in the Eastern part of Nigeria use the plant's preparation in the form of tincture (solution of plant extract in local alcohol) for treating coronary heart disease and related conditions, such as cardiovascular disorders.

Cholesterol is the major sterol in animal tissues and its amphipathic nature enables it to occur in cell membranes (Nelson and Cox, 2000). It is abundant in the brain, liver, adrenal glands and nervous system (Osmund, 2001). Dietary cholesterol is obtained from animal products. The maximum dietary cholesterol required in a day by an adult is 300 mg. The liver produces sufficient cholesterol (in the absence of enough dietary cholesterol) for all normal body functions. Higher cholesterol levels are found in males and older people. It is carried in the blood in the form of lipoproteins (Osmund, 2001).

High cholesterol in the blood (hypercholesterolaemia) is associated with an increased risk of various disorders, such as coronary heart disease and stroke (Hornstra et al., 1988). These disorders are caused by blood vessels becoming narrowed with fatty deposits (which cholesterol is part of), leading to reduced blood flow (or total blockage of blood flow) to vital organs, like brain. Arthrosclerosis is caused by hardening and narrowing of arteries (Sundram et al., 1995). Factors that facilitate development of the disorders of hypercholesterolaemia include smoking, lack of proper exercise, emotional stress, diets rich in saturated fatty acids, coffee drinking, diabetes and heredity (osmund, 2001).

The leaves of C*. citratus* are widely used in the Eastern Nigeria to treat various heart disorders. Thus, it is imperative to investigate if this could be based on reduction of blood cholesterol level.

## MATERIALS AND METHODS

### Animals

Twenty adult albino rats weighing between were purchased from

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**Table 1.** Weight changes and serum cholesterol levels in rats given high egg yolk diet.

| Parameter | Egg yolk diet | | Control |
|---|---|---|---|
| | Group A | Group B | Group C |
| Initial Weight (g) | 82.50+8.09 | 87.50+10.4 | 95.00+11.18 |
| Final weight (g) | 135.00+7.07 | 156.25+10.31 | 107.00+2.74 |
| Cholesterol (mg/dl) | 205.50+10.61 | 207.75+14.50 | 105.90+2.12 |

Values are mean + SD.
Values in the same row bearing different letter vary significantly (P≤ 005); n = 5.

The Zoological Garden of the University of Nigeria, Nsukka, and transported down to the Animal House of the Department of Biochemistry/Biotechnology, Ebonyi state University Abakaliki. They were acclimatised, placed in groups of five animals per cage. Food and water was given *ad libitum* throughout the duration of the experiment.

### Plant material and extraction of active ingredient

Fresh leaves of *C. citratus* were taken from a local source after identification by a plant taxonomist. Extraction of active ingredient was according to the method of Agbafor (2004). 200 g of fresh leaves of *C. citratus* were cut into pieces homogenised and soaked in 400 ml of ethanol for 24 h. It was filtered to get a dark green solution. The organic solvent was removed with rotor evaporator to obtain crude active ingredient.

### Experimental design

The study consisted of two segments. In the first segment which lasted 14 days animals were divided into three groups A B C. Animals in group C were five in number while those in group A were 10. the animals in group C were fed the normal rat chow while those in group A, were given diets fortified with egg yolk. Animals in all the groups were allowed free access to food and water. At the end of 14 days, blood was collected from all the animals by cutting the tail vain under mild anaesthesici with diethylether.

In the second stage, which was designed to test the potency of the crude ethanol leaf extract of *C citratus***,** animals in group A were divided into two sub groups $A_1$ and $A_2$ with 5 animals in each sub group. Animal in $A_2$ received 100 mg/kg while those in $A_1$ were given 200 mg/kg of the crude leaf extract. All extracts were all administration was orally dissolved in 0.8 – 1 ml of distilled water. Animals in groups and were given 0.8-1 ml of distilled water orally daily for seven days as place 60. After the 7 days period, blood was collected by cutting the tail of all the animals under mild anathesia.

### Cholesterol determination

Blood collected by cutting the tail vain of the rats were put in specimen bottles and allowed to clot. They were then centrifuged at 3000 g for 10 min to obtain clear serum which was used for cholesterol determination according to the method of Meiathnin et al. (1978). 0.01 ml of reagent A (PIPES 35 mmol/L, sodium cholate 0.5 mmol/L, phenol 28 mmol/L, cholesterol esterase 0.25 mmol/ml, cholesterol oxidase 0.l5 U/ml, peroxidase 0.85 U/ml and 4-aminoantipyrene 0.5 mmol/L, pH 7.0) was mixed with 0.1 ml of serum and incubated for 10 min at room temperature (20-25°C). The absorbance was read at 500 nm against a blank. Cholesterol standard (200 mg/dL) was similarly treated.

### Statistical analysis

Statistical analysis was done by analysis of variance (ANOVA) and means were compared using Duucan's multiple range analyses (Sokahl and Rholf, 1969).

## RESULTS AND DISCUSSION

Percentage yield of the crude ethanolic extract of fresh leaves of *C. citratus* was 23.5+1.25. This indicates that substantial fraction of the constituents is freely soluble in ethanol.

A general increase in physical activities, food and water intake were observed for all the animals during the feeding experiment. The animal on the high egg yolk diet recorded significant ($P \leq 0.05$) weight gains compared to the animals on the normal rat chow (Table 1). The increase in weight of the animals suggests that they accumulated calories in the form of fats from the egg yolk diet. This result agrees with the report of Wells et al. (1987) which suggests that accumulation of fats from diets such as egg yolk and liver might increase body weight. This suggestion is further corroborated by the significant increase ($P \leq 0.05$) in the serum cholesterol level of animals on the egg yolk diet (Table 1). This observation tallies with the report of Laakso et al. (1988) that egg yolk supply significant amount of cholesterol to human diet which could be accumulated in the body and may lead to hypercholesterolaemia.

A different picture emerged following the administration of the crude ethanolic extract of fresh leaves of *C. citratus* on the animals given the egg yolk diet for seven days. The animals exhibited reduced physical activity and also consumed less food and water compared to the untreated animals. These treated animals also recorded significant ($P \leq 0.05$) decreases in weight and lower serum cholesterol levels relative to untreated animals (Table 2). These reductions in serum cholesterol level were dose dependent. The serum cholesterol level in the animals given the higher dose (200 mg/kg) of *C. citratus* ethanol extract was almost at par with those of the animals that were never given the egg yolk diet.

The mechanism underlying these observations especially the loss of appetite is not clear. However, there is evidence of metabolic upset. Studies aimed at understanding these events are going on in our laboratory. The cholesterol-lowering potential of the extract many be ascribed to modification of cholesterol uptake from the intestine, conversion of cholesterol to bile acids and increasing excretion of bile acids by extracts of *C. citratus*

**Table 2.** Weight changes and serum cholesterol levels in rats fed high egg yolk diet and treated with ethanol extract of *C Citratus*.

| Parameter | (Group $A_1$) Egg yolk + 200 mglkg extract | (Group $A_2$) Egg yolk + 100 mglkg extract | (Group B) Egg yolk + distilled water | (Group C, control) Rat chow + distilled water |
|---|---|---|---|---|
| Initial weight (g) | 132.50+3.54 [b] | 132.50+0.70 [b] | 155.00+9.82 [b] | 106.75+2.02 [a] |
| Final weight (g) | 102.50+3.00 [a] | 122.50+0.68 [a] | 152.50+8.99 [b] | 105.60+2.01 [a] |
| Cholesterol (mg/dl) | 105.25+1.77 [a] | 160.00+2.83 [b] | 205.50+12.02 [c] | 104.00+2.12 [a] |

Values are mean + SD.
Values in a row bearing different alphabets differ significantly ($P \leq 0.05$); n = 5.

and curcumin plants as reported (National cholesterol Education programme Expert panel, 1988). Our result therefore seems to confirm the anti-hypercholesterolaemic potentials of ethanolic extracts of fresh leaves *of C. citratus* which may explain its use in management of heart disease in ethnomedicine.

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