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DIURETIC STUDIES ON LEMON GRASS TEA FROM *CYMBOPOGON CITRATUS* (DC) STAPF IN RAT

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The safety of lemon grass tea prepared from *Cymbopogon citratus* (DC) Stapf. (lemon grass) was evaluated in rats. The extract was administered for 6 weeks intragastrically and produced no adverse effects after its use. No morphometrical or histological changes were noticed in the vital organs of the test and control animals. Besides no biochemical changes were noticed in the blood and urine of test rats under our experimental conditions. The results were comparable with standard green tea. It was diuretic in action.

Key words: *Cymbopogon citratus* (DC) Stapf., Green tea, Toxicity, Diuretic effect.

Introduction

Cymbopogon citratus (DC) Stapf. (Poaceae) commonly known as "Serai" or lemon grass is reported to have many medicinal properties. It is used as sudorific, stimulant, antiperiodic and anticatarrhal (Chopra *et al* 1956) A decoction made from the leaves is recommended as diaphoretic in fever (Chopra *et al* 1958).

An infusion of lemon grass is sometimes taken as a refreshing beverage and this use gives it a local name "Hirva cha" or green tea (Anonymous 1950). In Java, it is used in preparation of highly spiced "sherbet" (Burkill 1935). A number of studies are available regarding the antimicrobial activity (Ibrahim 1992) and antimutagenic properties of the plant extract towards chemically induced mutation in *Salmonella typhimurium* strains TA 98 and TA 100 (Vinitketumnuen *et al* 1994). A survey of the literature showed that the safety of lemon grass tea from *C. citratus* was not investigated on scientific grounds. The present study was therefore undertaken to evaluate the merits of lemon grass tea prepared from this plant for human consumption and its comparison with green tea (standard) presently consumed.

Materials and Methods

Animal. Albino rats (Sprague Dawley strain), weighing between 150-200 g fed on standard diet were used. They were kept in plastic cages (45.2 x 26 x 23 cm) with sliding perforated stainless steel covers maintained under 12 h light/dark cycle at 25 ± 1°.

Source of tea. Lemon grass tea made from *Cymbopogon citratus* a standard green tea (MW-R-HAD) was procured from M/s Goodricke Tea Co, Calcutta, India.

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Hot water extract of the tea. Twenty g of standard and test (lemon grass tea) were soaked in 100 ml of boiling water separately for 5 minutes. Then the extracts were filtered and the filtrates were fed intragastrically to rats at a temperature of 37 ± 1°.

Toxicity studies. The rats were divided into 3 groups as follows:

Group I, Test (Lemon grass tea). Each group comprised of six animals either sex (3 males and 3 females) kept separately. They received the filtered extract intragastrically 2 ml 100 g^{-1} body weight per day for 6 weeks along with the standard diet (Clarke and Clark 1975; Loomis 1978). The blood-glucose, total cholesterol and protein in blood of each animal were estimated weekly.

Group II, Standard (Green tea MW-R-HAD). Rats in this group were divided in the same way as in group I and received the same amount of tea extract intragastrically for 6 weeks with standard diet. The other experimental conditions remained the same.

Group III, Control. In this group the rats were administered an equivalent volume of distilled water intragastrically along with normal laboratory diet.

Blood cholesterol, glucose and protein. Five ml of blood was drawn from the animals via direct cardiac puncture and kept for 20-30 minutes at room temperature then centrifuged for 10 minutes at 2000 rpm. Serum was analyzed for total cholesterol, glucose and protein. For analysis enzymatic methods were employed, using kits from Boehringer Mannheim GmbH Diagnostica.

Analytical procedures in all the estimations were based on the production of chromogen by enzymatic reactions and absorbance was noted on clinicon spectrophotometer Boehringer Model, 4010 (Table 1).

Table 1

Analysis* of blood samples in test, standard and control rats

Sample	Total cholesterol mg μ^{-1} (average)	Total glucose mg μ^{-1} (average)	Total protein g μ^{-1}
Test tea (Lemon grass)	186	94	6.7
Standard green tea ((MW-R-HAD)	200	100	7.3
Control	170	107	7.8
Normal range	upto 200	76-110	6.6-8.7

*Boehringer Mannheim GmbH Diagnostica kits.

Statistics. Students 't' test and a probability of P value <0.05. were chosen on the criterion of statistical significance values as estimated for Na^+ and K^+ electrolyte in Table 2. Greater value was calculated for K^+ electrolyte in standard green tea; all the data were compared with control.

Diuretic activity. The lemon grass tea extracts were administered intragastrically at 1 g kg^{-1} body weight (Clarke and Clarke 1975; Loomis 1978). The test and control animals were isolated in metabolic cages. Six albino male rats in each group and their urine was collected after an interval of 6 h. The test animals received the lemon grass tea while the control set received the same quantity of the distilled water (Table 2).

Analytical procedure. Electrolytes were estimated for samples of pooled urine of test and control rats after 6 hours following the intake of tea. The concentrations of Na^+ and K^+ were determined by flame photometer (Corning "410") (Table 2). The specific gravity, pH, urobilinogen, protein, blood cells, ketone, bilirubin and glucose in all the samples of urine were determined using test strips, Bayer Diagnostics Ames Multi-stix SG (Navarro *et al* 1994). The data obtained is shown in Table 3.

Histological studies. Tissues from liver and kidneys of the test and the control rats were kept in Bouin's fluid for 24 hours. Sections were then cut at 6μ and were stained in haematoxylin and eosin and finally mounted in Canada balsam. The microphotographs taken from prepared slides are presented in Fig 1-6.

Results and Discussion

The test tea lemon grass given by oral route to the albino rats was found to be non-toxic. A comparative study of glucose level in blood of the test and the control animals showed no increase of blood-glucose level in all the cases. The animals receiving tea extracts showed normal blood-glucose in comparison with control (Fig 7). The observations of Isigaki *et al* (1991) and Shimizu *et al* (1988) regarding the normal range of blood-glucose after the consumption of test tea is in line with our observations (Table 1).

The biochemical tests of the urine of the test and the control rats showed no difference (Table 3). The Na^+ and K^+ electrolytes also remained within normal range (Table 2). The urine quantity collected from test rats was, however, noted to be almost double as compared to the control rats, indicating that the lemon grass tea is diuretic in action. There was significant difference in urine out put between the control and the test tea

Table 2

Effect of test and standard green tea on urinary electrolyte excretion in rats after 6 h intake

Sample	Urine volume (ml)	Na^+ meq $100g^{-1}$ mean ± SE	P value	K^+ meq $100g^{-1}$ mean ± SE	P value
Test tea lemon grass	5.30 ± 0.30	0.50 ± 0.07	0.0089	0.15 ± 0.01	0.0089
Standard tea (MW-R-HAD)	5.10 ± 0.80	0.50 ± 0.10	0.0045	0.20 ± 0.03	0.0224
Control	2.98 ± 0.85	0.42 ± 0.01		0.13 ± 0.01	

The values represent the mean of at least 10 experiments ± SE.
P value <0.05 shows significant changes in both electrolytes.

Note: The mean 2 hours urinary excretion values for control were 1.8 ml of urine, 0.08 meq $100g^{-1}$ of Na^+ and 0.05 meq $100g^{-1}$ of K^+ (R. Meisheri *et al* 1994, *Cardiovascular Pharmacology*, Upjohn Labs, Kalamazoo, Michigan 49001).

(lemon grass tea). Statistically significant values were estimated for Na^+ and K^+ electrolytes (Table 2) in the urine of rats fed on standard green tea. All the data were compared with the control. No morphometric and histological changes were observed in the liver and kidney of the test rats as compared with control (Figs 1-7). The biochemical and hematological parameters were also unaffected after the consumption of test tea extracts.

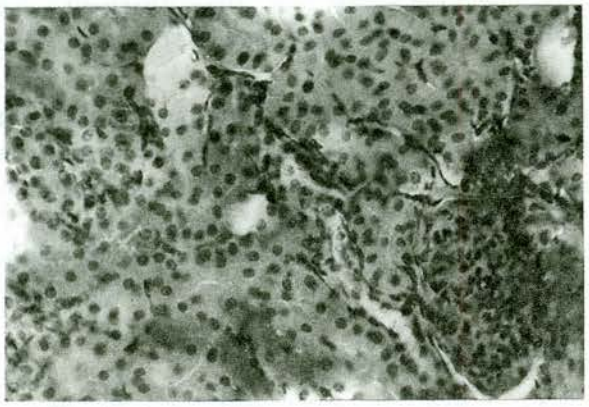

Fig 1. Control/normal kidney section showing Bowman's capsule proximal convoluted tubules (40X).

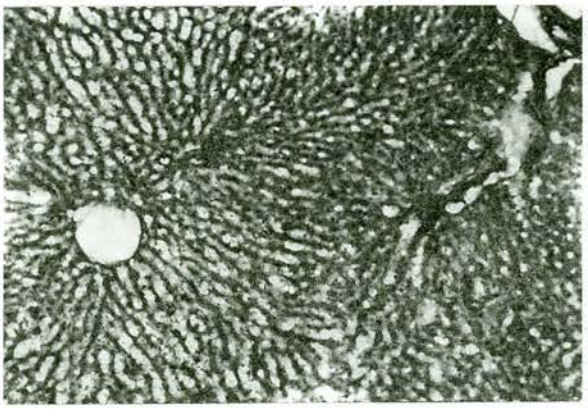

Fig 2. Control/normal liver showing central vein and bile duct portion (20X).

Fig 3. Test (lemon grass green tea) kidney showing convoluted tubules and Bowman's capsule; black particles are present in the blood but no change in the cells (20X).

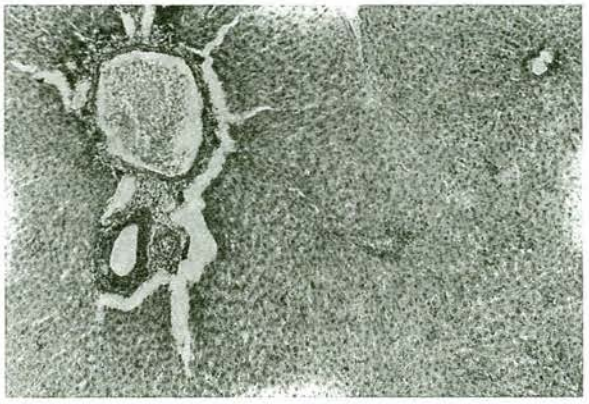

Fig 4. Test (lemon grass green tea) liver showing portal area and central vein; no change in the cells (10X).

Fig 5. Standard green tea, (MW-R-HAD), kidney showing Bowman's capsule, medullary ray and convoluted tubules; black particles are present in the blood, no change in the cells (10X).

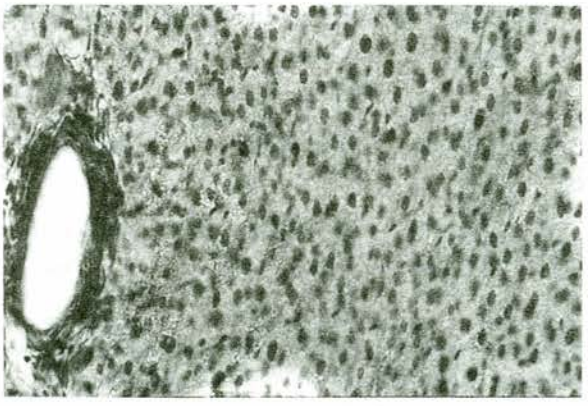

Fig 6. Standard green tea, (MW-R-HAD), liver showing interlobular bile duct; no change in the cells (40X).

Table 3
Biochemistry* of urine samples of albino rats

Sample fed	Urobilinogen ml l^{-1}	Protein g l^{-1}	pH	Blood Ca cells ml^{-1}	Specific gravity	Ketone	Bilirubin	Glucose
Test tea (lemon grass)	3.2	Traces	8.5	Negative	1.000	Traces	Traces	-ve
Standard green tea (MW-R-HAD)	3.2	Traces	7.0	Negative	1.010	Traces	Traces	-ve
Control	3.2	Traces	8.5	Negative	1.030	Traces	Traces	-ve

*Reagent strips of Bayer Diagnostics Ames Multistix SG were used.

Table 4
Physico-chemical properties of lemon grass tea and standard green tea

Sample	Colour	Taste/aroma	pH	Density at 20°C	Viscosity at RD 33°C	Refractive index at 20°C	Specific gravity at 20°C	Optical rotation at 20°C
Test tea (lemon grass)	Olive green	Pleasant with lemon aroma	6.0	1.0115	20.2566 poises	1.4710	1.015	0.61
Standard green tea (MW-R-HAD)	Amber	Pleasant	6.0	1.0115	23.1932	1.4611	1.016	0.63

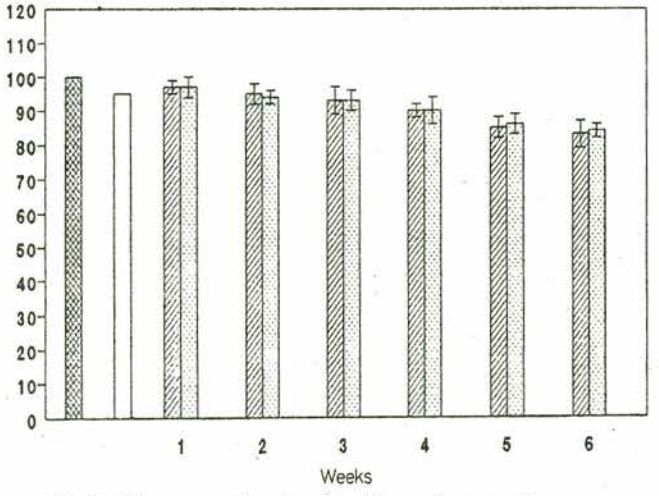

Fig 7. Histogram showing the effect of test tea (Lemon grass and standard green tea) on blood glucose level in rats.
Vertical bars show SEM and the values represent the mean of 10 experiments ± SEM.

Normal blood glucose level; Lemon grass (Test tea); Standard green tea (MW-R-HAD); Control.

The physico-chemical properties of test tea revealed that the colour, aroma, pH, density, viscosity, refractive index, specific gravity and the optical rotation of the lemon grass tea is similar to the standard tea (Table 4).

Knowing the principal constituents of lemon grass tea to be Citral (Geranial and Neral) which is quite harmless as reported (Husain *et al* 1988; Idrissi *et al* 1993) and in the light of the present results, it can be concluded that the lemon grass tea is as safe as other widely used green tea.

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