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

Nahid Abbas ^{*1}, Mashaal Hamed Al-Sueaadi ², Ahlaam Rasheed ³ and Eiman Sayed Ahmed ³

Department of Medicinal Chemistry ¹, Department of Histopathology ², Qassim University, College of Pharmacy, Qassim - 51452, KSA.

Qassim University ³, College of Pharmacy, Qassim - 51452, KSA.

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Correspondence to Author:

Nahid Abbas

Department of Medicinal
Chemistry, Qassim University,
College of Pharmacy, Qassim -
51452, KSA.

E-mail: nahid.is.abbas@gmail.com

ABSTRACT: Dexamethasone drug induced the hyperglycemia in the albino mice when intra-peritoneally administered at the dose of 10 mg/kg. Administration of dexamethasone raised the level of blood sugar in the mice. Administration of aqueous extract of *C. citratus* root and flower extract reduced the fasting and postprandial blood sugar levels, bringing them towards normal. We were observed anti-diabetic effect both root and flower extracts but the root had better anti-diabetic effect.

INTRODUCTION: Many indigenous Indian medicinal plants have been found to be useful to successfully manage diabetes. One of the great advantages of medicinal plants is that these are readily available and have very low side effects ¹. The antihyperglycemic effects that results from treatment with plants are often due to their ability to improve the performance of pancreatic tissue, which is done by increasing insulin secretions or reducing the intestinal absorption of glucose ². Most plants contain carotenoids, flavonoids, terpenoids, alkaloids, glycosides and can often have anti-diabetic effects ³. *Cymbopogon citratus* (DC.) Stapf, popularly known as citronella grass or lemongrass. This species belongs to the Poaceae family ⁴.

C. citratus is native from the southwest Asia and, now, it grows spontaneously around the world, mainly in the tropical and savannah regions ⁵. Its aqueous extract is commonly used as an aromatic drink while the whole plant is well incorporated into traditional food for its lemon flavour. It also enjoyed wide application in folk medicine.

Lemongrass is a folk remedy for coughs, elephantiasis, flu, gingivitis, headache, leprosy, malaria, ophthalmic, pneumonia and vascular disorders. Studies have shown that the lemon grass has antibacterial and antifungal properties. Mixed with pepper, it's a home therapy for menstrual troubles and nausea. The lemon grass is a good cleanser that helps to detoxify the liver, pancreas, kidney, bladder and the digestive tract. It cuts down uric acid, cholesterol, excess fats and other toxins in the body while stimulating digestion, blood circulation, and lactation; it also alleviates indigestion and gastroenteritis. It is said that lemon grass also helps improve the skin by reducing acne and pimples and acts as a muscle and tissue toner.

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Also, it can reduce blood pressure. A recent study by the Food and Nutrition Research Institute of the department of Science and technology (DOES) show lemon grass can help prevent cancer⁴. Lemongrass extracts contained several medicinal chemical components which reside in its essential oil and aqueous extract⁶. One of the main constituents of many different species of lemongrass is citral (3, 7-dimethyl-2, 6-octadien-2-al). Lemongrass oil has been found to contain up to 75 - 85% citral⁷. Citral is a mixture of two stereoisomeric monoterpene aldehydes; the trans-isomer geranial (40 - 62%) dominates over the cis-isomer neral (25 - 38%)⁴. Lemongrass also contains borneol, estragole, methyleugenol, geranyl acetate, geraniol, beta-myrcene, limonene, citronellal, careen-2, alpha-terpineol, pinene, farnesol, proximadiol, and (+)-cymbodiactal⁷, methyl heptenone, nerol, terpinolene, linalyl acetate, linalool, β -caryophyllene⁸. The volatile oil from the roots contains 56.67% longifolene - (V4) and 20.03% selina-6-en-4-ol⁷.

In recent years huge number of studies have been carried out, acclaimed medicinal properties emphasized on different pharmacological effects of the lemongrass such as: antiamebic, antibacterial, antidiarrheal, antifilarial, antifungal, anti-inflammatory, antimalarial, antimycobacterial, antinociceptive, anti-protozoan, ascaricidal, free radical scavengers and antioxidant, hypocholesterolemic, hypoglycemic, hypolipidemic, larvicidal activity, neurobehavioral effect⁸, anticancer, anti-hypertensive, insects repellent and insecticide⁵, antigout⁹. Also antimutagenicity such as protective effect of essential oil from lemongrass in N-methyl-N-nitrosurea (MNU) induced leukocyte DNA female Balb/C mice, exhibited protective action against MNU-induced DNA damage⁶ and antihepatotoxic action against cisplatin induced hepatic toxicity in rats⁴, have been reported for this medicinal plant.

Aims and Objectives: Objective of this study is to evaluate the antidiabetic activity of lemongrass (*C. citratus*) aqueous extract of roots and flowers on albino mice.

MATERIALS AND METHODS:

Plant Material: Studied sample was provided by the Al-Qassim pharmacy college KSA, on March, 2017 with botanical sample qas101.

Standard Drugs: Glibenclamide 500 μ g/kg per oral.

Chemical: Dexamethasone 10 mg/kg/day, was provided from the Research Centre of College of Pharmacy, Al Qassim University.

Preparation of Extracts:

Methods:

Plant Materials and Extract Preparation: Roots and flowers fresh air-dried, powdered with 500 gm of crude drug of lemongrass roots and flowers 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. All the extracts were preserved in a refrigerator till further use. Preliminary phytochemical analysis was carried out in all 4 extracts by different methods of phytochemical analysis. 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: The study was conducted after obtaining approval from the Al-Qassim Ethical Committee for Animal Experimentation. Male albino mice of wistar strains were obtained from, and maintained in, the animal house, Department of Pharmacology, KSA. The rodents weighed 25 - 50 g and had access to food and water *ad libitum*. They were under natural light-and-dark cycles at a temperature of 28 ± 4 °C, and were acclimatized for 3 days before the beginning of the experiment.

Experimental Procedure: Animals were divided into 5 groups. In each group, there were 6 mice. The present study was planned with 30 mice. Group 1 served as normal control; groups 2, 3, 4, 5, received dexamethasone 10 mg/kg/day subcutaneously for 10 days; on day 11, after overnight fasting, retro-orbital puncture was performed to obtain blood samples for estimation of fasting and postprandial blood sugar. Only those mice whose fasting and postprandial blood glucose levels were higher than those of the normal controls were utilized for further study. From day 11 to day 20, groups 2, 3, 4, 5, continued to receive dexametha-

sone 10 mg/kg/day subcutaneously. Group 3 received glibenclamide 500 µg/kg per oral, in addition to dexamethasone. Group 4 received 100 mg/kg/day of lemongrass roots extract. Group 5 received 100 mg/kg/day of lemongrass flower extract powder.

On the 20th day, after overnight fasting, retro-orbital puncture was done on the right eye to obtain blood for estimation of fasting blood glucose using glucometer. Immediately after this, a glucose load of 2.5 g/kg orally by gastric intubation was given and retro-orbital puncture was done on the other eye to measure the blood glucose level 1 h after glucose load for estimation of postprandial blood glucose levels. With dexamethasone, at different times, a few mice died, probably due to infection; as and when the mice died, we would include new mice and experiment with them from the beginning such that there were ultimately 6 mice per group. We had planned the present study with 30 mice, but we needed 40 mice for completion of the project. To do the CBC we sacrificed the animals and collected blood using intra-cardiac method of blood extraction.

RESULTS: In the present study, there was increase in the fasting and postprandial glucose level with 10 mg/kg/day of dexamethasone for 10

days when compared to normal controls. Reduction in the fasting and the postprandial blood sugar levels with roots and flower extracts of lemongrass was comparable with that obtained with glibenclamide 500 µg/kg at 100 mg/kg of powdered root and flower of lemongrass.

TABLE 1: EFFECT OF C.CITRATUS ROOT EXTRACT, FLOWER EXTRACT, AND GLIBENCLAMIDE ON BLOOD SUGAR IN DEXAMETHASONE INDUCED HYPERGLYCEMIA

| Glucose (gm/dl) | Day 0 | Day 7 | Day 14 |
|------------------|-------------|-------------|-------------|
| Normal control | 80.1 ± 3.5 | 78.8 ± 4.8 | 78.1 ± 3.02 |
| Diabetic control | 140 ± 8.1 | 190 ± 11.3 | 209.1 ± 7.2 |
| Diabetic ± std. | 130.1 ± 8.6 | 105.1 ± 6.3 | 95.5 ± 6.2 |
| Glibenclamid | | | |
| Roots extract | 85 ± 6.5 | 76.5 ± 7.1 | 66.5 ± 5.1 |
| | P = 0.11 | P = 0.18 | P = 0.135 |
| Flowers extract | 110 ± 1.1 | 110.3 ± 2.2 | 106 ± |
| | P = 0.043 | P = 0.304 | 0.004 |
| | | | P = 0.003 |

The **Table 1** shows the anti-diabetic effect of *C. citratus* root extract, flower extract, and glibenclamide on blood sugar in dexamethasone induced hyperglycemia. It was observed that the root extract has better anti-diabetic effect than flower extract. **Table 2** Depicts the complete CBC. It was observed that the Heamoglobin level was not altered as there was a tremendous decrease in the group treated with dexamethasone.

TABLE 2: THE CBC OF THE ANIMALS

| CBC | Normal control Mean ± SD | Diabetic control | Diabetic + Glibenclamide | Roots extract | Flower extract |
|---------------------------|-----------------------------|---------------------|-----------------------------|------------------|-------------------|
| WBC-10 ³ /ml | 6.0 ± 0.05 | 8.2 ± 0.04 | 5.9 ± 0.1 | 6.5 ± 0.02 | 8.4 ± 0.03 |
| RBC-10 ⁶ g/dl | 8.8 ± 0.5 | 5.5 ± 0.3 | 8.0 ± 0.2 | 8.1 ± 0.05 | 8.3 ± 0.5 |
| Hgb-g/dl | 14.01 ± 0.04 | 12 ± 1.02 | 13.33 ± 0.04 | 14.5 ± 0.02 | 14.3 ± 0.03 |
| HCT % | 49.8 ± 0.05 | 48 ± 0.02 | 49 ± 0.01 | 49.3 ± 0.01 | 49.5 ± 0.2 |
| PLT × 10 ³ /UL | 162 ± 0.1 | 40 ± 0.1 | 163 ± 0.1 | 162.5 ± 0.1 | 161 ± 0.3 |
| RDW – CVRL (FL) | 36.3 ± 0.19 | 34 ± 0.1 | 36.9 ± 0.1 | 35.9 ± 0.1 | 35.6 ± 0.03 |
| MCV (F) | 55.3 ± 1.11 | 52.0 ± 0.01 | 60 ± 1.01 | 63 ± 0.03 | 62 ± 0.14 |
| MCH (pg) | 16.1 ± 0.21 | 15.1 ± 0.04 | 17.8 ± 0.4 | 18.1 ± 0.6 | 18.3 ± 0.21 |
| MCHC (g/dl) | 30.1 ± 0.8 | 1.8 ± 0.83 | 28 ± 1.2 | 27.3 ± 0.06 | 26.8 ± 0.35 |

DISCUSSION: Diabetes mellitus induced by glucocorticoids is similar to type 2 diabetes mellitus, where insulin resistance constitutes an essential component. Further it may be mentioned that glucocorticoids also cause obesity, hypertension, hyperurecemia, increased plasminogen activator inhibitor - 1, low HDL (high-density lipoprotein) cholesterol along with glucose intolerance. The cluster of these abnormalities was coined as “metabolic syndrome” by WHO in 1999 ¹⁰.

Dexamethasone is a long-acting glucocorticoid with t½ more than 36 h. According to a study, transgenic mice producing excess of 11 - beta HSD develop typical features of the metabolic syndrome, suggesting that excess of cortisol in tissues might be responsible for the insulin resistance, a core feature of type 2 diabetes mellitus. Dexamethasone produces dose dependent inhibition of insulin release caused by glucose, tolbutamide and other insulin releasers ¹¹.

Therefore, only insulin sensitizers and insulin are likely to be effective in dexamethasone - induced hyperglycemia. Insulin sensitizers like Rosiglitazone and metformin are being evaluated for primary prevention of type 2 diabetes mellitus in high-risk patients¹².

Plant products have been used in folk medicine and traditional healing systems and are being evaluated for their hypoglycemic effects. The study was planned to evaluate the anti-diabetic effect of *C. citratus* roots and flower extracts in dexamethasone-induced hyperglycemia in male albino mice, where application of dexamethasone at 10 mg/kg induced hyperglycemia in the mice which was supported by biochemical findings. In the present study, we observed there is an anti-diabetic effect by both root and flower extracts, but the root extract had better antidiabetic effect. The biological findings for hemoglobin level showed lower in mice treated with glibenclamide the standard antidiabetic drug whereas the mice treated with *C. citratus* roots and flower extracts had better hemoglobin level.

CONCLUSION: From the present study it was also concluded that administration of extract of root and flower of lemongrass (*Cymbopogon citratus*) reduced the fasting and postprandial blood sugar levels, bringing them down towards normal, in dexamethasone - induced hyperglycemia in mice. Reduction in the fasting and the postprandial blood sugar levels with root and flower of lemongrass was comparable with that obtained with Glibenclamide 500 µg/kg at 100 mg/kg/day of powdered root and flower of lemongrass, but the root extract had better antidiabetic effect than flower extract.

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