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Original Research Article

Evaluation of potential antidiabetic activity of abelmoschus esculentus and evidence of possible pharmacokinetic interaction with metformin

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ABSTRACT

The study is aimed at the evaluation of potential activity of *Abelmoschus esculentus* and possible interaction with metformin in animal Models of Diabetes Mellitus. Study objectives include study the anti-diabetic effect of *Abelmoschus esculentus* for Diabetes Mellitus in animal models and also to study the effect of Abelmoschus esculentus with metformin and explore any interaction. Plant material was collected (*Abelmoschus esculentus*) followed by extraction of plant materials (*Abelmoschus esculentus*) Exudate collection of *Abelmoschus esculentus* and activity test study was done (acute toxicity study, according to standard OECD guidelines) Experimental animals were divided into groups. Dosing was done for 28 days. Biochemical parameters were studied. Histopathology studies are done. Results showed that in this study administrations of Abelmoschus esculentus extract (2000mg/kg body weight) Metformin with *Abelmoschus esculentus* extract (5mg/kg b.w. and 2000mg/kg body weight and Metformin 5mg/kg body weight decreased elevated blood glucose levels significantly from first to fourth week compared to diabetic control rats and showed minimal safety concerns.

1. Introduction

Okra (*Abelmoschus esculentus*), also known as “lady’s fingers,” is a green flowering plant. Okra belongs to the same plant family as hibiscus and cotton.[1–6] The term “okra” most commonly refers to the edible seedpods of the plant. Okra has long been favored as a food for the health conscious people. It contains nutrients like potassium, vitamin B, vitamin C, folic acid, and calcium. It’s low in calories and has high dietary fiber content. Recently, a new benefit of including okra in your diet is being considered. Okra has been suggested to help manage blood sugar in cases of type 1, type 2, and gestational diabetes.

The study is aimed at the Evaluation of Potential Activity of *Abelmoschus esculentus* and Possible Interaction with Metformin in Animal Models of Diabetes Mellitus. Study objectives include study the anti-diabetic effect of *Abelmoschus esculentus* for Diabetes Mellitus in animal models and also to study the effect of *Abelmoschus esculentus* with metformin and explore any interaction.

2. Materials and Methods

Plant material was collected (*Abelmoschus esculentus*) followed by extraction of plant materials (*Abelmoschus esculentus*) Exudate collection of *Abelmoschus esculentus* Pre- ProcessingActivity test study was done (acute toxicity study, according to standard OECD guidelines). Animals

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are divided into five groups. The experimental animals received drugs for 28 days.[1,7–11] Biochemical studies are checked. Histopathology studies are done. Results, data were collected and estimated Results and data are estimated and graphs are plotted.

2.1. Raw plant material collection

500 gm of fresh pod or fruits of *Abelmoschus esculentus* were collected from the local market of Sugandhya, Delhi road, Chinsurah, West Bengal and a sample was authenticated by the Botanical survey of India, Shibpur as *Abelmoschus esculentus* which was archived for future reference. (BSI/Plant spec./2016).[12–15]

2.2. Chemicals

Metformin HCL, Glucose, Sucrose, streptozotocin, nicotinamide, DPPH, Accu-check Glucometer, Auto-analyser (Rovonic) Experiments were performed on a total of 15Albino Wister rats weighing about 100-200 gm of either sex. They were maintained in colony cages (3 rats per cage) at an ambient temperature of 25-27o C with 12 hours light and dark cycles having proper ventilation in the room. They were fed normal diets purchased commercially from the vendor and water. The rats were allowed to acclimatize to the laboratory environment for one week and were randomly divided into groups for experiments.[16,17]

Preparation of viscous water-soluble fraction of *Abelmoschus esculentus*: 500 gm of fresh pods or fruits of okra (*Abelmoschus esculentus*) were collected. Then, the pods were thoroughly washed with distilled water, cut into small slices by a sharp knife. The sliced pods were immersed into distilled water in a beaker. The mixture was then stirred gently for 10-15 minutes with a glass rod. After that, it was filtered using a thin layer of cotton to remove the insoluble matters and filtrate was collected. The amount of filtrate was measured.

2.3. Induction of diabetes

Diabetes was induced in rats by a single intra peritoneal injection of streptozotocin (45 mg/kg body weight) dissolved into citrate buffer. 15 minutes later of streptozotocin injection, nicotinamide injection (110 mg/kg body weight) was induced by the same route. 21 days later, plasma glucose concentration was determined in blood samples obtained from rats. Rats with diabetic (>200 mmol/L) were included in the study and the rats which no diabetic (<100mmol/L) were excluded from the experiment.

2.4. Experimental design

Rats were divided into five groups. Each group contained three Wistar albino rats (n = 3 per groups). The groups are divided as Normal control, Diabetic control (diabetic but were not under the treatment, DC) Diabetic with Metformin only; Metformin control (MC) Diabetic with WSF of *Abelmoschus esculentus* (WFC) Diabetic with Metformin and WSF of *Abelmoschus esculentus* (DMF)

2.5. Acute toxicity study

Acute toxicity study of *Abelmoschus esculentus* extract was determined as per Organization for Economic Cooperation and Development guidelines (OECD) 423.

Table 1:

Concentration of DPPH+ ascorbic acid	Absorbance of test group	Mean value
20	0.573	
40	0.583	
60	0.585	0.588
80	0.590	
100	0.610	

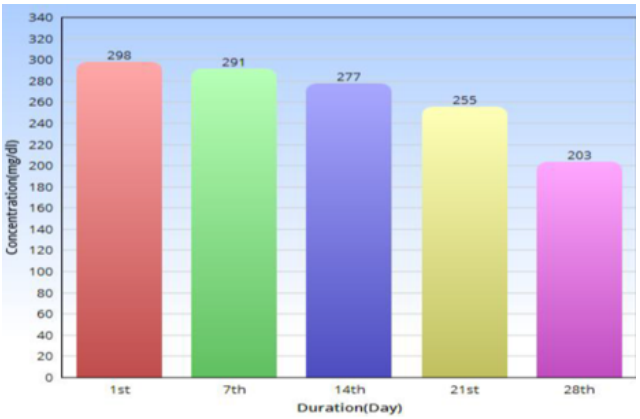

Fig. 1: Blood sugar levels in experimental groups

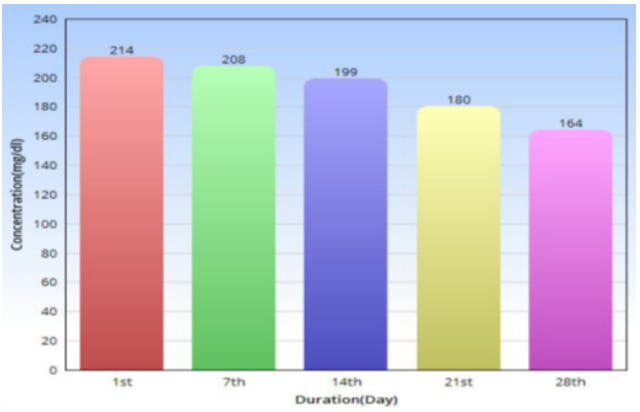

Fig. 2: Liver function tests(ALT and AST)

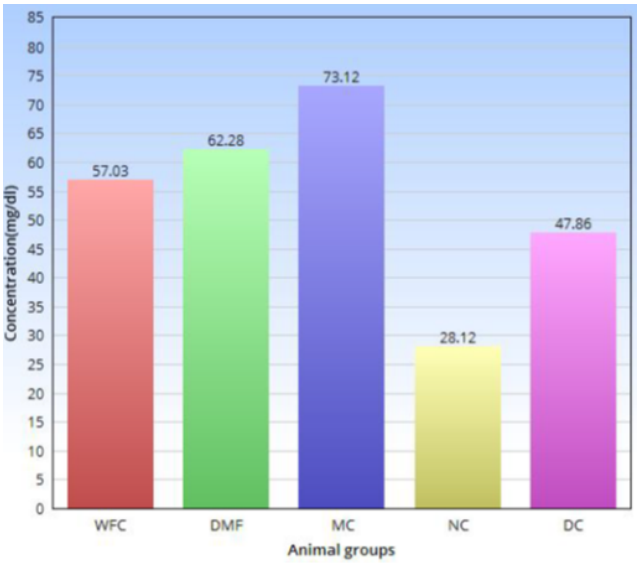

Fig. 3: Antidiabètic experimental groups

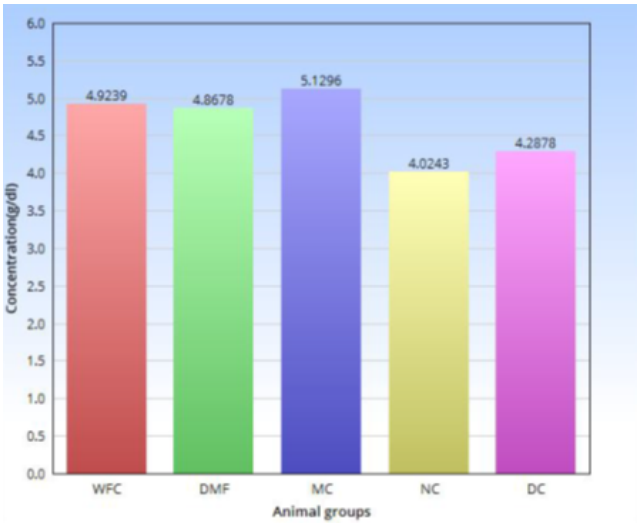

Fig. 4: Serum albumin

Five (05) mice were used for the acute toxicity study. For acute toxicity study mice were treated with the 2000mg/kg body weight extract of okra by oral route. After the oral administration of okra extract, animals were observed individually at least once during the first 30 minutes, periodically during the first 24 hours, with special attention given during first 4 hours, and 14 days regularly observed for toxicity determination of extract of *Abelmoschus esculentus.*

Dosing protocol using 5mg/kg body weight of the standard drug metformin was weighted and dissolved in sterile distilled water. It was given to the Metformin Control (MC) group.0.4ml/L animal body weight extract of Okra (*Abelmoschus esculentus*) was measured and it was given to the Diabetic with WSF of *Abelmoschus esculentus* (WFC) group. *Abelmoschus esculentus* extract was given to the Diabetic rats with metformin and WSF of *Abelmoschus esculentus* (DMF) group. The Diabetic Control group and the normal Control group were not treated by the test drugs. The groups were fed with normal diet and water was given ad libitum.

3. Statistical Analysis

All the data were expressed as mean + SEM were evaluated by one-way analysis of variance (ANOVA) followed by Drunnett's test for multiple comparisons using prism Graphpad version 5.0 and values of $P<0.05$ were considered as statistically significant.

4. Results

Results of the In-Vitro Anti-Oxidant activity of Ascorbic acid by DPPH free radical scavenging method: Calculation of Antioxidant activity test group is summarised in Table 1.

5. Discussion

There were no significant changes in the mice body weight. The dose was 2000 mg/kg. The oral administration of okra (*Abelmoschus esculentus*) extract did not show any toxicity signs and mortality up to 14 days during acute toxicity study. The extract was found to be safe at the dose level of 2000mg/kg body weight. There was no toxic effect, no lethal effect on animals in all groups after 14 days of observation. LD50 higher than 15 gm/kg b.w. is categorized "Practically Non-Toxic". In this study, administrations of *Abelmoschus esculentus* (okra) extract (2000mg/kg b.w.), Metformin with *Abelmoschus esculentus* extract (5mg/kg b.w. and 2000mg/kg b.w.) and Metformin (5mg/kg b.w.) decreased elevated blood glucose levels significantly from first to fourth week compared to diabetic control rats.

6. Conclusion

In this study administrations of *Abelmoschus esculentus* (okra) extract (2000 mg/kg body weight led to reduction of fasting and post prandial glucose levels, Metformin with *Abelmoschus esculentus* extract (5mg/kg body weight. And 2000 mg/kg body weight and metformin 5mg/kg body weight decreased elevated blood glucose levels significantly from first to fourth week compared to diabetic control rats and showed minimal safety concerns.

7. Source of Funding

None.

8. Conflict of Interest

None.

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