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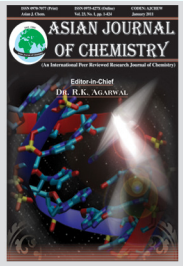

Antidiabetic and Antiinflammatory Studies of *Alpinia galanga* Rhizome

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Alpinia galanga rhizome is widely used in traditional medicine to treat various human aliments. In order to prove scientifically the ethnomedical uses of *Alpinia galanga*, the antiinflammatory and antidiabetic properties of the methanolic extract and isolated galangoisoflavonoid (AG12) component of *Alpinia galanga* in experimental animal models are investigated. The obtained results were found to be significant.

Key Words: *Alpinia galanga*, Carragenan, Alloxan monohydrate.

INTRODUCTION

Alpinia galanga Willd is a perennial herbaceous plant belonging Zingiberaceae family, commonly known as Kulingen, greater galangal[1-3]. *Alpinia galanga* Willd is known to possess antimicrobial activity, antioxidant activity, anticancer activity and gastroprotective activity[4-6]. *Alpinia galanga* is widely used in traditional medicine for the management and control of a plethora of human ailments. In the continuation of extraction and isolation work done on *Alpinia galanga*[7-9], the present study was undertaken to investigate the antiinflammatory[10] and antidiabetic[11] properties of the methanolic extract and isolated galangoflavonoid component of *Alpinia galanga* in experimental animal models.

EXPERIMENTAL

The dried rhizomes of *Alpinia galanga* (Zingiberaceae), purchased locally from the market of Pusad and were identified by Prof. Anjula Pandey, Taxonomist, National Bureau of Plant Genetic Resources, PUSA, New Delhi. Voucher specimen No. EP-542 was deposited in the Natural Medicine Research Center of this Institute.

Extraction[7-9] : Defatting of dried, ground rhizomes of *Alpinia galanga* (3000 g) was done with petroleum ether and successively extracted with methanol using Soxhlet apparatus. The methanolic extract was evaporated to yield a dark brown solid, which was subjected to various pharmacological activities. Ethical clearance for animal study was obtained from institutional animal ethical committee (IAEC/NIET/06/02).

Isolation[9]: The methanolic extract of *Alpinia galanga* was subjected to column chromatography and eluted with ethyl acetate-methanol (9:1) to yield galangoisoflavonoside (AG12). The structure of the isolated compound AG12 compound is given in Fig. 1.

Compound AG12: IUPAC name: 5,6,7,8,4'-pentahydroxy isoflavone-6-(9"-octadecenoate)-7-[β-D-glucopyranosyl-(G-2→G-1')-β-D-glucopyranosyl(G-2'→G-1")-β-D-glucopyranosyl-(G-2"→G-1"')-β-D-glucopyranosyl]4'-[β-L-arabinofuranosyl-(A-2→A-1')-β-L-arabinofuranosyl-A-2→A-1')β-L-arabinofuranosyl(A-2"→A-1"')-β-L-arabinofuranoside.

Antidiabetic study: The investigations of methanolic extract and isolated galangoflavonoid component of *Alpinia galanga* were done on albino rats of either sex (110-140 g) in groups of 6 each. The albino rats were kept under standard conditions at an ambient temperature 25 ± 2 °C. Food and water were withdrawn prior to the experiments. Alloxan monohydrate 150 mg/kg, body weight was dissolved in normal saline and injected intraperitoneally to induce hyperglycemia. The blood glucose level (BGL) was monitored after alloxanization in blood. The blood samples were collected by tail tipping method. The blood glucose level was measured using glucometer (Easy Gluco™ Meter, Morepan Ltd.) and test strips (Easy gluco™ Teststrips, Infopia Ltd.). After 48 h, the rats having blood glucose level above 150 mg/dL of blood were selected for the study and divided into 5 groups: Group I contained normal animals and served as normal control. Group II served as diabetic control. Group I and II received vehicle during the experiments. Groups III received Human Mixtard

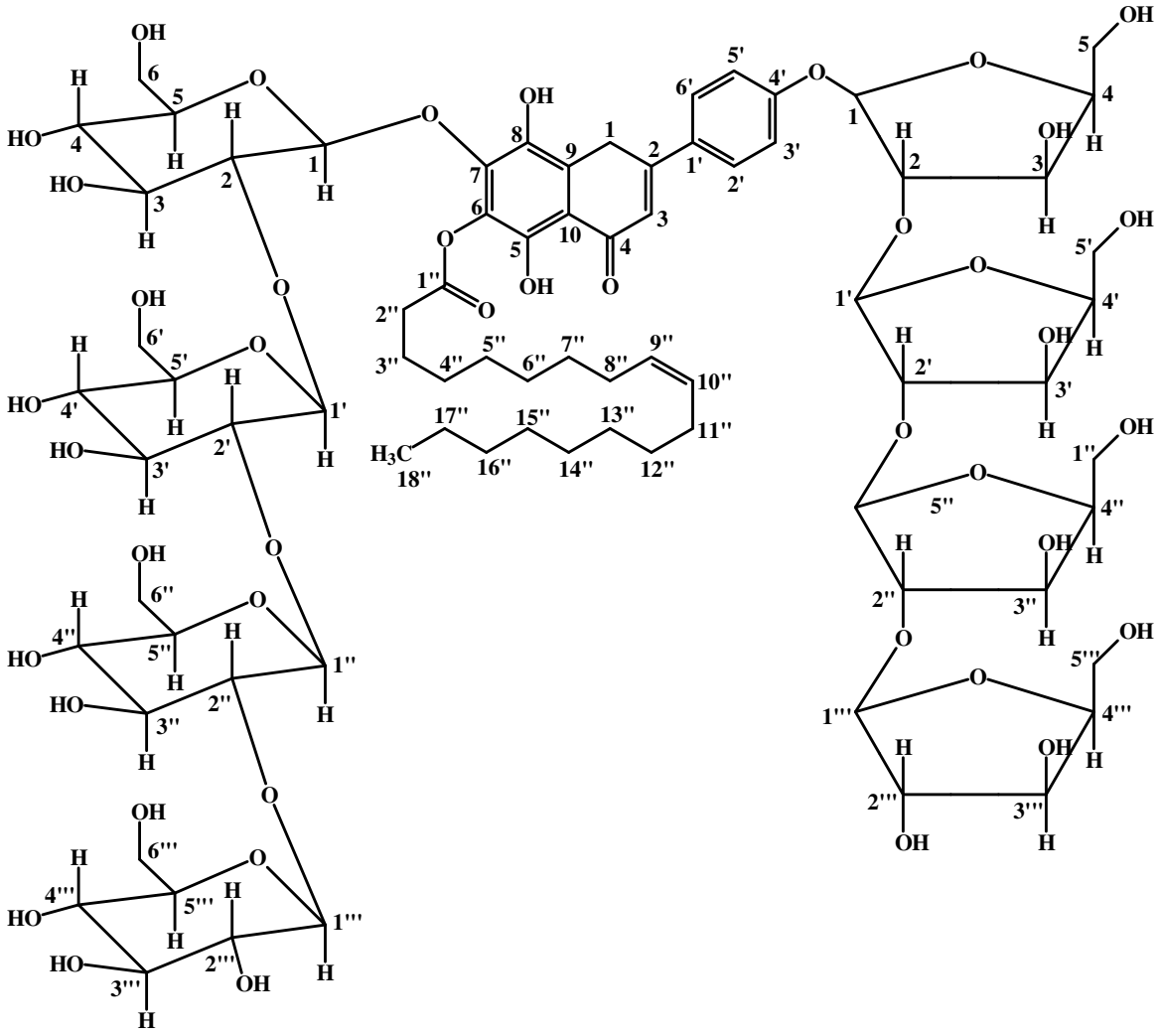

Fig. 1. Structure of galagoisoflavonoid (AG12)

(Insulin injection biphasic isophane, Ph. Eur) 2 IU/mL. Group IV and V received *Alpinia galanga* methanolic extract at dose 100 mg/kg, 200 mg/kg, respectively for 5 days.

Group VI and group VII received isolated compound AG12 at dose 5 mg/kg, 10 mg/kg body wt., respectively. The dosing was done at 9.00 AM daily. Initial and 5 days nonfasting blood glucose levels were determined. The body weight of animals were monitored to adjust the dose.

Antiinflammatory activity: Antiinflammatory activity was studied by carrageenan induced hind paw edema method[11]. The first group and second group were kept as control and standard, which were administered orally with 0.5 % carboxymethyl cellulose solution and diclofenac sodium, respectively. Where as the rest of test groups received the methanolic extract and isolated compound AG12. After 1 h of administration of test *i.e.* methanolic extract and compound AG12, a freshly prepared solution of carrageenan (1 % in sterile 0.9 % NaCl solution) in a volume of 0.1 mL was injected subcutaneously into the sub planter region of the right hind paw. Then, after 3 h of administration of carrageenan injection, right hind paw volume was measured with the help of plethysmometer. The percentage inhibition of inflammation was calculated according to the formula given below:

$$\text{Inhibition of inflammation (\%)} = \left(1 - \frac{V_t}{V_c}\right) \times 100$$

where, V_t represents the mean increase in paw volume in rats treated with test compounds. V_c represents the mean increase in paw volume in control group of rats.

RESULTS AND DISCUSSION

The results of the antidiabetic activity of the extracts are summarized as the change in blood glucose level (BGL) in Table-1. The administration of methanolic extract (at a dose level of 100 and 200 mg/kg body weight) as well as isolated compound AG12 (at a dose level of 5 and 10 mg/kg body weight) of *Alpinia galanga* to alloxanized diabetic rat produced a significant reduction ($p < 0.01$) in blood glucose level in prolonged treatment (5 days) in comparison to control group. A sustained significant ($p < 0.01$) reduction in the blood glucose levels of treated rats was observed throughout the period of treatment. The administration of methanolic extract at a dose level of 100 and 200 mg/kg body weight produced a significant ($p < 0.01$) percentage inhibition of carragenan induced paw oedema with 42.81 % and 54.37 %, respectively. Also, adminis-

TABLE-1
ALLOXAN INDUCED ANTIDIABETIC STUDY OF METHANOLIC EXTRACT AND AG12

S. No.	Treatment	Dose	Blood glucose level (mg/dL)	
			Initial	Fifth day
1	Control (Vehicle)	–	97.8 ± 9.6	96.8 ± 4.8
2	Control (Diabetic)	–	452.16 ± 8.2**	458.66 ± 7.1
3	Standard (insulin)	2 IU/kg	573.33 ± 5.175**	256.83 ± 2.4**
4	Extract of *Alpinia galanga*	100 mg/kg	346 ± 13.3**	105.5 ± 5.9**
5	Extract of *Alpinia galanga*	200 mg/kg	316.83 ± 8.6**	93.33 ± 3.204**
6	Isolated compound (AG12)	5/mg, i.p	335.33 ± 12.7**	139.6 ± 6.426**
7	Isolated compound (AG12)	10/mg, i.p	244.33 ± 3.141**	133.5 ± 1.73**

n = 6; p** < 0.01, compared to control (vehicle on initial and diabetic on 5th day). Data was analyzed by Annova applying Dunnet's test.

TABLE-2
CARRAGEENAN-INDUCED HIND PAW EDEMA METHOD

S. No.	Treatment	Dose	Mean Edema ± SD (mL) after		% Inhibition of Edema	
			1 h	3 h	1 h	3 h
1	Control (Saline)	5 mL/kg	0.320 ± 0.13	0.53 ± 0.14	–	–
2	Standard (Diclofenac)	10 mg/kg	0.070 ± 0.03**	0.11 ± 0.03**	76.02	77.81
3	Extract	100 mg/kg	0.240 ± 0.06	0.30 ± 0.08**	25.51	42.81
4	Extract	200 mg/kg	0.210 ± 0.04**	0.24 ± 0.17**	33.16	54.37
5	Isolated Compound (AG 12)	5 mg/kg	0.260 ± 0.06	0.32 ± 0.03**	26.00	41.19
6	Isolated Compound (AG 12)	10 mg/kg	0.221 ± 0.06	0.26 ± 0.08**	36.96	53.43

n = 6; p** < 0.01 compared to control. Data was analyzed by Annova applying Dunnet's test.

tration of isolated compound AG12 (at a dose level of 5 and 10 mg/kg of *Alpinia galanga* produced a significant ($p < 0.01$) percentage inhibition of carragenan induced paw oedema with 41.19 and 53.43 %, respectively (Table-2).

Edema depends upon the participation of kinins and polymorphonuclear leukocytes with their pro inflammatory factors including prostaglandins. The development of edema in the paw of the rat after the injection of carrageenan has been described as a biphasic event. The initial phase was observed for around 1 h, for observation of the release of histamine and serotonin. The second accelerating phase of swelling is due to the release of prostaglandin like substances.

Conclusion

The methanolic extract of *alpinia galanga* as well as the isolated compound AG12 showed significant antidiabetic and antiinflammatory activity. Both of these activities might be attributed to the presence of flavonoid nature of compound. For proving it as efficacious drug, it still requires chronic studies in future.

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