Analgesic and antiinflammatory activities of *Sida cordifolia* Linn

Sida cordifolia Linn is a herb belonging to the family *Malvaceae*. The water extract of the whole plant is used in the treatment of rheumatism.[1] Earlier, phytochemical studies of its roots have shown the presence of ephedrine, vasicinol, vasicinone and N-methyl tryptophan.[2] The objective of the current study is to evaluate the analgesic and antiinflammatory activities of different extracts of S*ida cordifolia* Linn (SIC).

The aerial parts of SIC were collected from the south-eastern region of Bangladesh. The air-dried powder of the plant (5.5 kg) was successively extracted with chloroform (3x72 h), methanol (3x72 h) and 80% ethanol (3x72 h). Chloroform and methanol extracts were evaporated to dryness under reduced pressure at 40°C to yield extracts A and B, respectively. The 80% ethanol extract C was concentrated to one-third of its volume and was partitioned with hexane, dichloromethane, ethyl acetate and butanol. Evaporation of the hexane, dichloromethane, ethyl acetate and butanol extracts, under reduced pressure at 40°C, yielded the dry extracts D, E, F and G respectively. After acid base treatment, the methanol extract B afforded the basic extract H and the neutral extract I.

Long Evans rats (150-200 g) and Swiss albino mice (25-30 g) of either sex were collected from the International Centre for Diarrhoeal Diseases and Research, Bangladesh (ICDDR, B). The animals were kept in polyvinyl cages under controlled room temperature (25±2°C) for 7 days and supplied with ICDDR, B formulated food pellets and water *ad libitum*.

No adverse effect or mortality was detected in the Swiss albino mice up to 4 g/kg, p.o., for any of the extract of SIC during the 24 h observation period.

The pre-screened Swiss albino mice employed for the acetic acid induced writhing test[3] were divided into groups. [Table 1] The inhibition of the writhing reflex in mice by the plant extracts (*p.o.* at a dose of 100 and 200 mg/kg, body weight) were compared against the standard analgesic, aminopyrine 50 mg/kg, p.o. The analgesic activity was assessed by calculating the number of writhing reflexes for 10 min, occurring immediately after 0.1 ml/10 g of intraperitoneal acetic acid (0.7%).

In carrageenan induced rat paw edema[4] the rats were divided into groups. [Table 2] Acute inflammation was produced by subplantar injection of 0.1 ml of 1% suspension of carrageenan with 2% gum acacia in normal saline, in the right hind paw of the rats, one hour after oral administration of the drugs. The paw volume was measured plethysmometrically (Ugo Basile, Italy) at 1, 2, 3, 4 and 24 h after the carrageenan injection. The plant extracts were given orally (100 and 200 mg/kg body weight) in suspension form. Phenylbutazone suspended in 2% gum acacia at a dose of 100 mg/kg, p.o., was used as the standard antiinflammatory drug.

Table 1

Effects of different extracts of *Sida cordifolia* Linn. on acetic acid induced writhing response

Group	*Dose[a] mg/kg*	*[b]Mean writhing ± SEM*	*% inhibition of writhing reflex*
Control		41.33 ±1.14	-
A	100	17.00 ±1.70*	58.86
	200	13.83 ±94*	66.53
B	100	22.50 ±1.47*	45.56
	200	19.50 ±1.62*	52.81
C	100	30.16 ±2.01*	27.02
	200	26.50 ±1.22*	35.88
D	100	21.16 ±1.76*	48.78
	200	18.33 ±1.79*	55.64
E	100	30.50 ±1.33*	26.20
	200	18.00 ±1.73*	56.44
F	100	30.33 ±1.98*	26.61
	200	19.66 ±1.87*	52.43
G	100	37.83 ±2.48	08.46
	200	31.83 ±1.13*	22.98
H	100	23.33 ±2.80*	43.55
	200	18.16 ±1,19*	56.06
I	100	24.33 ±2.26*	41.13
	200	18.66 ±2.02*	54.85
Aminopyrine	50	10.32 ±2.00*	75.03
One-way ANOVA	F	22,6	
	df	19,100	
	P	<0.0001	

[a]1 h after drug treatment, the mice were injected i.p., with 0.7% (v/v) acetic acid (0.1ml/10 g); immediately after the injection, the writhing reflexes were counted for 10 min. [b]Values are mean± SEM. n=6 in each group; One-way ANOVA; **P*<0.01 compared to control; A=chloroform extract; B=methanol extract; C=80% ethanol extract; D=hexane extract; E=dichloromethane extract; F=ethyl acetate extract; G=butanol extract; H=the basic fraction of methanol extract; I= the neutral fraction of methanol extract.

The results were analyzed for statistical significance using one-way ANOVA followed by Dunnett's test. $P<0.05$ was considered significant.

From the experimental data [Table 1], it is found that the extracts A, B, D, E, F, H and I in doses of 100 and 200 mg/kg body weight showed significant inhibition of writhing reflexes i.e., (58.86, 66.53%), (45.56, 52.81%), (48.78, 55.64%), (26.20, 56.44%), (26.61, 52.43%), (43.55, 56.06%) and (41.13, 54.85%), respectively with the statistical significance of ($P<0.01$). Among the SIC, the maximum and minimum analgesic activity was exhibited by chloroform extract A and butanol extract G respectively.

Table 2

Effects of different extracts of *Sida cordifolia* Linn. on carrageenan induced rat paw edema

Group	*Dose[a] mg/kg*	*Carrageenan induced rat paw edema (% inhibition of paw volume)*				
		1 h	*2 h*	*3 h*	*4 h*	*24 h*
Control	-	145.50 ± 7.43	120.00 ± 7.41	92.33 ± 4.46	78.33 ± 6.70	40.33 ± 2.16
A	200	113.33 ± 4.30** (22.10)	87.17 ± 4.93** (27.35)	64.33 ± 4.32** (30.32)	52.00 ± 3.16** (33.61)	34.83 ± 1.17 (13.63)
B	200	121.16 ± 3.84** (16.72)	95.50 ± 7.99* (20.41)	66.83 ± 3.58** (27.61)	52.50 ± 3.54** (32.97)	34.66 ± 2.59 (14.05)
C	200	117.33 ± 3.32** (19.36)	91.83 ± 5.51** (23.47)	69.66 ± 4.73* (24.55)	68.33 ± 4.12 (12.76)	37.33 ± 1.26 (7.43)
D	200	125.66 ± 4.89** (13.63)	97.33 ± 5.96* (18.89)	78.83 ± 3.79 (14.62)	69.16 ± 5.66 (11.70)	37.16 ± 1.19 (7.86)
E	200	129.50 ± 4.09 (10.99)	106.66 ± 3.12 (11.11)	69.33 ± 6.77** (24.91)	60.66 ± 3.92** (22.55)	35.16 ± 1.56 (12.81)
F	200	115.66 ± 4.59** (20.50)	90.66 ± 3.98** (24.45)	68.66 ± 4.65** (25.63)	51.33 ± 2.78** (34.46)	36.33 ± 1.33 (9.91)
G	200	105.50 ± 4.22** (27.49)	82.00 ± 6.49** (31.66)	57.50 ± 6.85** (37.72)	47.50 ± 3.76** (39.35)	36.16 ± 2.27 (10.33)
H	200	120.16 ± 5.10** (17.41)	95.83 ± 6.37* (20.14)	60.00 ± 4.66** (35.01)	46.33 ± 4.71* (40.85)	35.33 ± 1.63 (12.39)
I	200	129.83 ± 5.86 (10.76)	101.66 ± 4.86 (15.28)	72.16 ± 2.80* (21.84)	60.33 ± 3.27** (22.97)	35.50 ± .99 (11.97)
PBZ	100	106.66 ± 3.88** (26.69)	76.00 ± 3.05** (36.66)	48.83 ± 4.10** (47.11)	48.33 ± 3.46** (38.29)	32.33 ± 2.25** (19.83)
One-way ANOVA	F	8.93	8.62	5.17	7.16	1.3
	df	10, 55	10, 55	10, 55	10, 55	10, 55
	P	<0.0001	<0.0001	<0.0001	<0.0001	<0.05

Values are mean±SEM. n=6 in each group. [a]1 h after drug treatment, p.o., carrageenan was administered in rat hind paw; paw volume is expressed in displacement height (in mm) of Hg level (% inhibition of edema within parentheses). One-way ANOVA; ***P*<.01,**P*<.05 compared to control; PBZ=phenylbutazone.

Results [Table 2] show that the extracts A, B, F, G and H exhibited sufficient inhibition of paw edema of 33.61, 32.97, 34.46, 39.35 and 40.85%, respectively at the end of the fourth hour. The activities of different SIC extracts were comparable to the standard drug, phenylbutazone. In this experiment, the lower dose 100 mg/kg did not show any significant antiinflammatory activity (data not given).

The exact mechanism(s) of the analgesic and antiinflammatory activities of the extracts is/are yet to be elucidated.

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