

## Anti-inflammatory activity of the hydroalcoholic extract of leaves of *Sida rhombifolia* L. (Malvaceae)

Najeh Maissar KHALIL <sup>1\*</sup>, Joceana Soares SPEROTTO <sup>2</sup> & Melania Palermo MANFRON <sup>2</sup>

<sup>1</sup> Dep. de Farmácia e Bioquímica - Laboratório de Bioquímica Clínica/UFVJM,  
Rua da Glória 187, 39100-000 - Diamantina- MG- Brasil.

<sup>2</sup> Departamento de Farmácia Industrial, UFSM, Av. Roraima s/n Prédio 26, CCS, DFI,  
Camobi, Santa Maria/RS, Brasil, 97119-900

**SUMMARY.** The hydroalcoholic extract of leaves of *Sida rhombifolia* L. (Malvaceae) were tested to evaluate its anti-inflammatory activity. Oedema induced by injecting carrageenan was decreased by oral administration of extract (400 mg/kg) presented inhibitory effects, compared to the control group (p<0.05). This result seems to support the use of *S. rhombifolia* leaves ethanolic extract in relieving inflammation.

**RESUMEN.** "Actividad antiinflamatoria del extracto hidroalcohólico de hojas de *Sida rhombifolia* L. (Malvaceae)". Se evaluó la actividad antiinflamatoria del extracto hidroalcohólico de hojas de *Sida rhombifolia* L. (Malvaceae). La inducción del edema de pata por carragenina fue significativamente inhibida (P<0,05) por la administración oral del extracto (400 mg/kg). Los resultados indican que el extracto hidroalcohólico de hojas *S. rhombifolia* estaría dotado de actividad antiinflamatoria.

### INTRODUCTION

Species belonging to the genus *Sida* has been used in traditional medicine and several therapeutic activities were reported, among them *S. humilis* possesses antiartritic action <sup>1</sup>; *S. rhombifolia*, *S. acuta* and *S. veronicaefolia* antibacterial activity <sup>2</sup>; *S. rhombifolia* exhibited cytotoxic activity <sup>3</sup> and from *S. acuta* <sup>4</sup> antimalarial activity.

In *S. rhombifolia* has been reported the presence of fatty acids, amino acids <sup>5</sup>; alkaloids <sup>6</sup> and ecdysteroids <sup>7</sup>; *S. rhombifolia*, *S. acuta* and *S. veronicaefolia* contain alkenes, steroids and hydrocarbons <sup>2</sup>; there are cyclopropenoid fatty acids in seed oils of *S. acuta* and *S. rhombifolia* <sup>8</sup>; *S. acuta* also contains heraclenol, beta-sitosterol, acanthoside B and daucoglycoside <sup>9</sup>.

The aim of the present paper was to study the anti-inflammatory activity of the hydroalcoholic extract of leaves of *S. rhombifolia*, in experimental model of oedema.

### MATERIALS AND METHODS

#### Collection of the material

The leaves of *S. rhombifolia* were collected during the first quarter of 1996 in the roundness

of the Campus of the Universidade Federal de Santa Maria. The botanical identification was accomplished in the Botanical Department.

#### Preparation of the extract (HAE)

The leaves were dried at 50 °C and then mashed to obtain the extract. Fifty g of the powder leaves were mixed with 500 mL of hydroalcoholic solution (ethanol: water 3:7 v/v), staying in maceration for 48 h. The extract was filtered and the hydroalcoholic solution concentrated under reduced pressure, being after conserved at 40 °C for obtaining the dry residue.

#### Anti-inflammatory activity

The anti-inflammatory activity was evaluated by measuring the carrageenan-induced paw oedema according to Winter *et al.* <sup>10</sup>. Inflammation was induced by injecting carrageenan (0.1 ml of carrageenan 0.5%) subcutaneously into the sub-plantar region of the right hind paw and 0.1 ml of sterile saline (0.9%) in the left paw. The test group received orally the hydroalcoholic extract (HAE, 400 mg/kg) 1h before carrageenan injection. The control group received saline. Indomethacin (Ind; 10 mg/kg) was used

PALABRAS CLAVE: actividad antiinflamatoria; extracto hidroalcohólico; *Sida rhombifolia*  
KEYWORDS: Anti-inflammatory activity, hydroalcoholic extract, *Sida rhombifolia*.

\* Author to whom correspondence should be addressed. E-mail: najeh@universia.com.br

as a standard. Paw volume was measured before and 0, 1, 2, 3 and 4 h after the carrageenan injection using the modified plethysmometric method. The oedema was reported as the difference between the final and the initial volumes of the paw.

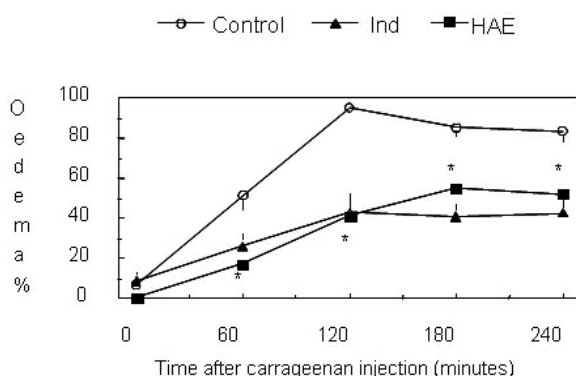
### Statistical Analysis

Data were expressed as mean  $\pm$  S.E.M. and the different treatments were compared by analysis of variance and the post-hoc Duncan's multiple range test, with the aid of the statistical software SPSS (version 1986). The minimum significance level was set at  $P < 0.05$ . Differences between two means were detected using the Student's t test

## RESULTS AND DISCUSSION

It was observed in this experiment a significant difference among the groups Ind and HAE in relation to the Control; 1, 2, 3 and 4 h after the oedema (Fig. 1;  $p < 0.05$ ). The HAE reduced the oedema significantly in 67% (1<sup>st</sup> hour  $17.27 \pm 2.07$ ) when compared with control ( $51.75 \pm 7.25$ ); in 56% (2<sup>nd</sup> hour  $41.68 \pm 3.76$ ) when compared with control ( $95.3 \pm 1.55$ ); in 37% (3<sup>rd</sup> hour  $55.27 \pm 2.52$ ) when compared with control ( $85.39 \pm 4.06$ ) and it remaining constant in 37% (4<sup>th</sup> hour  $52.37 \pm 3.57$ ) when compared with control ( $52.37 \pm 3.57$ ).

The anti-inflammatory process represents the answer of the organism to harmful incentives. In that process a variety of substances, denominat-ed as mediators of the inflammation, they are



**Figure 1.** Effect of hydroalcoholic extract (HAE) on carrageenan-induced paw oedema in rats. The results are expressed in the comparative increase in % of volume of paw oedema evaluated at 0, 1, 2, 3 and 4 hours after the carrageenan injection. # Values are expressed as means  $\pm$  SD (n=6). \* Significant at  $p < 0.05$  by Duncan's test. Ind.: indomethacin

formed and liberated at the place of the lesion. Carrageenin-induced oedema is commonly used as an experimental model for evaluation the anti-inflammatory potential of natural products <sup>11</sup>.

In agreement with literature's data, the paw oedema induced by the carrageenan injection is associated with three different phases from alterations of the vascular permeability induced by mediators. During the first 60 min, possibly histamine and serotonin release occurs. A second phase is characterized by bradykinin and prostaglandins (mainly PGE<sub>2</sub>) release <sup>12,13</sup>.

$\beta$ -sitosterol, a sterol isolated of different species of *Sida* <sup>2</sup>, which is reported to have anti-inflammatory properties <sup>14</sup>, similar to hydrocortisone and oxyphenilbutazone, might be responsible for the activity showed for HAE. The anti-inflammatory activity accomplished in mice by the oral administration of HAE of *S. rhombifolia* and Ind, as standard, showed considerable effectiveness, inhibiting the oedema of the injection subcutaneously into the sub-plantar region of 0.1 ml of carrageenan 0.5%, probably acting on the agents mediators of the inflammation.

## REFERENCES

1. Chaturved G.N. & R.H. Singh (1965) *Indian J. Med. Res.* **53**: 71-80.
2. Goyal M.M., K.K. J. Rani (1988) *J. Indian. Chem. Soc.* **65**: 74-6.
3. Islam M.E., M.E. Haque & M.A. Mosaddik (2003) *Phytother. Res.* **17**: 973-5.
4. Karou D., M.H. Dicko, S. Sanon, J. Simporé & A.S. Traore (2003) *J. Ethnopharmacol.* **89**: 291-4.
5. Bhatt D.J., A.J. Baxi & A.R. J. Parikh (1983) *J. Indian. Chem. Soc.* **60**: 98.
6. Prakash A., R.K. Varma & S. Ghosal (1981) *Planta Med.* **43**: 384.
7. Dinan L., P. Bourne & P. Whiting (2001) *Phytochem. Anal.* **12**: 110-9.
8. Ahmad M.U., S.K. Husain, M. Ahmad & S.M. Osman (1976) *J. Am. Oil Chem. Soc.* **53**: 698-9.
9. Cao J.H. & Y.P. Qi (1993) *Zhongguo Zhong Yao Za Zhi.* **18**: 681-2.
10. Winter C.A., E.A. Risley & G.W. Nuss (1962) *Proc. Soc. Biol.* **111**: 544-7.
11. Della Loggia, A., A.P. Tubaro, C. Zili, P. Del-Nagra (1986) *Clin. Biol. Res.* **219**: 481-8.
12. Di Rosa, M. (1972) *J. Pharm.* **24**: 89-102.
13. Goetzl, E.J. (1980) *N. Engl. J. Med.* **303**: 822-5.
14. Gupta, M.B., R. Nath, N. Srivastava, K. Shanker, K. Kishor & K.P. Bhargava (1980) *Planta Med.* **39**: 157-63