



SALVADORA PERSICA; ANTI-INFLAMMATORY ACTIVITY IN RATS

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Article received on:

29/04/2013

Accepted for Publication:

18/11/2013

Received after proof reading:

03/02/2014

ABSTRACT... Objective: To evaluate anti-inflammatory activity of *Salvadora persica* in rats. **Materials & methods:** The anti-inflammatory activity of *Salvadora persica* was assessed in 63 albino rats of both sexes, weighing 400 gm. They were divided into three groups, A (control), B (crude drug), C (standard drug) with twenty one animals. Each group was divided into three subgroups with seven animals. Groups B & C were given crude drug and aspirin diluted in one ml of distilled water once daily orally, in doses of 300, 500, & 700 mg/kg body weight respectively, prior to induction of edema and Group A was given same volume of saline. Inflammation was induced in hind paw of rat by sub-planter injection of 0.1 ml of 1% carrageenan. Paw volume was measured in terms of milliliters using plethysmometer, immediately before injection & then hourly up to 5 hours & mean was calculated. The inhibition of edema was calculated for each subgroup with respect to control group. **Results:** After carrageenan injection mean paw volume of control group was 5.43 ml, while that of drug treated subgroup was 4.32 ml & standard group was 4.49 ml at the dose of 700 mg/kg body weight. Comparison of crude drug with the control was found to be statistically significant only at 700 mg/kg & was comparable with the standard drug aspirin. **Conclusions:** *Salvadora persica* has shown anti-inflammatory activity by decreasing the paw volume of carrageenan induced edema.

Key words: *Salvadora persica*, Inflammation

Article Citation: Hoor T, Farooqui R, Shaikh JM, Karim N. *Salvadora persica*; anti-inflammatory activity in rats. Professional Med J 2014;21(1): 070-074.

INTRODUCTION

Inflammation is part of the complex biological response of vascular tissues to harmful stimuli, such as pathogens, damaged cells, or irritants¹. Inflammation is a protective attempt by the organism to remove the injurious stimuli and to initiate the healing process².

Acute inflammation is a short-term process, usually appearing within a few minutes or hours and ceasing upon the removal of the injurious stimulus³. It is characterized by five cardinal signs⁴. The traditional names for signs of inflammation come from Latin: Dolor (pain), Calor (heat), Rubor (redness), Tumor (swelling), Functiolaesa (loss of function)⁵.

The first four (classical signs) were described by Celsus (ca 30 BC–38 AD),⁶ while loss of function

was added later by Galen⁷ even though the attribution is disputed and the origination of the fifth sign has also been ascribed to Thomas Sydenham⁸ and Virchow^{3,4}.

Redness and heat are due to increased blood flow because of the locally released bradykinin & prostaglandins which cause vessel dilation and accumulation of inflammatory mediators to the inflamed site; swelling is caused by accumulation of fluid; pain is due to release of chemicals that stimulate nerve endings. Loss of function has multiple causes⁴.

Today's era has found a renewed interest in using herbal medicines. The reason behind this is that the allopathic medicines are generally expensive, over-prescribed, and possibly dangerous. On the other hand herbal medicines are considered safe

& 'natural'. Therefore herbal medicines are increasingly becoming popular among patients as a complementary treatment for arthritis, depression, diabetes, pulmonary complaints and for many other ailments⁹. However, the scientific screening of traditional medicines along with bioassays is not available to include them with confidence in the treatment of various ailments.

Salvadora persica (miswak/peelu) is a unique plant with anti-inflammatory, analgesic, antibacterial, antifungal, anti-ulcer, anti-seizure, antioxidant, anti-platelet, diuretic & lipid lowering activities hidden within a single plant. Extensive literature search of past five decades provide only few articles giving evidence of the anti-inflammatory activity of this plant. Whatever is available is only done along with several other activities & not separately. Available literature proves the dental aspects of the inflammatory treatment^{10,11,12,13}. It is hypothesized that this plant may possess some anti-inflammatory activity, which can be utilized elsewhere in the body. Therefore this experimental prospective study was planned to explore the anti-inflammatory activity of the plant and compare it with the gold standard drug aspirin.

MATERIALS & METHODS

This study was conducted at department of pharmacology, faculty of pharmacy, University of Karachi to detect the anti-inflammatory activity of *Salvadora persica* in animals. Albino rats bred in the animal house of faculty of pharmacy, University of Karachi were used. Animals of either sex weighing 400 gm on an average were included. Grossly overweight and grossly underweight animals were not included in the study. The plant extract was prepared by chopping fresh cleaned *salvadora* sticks (miswak) into small pieces. The chopped material was macerated with ethanol for 15 days (2 times) at room temperature. The ethanolic extract was then filtered and evaporated under reduced pressure in rotary evaporator to yield a dark brown residue. The animals were divided into three groups, A (control), B (crude drug), C (standard drug) with twenty one animals. Each group was divided into three subgroups with

seven animals. Group A was given one ml of saline. Group B & C were given crude drug and aspirin diluted in one ml of distilled water once daily orally through a metallic feeding tube in doses of 300, 500, & 700 mg/kg body weight prior to induction of edema by inflammatory agent carrageenan. Anti-inflammatory activity was determined in rats by measuring the mean increase in hind paw volume after the sub-planter injection of carrageenan¹⁴. The animals were injected with 0.1ml 1% carrageenan in 0.9% saline in the right hind foot under the planter aponeurosis.

All the doses of crude extract, aspirin and saline were given 30 to 40 minutes before carrageenan injection. The hind paw volume was measured in terms of milliliters using plethysmometer, immediately before carrageenan injection. The inflammation is again determined after every one hour of carrageenan injection up to five hours. The percent inhibition of edema was calculated for each group with respect to its vehicle treated control group. The inflammatory activity was calculated by the following relationship.

$$A-B \times 100 / A$$

Where A and B denote mean increase in paw volume of control and drug treated animals respectively¹⁵.

RESULTS

The results of anti-inflammatory activity are depicted in table I. The results show a decrease in hind paw volume of drug treated animals as compared to the control group. This finding suggests that extract of *Salvadora persica* possesses some anti-inflammatory activity. The crude extract was tested in three doses as 300 mg/kg, 500 mg/kg and 700 mg/kg of tested animals.

The results of drug treated animals, when compared with standard (aspirin at same doses respectively) showed their anti-inflammatory activity to be comparable with aspirin. It is important to note that anti-inflammatory activity of crude extract and aspirin gradually increased and

Time	Control	Crude extract (Salvadorapersica)			Standard (Aspirin)		
		300 mg/kg	500 mg/kg	700 mg/kg	300 mg/kg	500 mg/kg	700 mg/kg
Hours	ml	ml	ml	ml	ml	ml	ml
0	3.23± 0.35	2.28± 0.04	3.53±0.19	3.36± 0.08	2.79± 0.23	2.83± 0.22	3.22± 0.23
1	4.42± 0.36	3.68±0.34	4.61±0.36	3.85±0.09	3.46±0.22	3.46±0.22	3.90± 0.24
2	4.60± 0.33	4.64±0.35	4.90± 0.52	4.23±0.15	3.88±0.22	3.88± 0.22	4.25± 0.15
3	4.67± 0.30	4.64± 0.35	5.23± 0.58	4.55±0.26	4.74±0.20	4.08± 0.13	4.37± 0.17
4	5.37± 0.42	5.51± 0.44	5.36± 0.56	4.49± 0.29*	4.74± 0.20	4.74± 0.20	4.03± 0.17
5	5.42± 0.30	5.09± 0.35	5.20±0.54	4.32± 0.24**	4.68±0.28*	4.68± 0.28*	4.49± .21**

Table-I. Changes in paw volume over the five hours in control, extract and aspirin treated animals.

± = SEM

* = p value < 0.05

** = p value < 0.005

n = 7

Time	Control group	Activity of crude extract at 700 mg/kg	Activity of standard Aspirin at 700 mg/kg
Hours	ml	ml	ml
0 hour	3.23±0.35	3.36±0.08	3.22±0.23
5 hour	5.42±0.30	4.32±0.24**	4.68±0.28*

Table-II. Comparison of lowest & highest activity of control, extract & aspirin treated animals

± = SEM

* = p value < 0.05

** = p value < 0.005

n = 7

became maximum at fifth hour after drug administration. A comparison of the control group and the activity of both crude and standard at zero hour and highest point (concentration & duration) are depicted in table II. The graphical representations of the results are shown in figures 1 to 3.

DISCUSSION

Salvadora persica is a plant with a religious value, belonging to the family Salvadoraceae. It is an evergreen shrub or small tree. The generic name was given in 1749 in honor of an apothecary of Barcelona, Juan Salvador Y Bosca (1598-1681), by Dr Laurent Garcin, botanist, traveler and plant collector¹⁶.

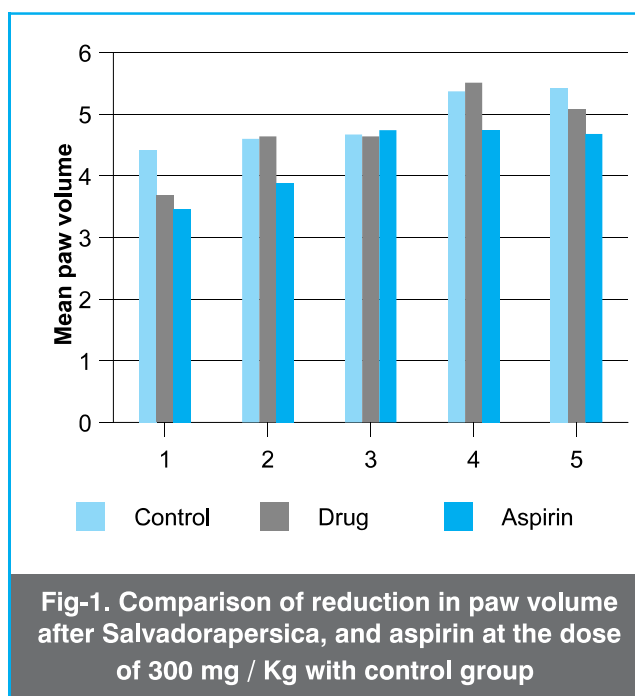
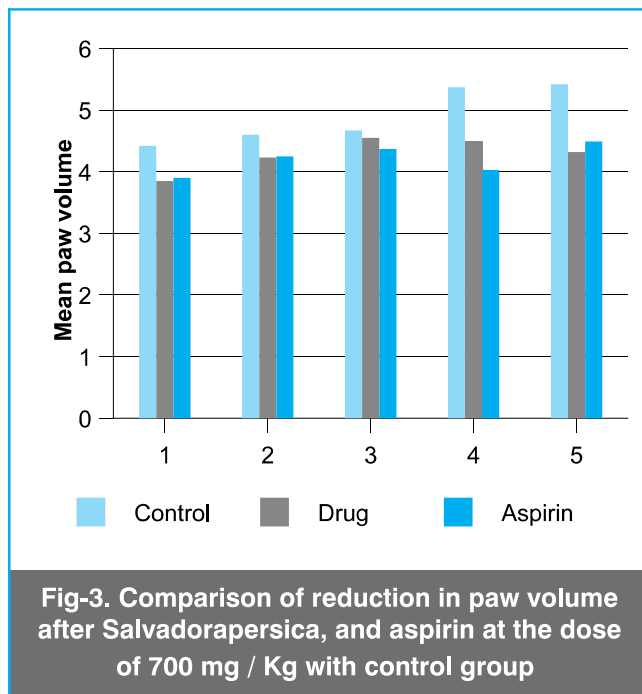
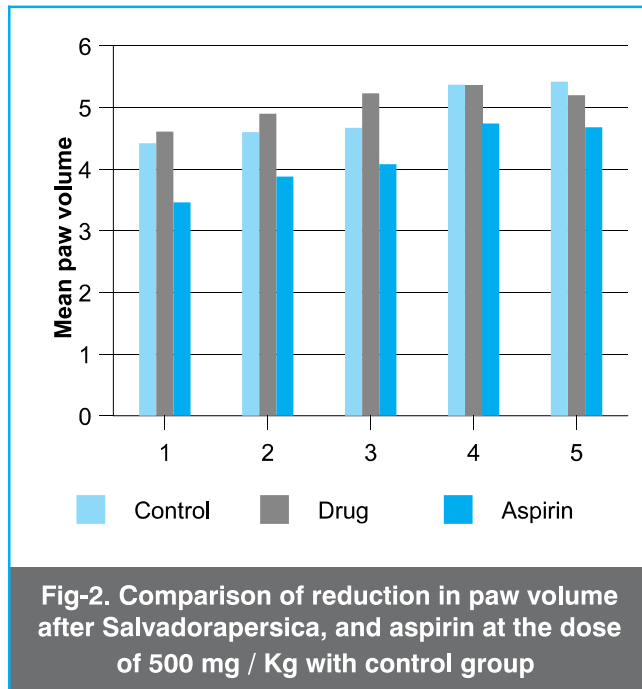


Fig-1. Comparison of reduction in paw volume after Salvadorapersica, and aspirin at the dose of 300 mg / Kg with control group

The literature survey showed that *Salvadora persica* is an important medicinal plant with various important medicinal activities for example analgesic, anti fungal, anti-bacterial etc^{17,18,19}.

The results of the present study showed that the crude ethanolic extract of *Salvadora persica* showed anti-inflammatory activity. This activity was not very significant at 300 mg/kg but was significant at 500 mg/kg and 700 mg/kg, which



were comparable with the standard drug aspirin. The most pronounced anti-inflammatory effect was observed after 4 hours which then started to decline.

These findings are in accordance with the findings of Ahmed²⁰ et al., who worked on ethanolic extract

in doses 300 & 500 mg/kg and compared it with indomethacin, he found that *Salvadora persica* has anti-inflammatory activity in 300 mg dosage but more pronounced on 500 mg/kg dose. Ibrahim²¹, who worked on aqueous extract & ethyl acetate extract of the same plant at 100 mg/kg dose compared it with indomethacin, found out that the anti-inflammatory activity is better than control group but not comparable with indomethacin. The vehicle itself i.e. water, ethyl acetate or ethanol *per se* does not have any anti-inflammatory activity. The above discussed results are indicative of the fact that this drug can be used as a useful agent not only in dentistry but with some modifications in other medical problems as well.

CONCLUSIONS

As a result of the above research it can be deduced that *Salvadora persica* has a dose dependent anti-inflammatory property which is maximum at 700 mg/Kg and stays up to four hours. Human trials are suggested for its safe use as anti-inflammatory agent.

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