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The Potential Anti-inflammatory activity of essential oils of *Pituranthos triradiatus* and *Anthemis deserti* in rats

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ABSTRACT
In this study, we evaluated the anti-inflammatory activities of essential oils of Pituranthos triradiatus and Anthemis deserti against the carrageenan induced rat paw edema. Thirty-six adult male rats weighting 180-200g were divided into six groups of six rats each. Group I (control) received the vehicle (0.25% gum acacia solution) while group II received indomethacin (0.2 mg/kg) orally, and served as reference. Animals of groups III and IV received essential oil of P. triradiatus at 25 and 50 mg/ kg, respectively. Groups V and VI received essential oil of A. deserti at 25 and 50 mg/ kg, respectively. Inflammation was induced by injecting 100 uL of 1% suspension of carrageenan into the subplantar surface of the left hind paw of the rats. The edema was quantified by measuring the paw volume at 1, 2, 3, 4, 5 and 6 h after carrageenan injection. After one hour of carrageenan injection, indomethacin (0.2 mg/kg) and the oils of P. triradiatus (50 mg/kg) and A. deserti (25 and 50 mg/kg) reduced the mean increase of paw volume as compared to the control paw volume. The mean differences (compared to control group) of reduction of paw swelling in case of 50 mg/kg of P. triradiatus and A. deserti oils after 5h of carrageenan injection were 22.92 and 27.38%, respectively corresponding to 49.68% in indomethacin. The better anti-inflammatory effect was recorded for P. triradiatus and A. deserti oils (26.15 and 31.38% inhibition, respectively) at a dose of 50 mg/kg4h after carrageenan injection.
Key words: *paw edema, carrageenan, anti-inflammatory activity, essential oils.*

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INTRODUCTION

Inflammation is a protective measure taken by the organism to eliminate the injurious stimuli. Acute inflammation is the initial response and is characterized by the increased movement of plasma and innate immune system cells, such as neutrophils and macrophages, from the blood into the injured tissues. The use of anti-inflammatory substances can be an effective tool in the therapeutic treatment of the diseases. In this context, medicinal plants and their isolated compounds are employed worldwide in folk medicine to treat different inflammatory conditions, such as lung and skin inflammations.

Essential oils are a mixture of volatile and natural substances, characterized by a strong odor and produced by aromatic plants as secondary metabolites. They have a wide range of applications and have been commercially important for the pharmaceutical, food, cosmetic and perfume industries. In Nature, essential oils play an important role in the attraction of insects to promote the dispersion of pollens and seeds or to repel other ones. In addition, essential oils may also act as antibacterials, antivirals, antifungals, insecticides, herbicides, or have feeding deterrent effects against herbivores by reducing their appetite for such plants [1]. This class of natural products is attracting the interest of many researchers to investigate its potential as drugs for the treatment of various diseases. Some pharmacological activities of

these oils, such as antitumoral and antinociceptive actions are related to their anti-inflammatory effects [2 &3].

Essential oils have a complex composition, containing from a dozen to several hundred components. The great majority of components identified in essential oils includes terpenes (oxygenated or not), with monoterpenes and sesquiterpenes prevailing. Nevertheless, allyl-and propenylphenols (phenylpropanoids) are also important components of some essential oils [1].

P. triradiatus belonging to family Apiaceae (Umbelliferae) are well known producers of furanocoumarins. Furanocoumarins have several interesting biological activities, such as analgesic, anti-inflammatory, antibacterial, antiviral, anticoagulant. Seven compounds were isolated from the roots of *Pituranthos tortuosus*. The isolated compounds were identified as bergapten, graveolone, xanthotoxin, isopimpinellin, aesculetin dimethyl ether, stigmasterol glucoside, in addition to the new ester 4-methoxyphenylumbellate.

Anthemis L., the second largest genusin the Asteraceae family, consists of more than 210 species. *Anthemis deserti* is used as a herbal medicine, insecticide, food additive, as well as an important source in aromatic and cosmetic industries [4]. *Anthemis deserti* showed cytotoxicity towards sensitive and drug-resistant solid cancer cell lines and normal cells [5].

The herbal compounds are getting more importance in the treatment of inflammation because of the toxic effect of the current therapy used to treat those inflammation using synthetic drugs. Herbal compounds are less toxic and less costly when compared to the synthetic drugs. Therefore, the aim of this study is to investigate the anti-inflammatory activity of the essential oils of *P. triradiatus* and *A. deserti* against the carrageenan induced rat paw edema.

MATERIAL AND METHODS

Plants under investigation (*Pituranthos triradiatus* and *Anthemis deserti*) were collected in February 2015 from Al-Kharj area- KSA, the collected plants were dried under shade for 7 days, after that grinded to fine powders.

Essential oil isolation- dry aerials parts powered (Stems, leaves and flowers) were hydro-distilled in a Clevenger type apparatus for 4 hours. The oil was separated from water using diethyl ether.

Experimental animals

Male Wistar rats weighing 165 to 180g were used for the experiment. Rats were obtained from Lab Animal Care Unit, Pharmacy College, Prince Sattam bin Abdulaziz University, Al-Kharj, KSA. They were housed in standard environmental condition like, ambient temperature (250 ± 10C), relative humidity (55±5%) and 12/12h light dark cycle. They were housed in standard environmental condition like, ambient temperature (250 ± 10C), relative humidity (55±5%) and 12/12h light dark cycle.

Anti-inflammatory activity

Anti-inflammatory activity was assessed by the method described by Winter [6]. Male Wistar rats were divided in six groups (n=6). Rats of groups I (normal control) and II (reference) were treated orally with the vehicle (5 mL/kg) and indomethacin (0.2 mg/kg), respectively. Rats of groups III and IV received the essential oil of *P. triradiatus* (25 and 50 mg/kg, respectively, P.O). Groups V and VI received the essential oils of *A. deserti* (25 and 50 mg/kg, respectively, P.O). One h after administration of indomethacin or oils; 100 uL of 1% suspension of carrageenan (λ-carrageenan, type IV, Sigma) in normal saline was injected into the subplanter region of left hind paw to induce edema. The paw volume was measured at 0, 1, 2, 3, 4, 5 and 6 h after carrageenan injection using plethysmometer (T Ugo Basil, Italy). The difference between the initial and subsequent values gave the actual edema volume, which was compared with control. The percentage inhibition of edema formation was calculated as:

% inhibition = 1- (Vt/Vc) X 100.

Where 'Vc' represents edema volume in control and 'Vt' edema volume in groups treated with the test oils.

Statistical analysis

Data analysis was carried out using one-way analysis of variance (ANOVA) followed by Dunnett's multiple comparison tests. $P < 0.05$ was considered statistically significant. Data values are each expressed as the mean ± S.D.

RESULTS AND DISCUSSION

The most widely used primary test to screen a new anti-inflammatory agent measures the ability of the compound to reduce local edema induced in the rat paw by injection of an irritant agent [6]. Carrageenan induced edema has been commonly used as an experimental animal model for acute inflammation and is believed to be biphasic. The early phase (1 – 2 h) of the carrageenan model is mainly mediated by histamine, serotonin and increased synthesis of prostaglandins in the damaged tissue surroundings. The

late phase is sustained by prostaglandin release and mediated by bradykinin, leukotrienes, polymorphonuclear cells and prostaglandins produced by tissue macrophages [7 & 8].

The effect of the essential oils of *P. triradiatus* and *A. deserti* (25 and 50 mg/kg) in carrageenan induced paw edema in rats is shown in Table 1 and Figure 1. Subcutaneous administration of 100 uL of 1% suspension of carrageenan induced edema in the foot pad of rat hind paw. The maximum volume of the carrageenan-injected foot pad was obtained 4 h after the administration. The paw volume at 4 h after carrageenan administration was 3.25 ± 0.19 mL.

As expected indomethacin significantly reduced carrageenan induced paw edema (Figure 1). Indomethacin at 0.2 mg/kg inhibited the edema volume by 49.68 % after 5 h of carrageenan injection as compared to the control vehicle treated group. Pretreatment with the essential oils of *P. triradiatus* and *A. deserti* showed dose-dependent inhibitory activity in carrageenan-induced paw inflammation over a period of 5 h. This indicates action against release of histamine, serotonin and kinins in early phase, while later phases are suspected to be arachidonate metabolites producing an edema dependent on mobilization of neutrophils [9]. The essential oil of *P. triradiatus* (25 mg/kg) did not influence the percentage inhibition of edema. On carrageenan induced acute inflammation model the essential oil of *A. deserti* (50 mg/kg) produced better inhibition of paw edema.

Table 1: Anti-inflammatory activity of the essential oils of *P. triradiatus* and *A. deserti* by Carrageenan-induced paw edema.

Treatment	Paw volume (mL) after						
	0 h	1 h	2 h	3 h	4 h	5 h	6 h
Control	1.35±0.08	2.07±0.11	2.76±0.13	3.12±0.16	3.25±0.19	3.14±0.18	2.84±0.21
Indomethacin (0.2 mg/kg)	1.35±0.09	1.58±0.06*	1.69±0.05*	1.78±0.07*	1.65±0.07*	1.58±0.06*	1.45±0.06
***P. triradiatus* (25 mg/kg)**	1.33±0.05	1.99±0.07	2.48±0.10	2.81±0.13	2.94±0.18	2.89±0.19	2.71±0.11
***P. triradiatus* (50 mg/kg)**	1.34±0.07	1.80±0.05*	2.09±0.14*	2.31±0.11*	2.40±0.15*	2.42±0.16*	2.31±0.13
***A. deserti* (25 mg/kg)**	1.38±0.08	1.85±0.03*	2.21±0.12*	2.49±0.12*	2.55±0.17*	2.56±0.14*	2.47±0.08
***A. deserti* (50 mg/kg)**	1.36±0.06	1.73±0.08*	1.99±0.06*	2.15±0.12*	2.23±0.11*	2.28±0.11*	2.22±0.19

Values represent the mean ± S.E. of six rats for each group.

*Significantly different from the values of the control rats at P< 0.05.

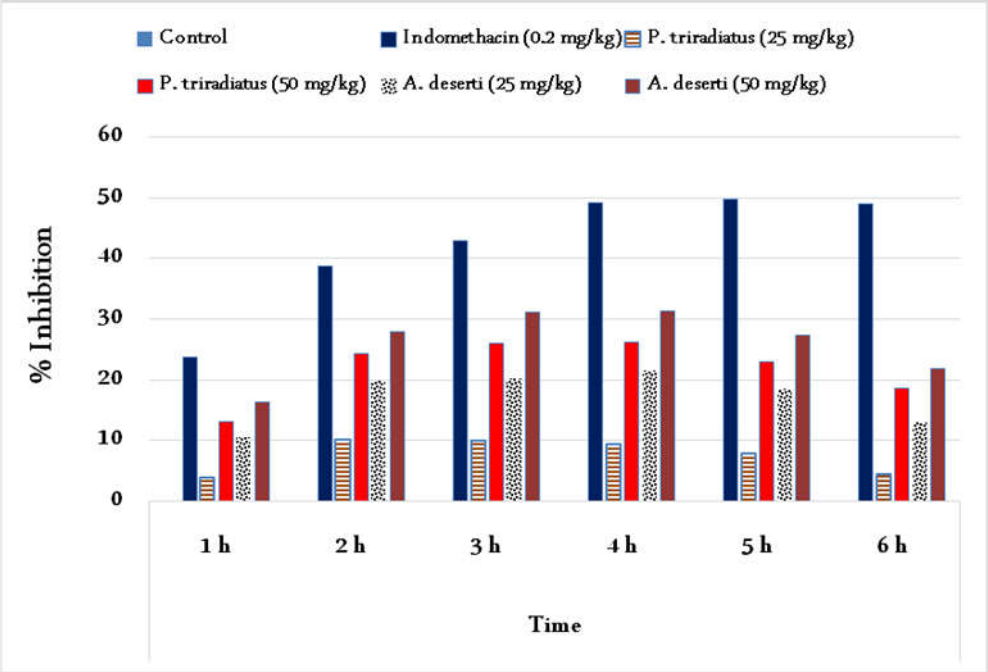

Figure 1: Percentage inhibition of paw edema exhibited by the essential oils of *P. triradiatus* and *A. deserti*.

CONCLUSION

It is concluded that the essential oils of *P. triradiatus* and *A. deserti* having good anti-inflammatory activities and it shown dose dependent activities. The results suggest the presence of biologically active components in both oils, which may be responsible for their anti-inflammatory activities.

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