

Nontoxicity and anti-inflammatory effect of extracts from *Echinacea purpurea* and *Onopordum acanthium*

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Echinacea purpurea and *Onopordum acanthium* belong to the family Asteraceae (Compositae) are among the most widely used medicinal plant species in traditional medicine. Their healing effect is due to the high content of biological active compounds – phenolic compounds, alkylamides and polysaccharides.

The aim of the study is to determine and compare the nontoxicity and anti-inflammatory effect of individual and combined extracts of *Echinacea purpurea* and *Onopordum acanthium*. Two *in vivo* methods were used to prove anti-inflammatory effect of these plants – carrageenan-induced paw edema in rats and induced inflammation with lipopolysaccharide identifying the levels of pro- and anti-inflammatory cytokines - TNF- α , IFN- γ , IL-10.

Materials and methods For these experiments we used 60% ethanol extracts of *E. purpurea* and *O. acanthium* and Combination 1 (1:1) and Combination 2 (3:1) respectively *E. purpurea* : *O. acanthium*, carrageenan, diclofenac sodium, lipopolysaccharide, cytokines: TNF- α , IFN- γ , IL-10, experimental animals: 142 white male Wistar rats. In an acute toxicity test of plant extracts, 54 male Wistar rats were treated orally with individual and combined plant extracts at a single dose of 5 g/kg b.w. and 10 g/kg b.w.. Two models of induced inflammation were used to study the anti-inflammatory effect of the extracts and their combinations:

1) with carrageenan - tested extracts at a dose of 500 mg/kg b.w.. Criteria for anti-inflammatory effect is the change in the size of the hind right paw of rats, which is reported on the second, third, fourth and 24th hour after carrageenan treatment 2) with lipopolysaccharide In this model, 40 animals were used, divided into 5 groups. They were treated for 14 days with the tested extracts at a dose of 500 mg / kg b.w., after which the animals were decapitated and blood was taken to test the levels of pro- and anti-inflammatory cytokines - TNF- α , IFN- γ , IL-10.

Results

- After the acute toxicity experiment, the results showed 100% survival of the animals, proving the nontoxicity of the individual and combined extracts.
- In a model of carrageenan-induced inflammation, Combination 2 was found to statistically significantly reduce paw edema at 24 hours. In the other groups, a decrease in edema was also observed, but only as a trend, without statistical significance.

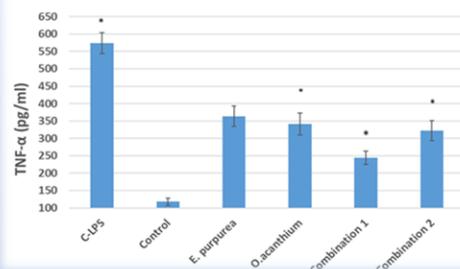


Figure 1. Levels of TNF- α in blood serum of rats exposed on induced inflammation with lipopolysaccharide after 14 days of treatment with individual and combined extracts of *E.purpurea* and *O. acanthium*

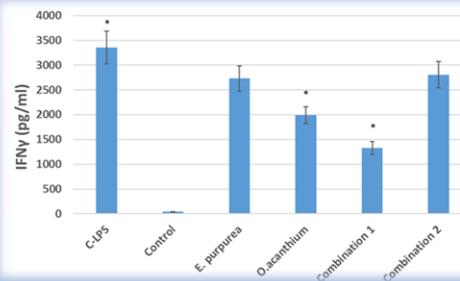


Figure 2. Levels of IFN- γ in blood serum of rats exposed on induced inflammation with lipopolysaccharide after 14 days of treatment with individual and combined extracts of *E.purpurea* and *O. acanthium*.

The most pronounced change in serum IFN- γ levels was observed in animals treated with the Combination 1 compared to the control group, followed by the groups treated with the extracts from *O. acanthium* and *E. purpurea*.

The decrease in serum TNF- α concentration in the group treated with Combination 1 was most pronounced compared to the control treated with lipopolysaccharide, followed by the group treated with Combination 2. Of the individual extracts, *O. acanthium* showed a better effect on TNF- α levels than that of *E. purpurea*.

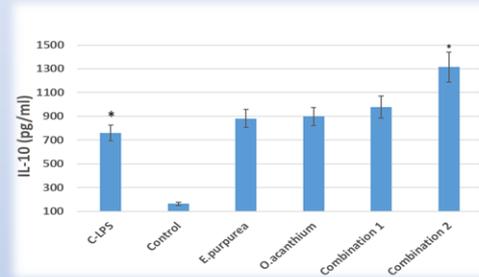


Figure 3. Levels of IL-10 in blood serum of rats exposed on induced inflammation with lipopolysaccharide after 14 days of treatment with individual and combined extracts of *E. purpurea* and *O. acanthium*.

Compared to the lipopolysaccharide-treated control group, IL-10 levels increased in all groups of animals treated with the test extracts, most notably in Combination 2, where the difference is statistically significant.

From the results obtained, it is clear that Combinations 1 and 2 show a better anti-inflammatory effect compared to individual extracts of *E. purpurea* and *O. acanthium*, significantly reducing serum levels of TNF- α , IFN- γ and increasing IL-10 levels.

Conclusion

The nontoxicity of the individual and combined extracts of *E. purpurea* and *O. acanthium* has been proven. Combined extracts have a greater effect on serum levels of TNF- α , IFN- γ , IL-10 compared to the individual extracts. This is most likely due to the synergistic action of biological active compounds contained in them. These results suggest that a combination of *E.purpurea* and *O.acanthium* possesses anti-inflammatory properties that deserve further investigation.