



Evaluation of the immunological changes in the use of Sumac herb powder (*Rhus coriaria*) compared with Levamisole in dogs

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ABSTRACT

Background & Aim: One of the major problems of modern medicine is the increasing consumption of synthetic drugs and frequent use of them will result in side effects. Considering this issue, patients should be mainly motivated to use pharmaceutical plants. Regarding the positive effects of sumac on the immune system, in the present study, we made a decision to compare sumac with levamisole as a chemical immune system stimulant compound.

Experimental: In this research, 8 native breed of dogs were studied for ten days. The dogs were divided into four groups of two including a control group, a group consuming levamisole, a group consuming the amount of 10 mg per kg sumac, and a group receiving 5 mg per kg sumac. Then, blood samples were taken and the relevant tests were performed after completing the period of intaking the prescribed amount of powders of sumac plant and oral levamisole.

Results: According to present results, significant differences were observed between treatment and control groups in terms of some factors including phagocytosis, multiplicity of phagocytosis mass and IGM whereas there was no significant difference in other factors ($p < 0.05$). It was revealed that sumac plant same as levamisole can increase immunity and phagocytosis in dogs.

Recommended applications/ industries: In present study, considering the significant positive effects of sumac on some immunological parameters, this herb is recommended to be prescribed in the food.

1. Introduction

One of the disadvantages of modern medicine is frequent and unceasing use of chemical drugs for the sake of treatment of diseases whose disadvantages can be referred to as side effects, high costs, and the availability of them in comparison to herbal medicines (Abbass et al., 2012). Considering the above mentioned cases; therefore, those of particular interest are proper nutrition, health care, physical activity, and preventive medicine which includes traditional medicine in

general and pharmaceutical herbs in particular. Therefore, today, patients should be essentially driven to the consumption of medicinal herbs (Shahbazi and Maleknia, 2015).

Considering the fact that the immune system means immunity against infectious diseases, you should keep in mind that it is affected by various factors, including diseases, stress, aging and so on. Therefore, the body's response to most diseases and disorders is the reciprocal response of the immune system (Abuk,

2015). Therefore, many efforts should be devoted to further study, strengthening and improving the health and control of this system in different situations. In addition, you can see the health of other organs and the biological and metabolic changes in the body as well as the effects and comparisons of chemical and herbal drugs by interpreting the immunological results.

Sumac, a shrub grown on mountains has cluster fruits and is of sapindales and anacardiaceae species (Tohouri, 2010). It also has leaves composed of 9 to 15 leaflets, with jagged and fluff coverings (Zargary, 1990). The part used in Iranian traditional medicine and culinary is the tiny, tart red cup-shaped shells of fruit surface called epicarp (Amin, 1991). Sumac grows widely in wild areas, from the Canary Islands (in the Atlantic) to the Mediterranean and in Iran and Afghanistan. The habitat location of sumac is Iran's East Azerbaijan province, Horand town, Arasbaran forests (Zargary, 1990). The scientific name of sumac is *Rhus coriaria* and in the ancient times was also said "Spica" (Mozafarrian, 1998).

This herb has many medicinal properties, including: blood purification of waste, antioxidant, antimicrobial, antipyretic, anti-inflammatory, anti-bleeding, relieve tooth pain, gingival strengthening, gout and rheumatism. It also lowers blood sugar to diabetics' advantage, because it prevents the occurrence of the combining process of glucose with vital proteins of body up to 81%. This process leads to a change in the chemical structure and function of these proteins and is one of the factors that makes various complications for diabetics (Mozafarrian, 1998; Tohouri, 2010).

Chemical drug used in this study was levamisole. It is an anti-worm and immune stimulant which is used to control gastrointestinal nematodes and breathing as well as to strengthen the immune system in various mammalian species, including man - carnivores - ruminants – poultry. (Ghamarian *et al.*, 2008; Einstein, 2010; Dana, 2004).

Therefore, the aim of this study was to examine and compare the effect of sumac on the immunological changes compared to that of the levamisole which is one of immune plus drugs. Due to the similarity of dog's immunology system to that of humans, outcome of present study can be a good example of generalizing the positive results of researches to human beings.

2. Materials and Methods

2.1. Supplying taxonomic identification of plant and the chemical drug being studied

Sumac plant powder was provided from herbalists in Shemiranat locality of Tehran and was identified at the Research Center of Medicinal Plants of Shahrekord Islamic Azad University, hence the validity of scientific name was approved after comparing with herbarium specimens available in Research Center of Medicinal Plants.

It was also attempted to provide chemical drug of levamisole hydrochloride commercially named as Damyazol and was packed in a 5 g sachet from veterinary pharmacies.

2.2. Sample of Animals Used in the Tests

To perform this study, eight native breed of male and matured dogs in the weight range of 25-30 kg were used. During the test, the dogs were kept in pairs in separate cages and under standard conditions at a temperature of 25-30 °C and under 12-hour photoperiodic cycles so that they had easy access to food and water. Dogs had a quite similar diet and were given anti parasites drugs of Mebendazole and Praziquantel (according to the dose) two weeks before the start of the study in order to wipe out any intestinal parasites diseases. Skin parasites were also removed by twice subcutaneous injection of Ivermectin and rinsing their skin with anti parasites skin shampoo. Then, their health is clinically examined once again before the beginning of the study. The dogs were divided randomly into four groups of two:

Group I: It was the control group and they only received food and water and no drug compound.

Group II: They were the recipient of 0.5 mg of chemical drug levamisole per kg weight.

Group III: They were the recipient of 10 mg powder of sumac herb per kg weight.

Group IV: They were the recipient of 5 mg powder of sumac herb per kg weight.

2.3. Powder prescription

Sumac plant powder and chemical drug levamisole were eaten in meals for 10 days.

2.4. Sampling

After tying the dogs, bloodletting of cephalic vein by 5 ml syringes were done; blood samples were transferred into two groups of test tubes with and without anticoagulant; and then they were sent to the

laboratory of the Faculty of Veterinary Medicine in order to be examined.

2.5. Tests of Immunology

For performing immunology tests, blood without anticoagulant was used in a manner that after centrifugation and separation of serum and blood clot formation, the amount of albumin factors, IGM and total protein were measured by spectrophotometry kits of Pars Azmun Co and by Eco-Plast Autoanalyzer device made in Italy with serial number 2006GD100139.

2.6. The percentage of phagocytosis

Staph latex (5 ml) with dilution of 10⁻⁵ was added to 1 cc fresh blood and incubated overnight at 35 °C. Then the sample was homogenized; a spread was prepared and stained with Giemsa; 100 neutrophils were counted in the spreads on lenses No. 100 and Sadr oil, and the percentage of phagocytosis were reported (Atiyabie, 2005).

2.7. The average number of phagocytosed mass

The number of 10 Staph phagocytic masses among neutrophils that showed phagocytosis were counted, averaged, and reported as the number of phagocytic mass (Atiyabie, 2005).

2.8. Statistical analysis of data

The data were statistically analyzed by ANOVA program in SPSS 23 software. The means evaluation was performed through the method of Dunnett and Tukey at the possibility level of 5 percent ($p < 0.05$).

3. Results and discussion

Immunological changes in immune factors including phagocytosis percentage, number of phagocytosed mass, phagocytosis total protein, albumin, immunoglobulin in three stages of measurement (before intervention, 5 days after intervention and 10 days after intervention) were compared in the form of charts and regarding to the use of sumac edible powder contrasting to Levamisole.

3.1. Phagocytosis Percentage

The results of one-way ANOVA indicated that although the changes made in "phagocytosis" factor, after 5 days of intervention there were no significant

difference among studied groups ($p > 0.05$). There was a significant difference 10 days after intervention ($p < 0.05$) in the studied groups received levamisole, sumac 10 g and 5 g (Table 1). In the previous study on the effect of alcoholic extract of *Zataria multiflora*, *Satureja bachtiarica* L., *Peucedanum officinale* plants on immunohematological factors of serum in rats, a significant increase was observed in phagocytosis percentage in the fifth group receiving 400 mg per kg of *Satureja bachtiarica* L. and also in the seventh group receiving 400 mg per kg of *Zataria multiflora* extract compared to the control group. Although in other experimental treatments no significant difference was observed in the percentage of phagocytosis, a relative increase in percentage of phagocytosis was observed in all of them compared to the control group (Dehkordi *et al.*, 2015). Ahmadian Attari *et al.* (2007) examined the antimicrobial effect of sumac fruit and concluded that its extract affected both gram positive and negative bacteria. This effect was stronger on gram-positive bacteria but it did not show any antifungal effects. It also affects on skin bacteria such as *Staphylococcus epidermus* and *Corine bacterium Zerousis*.

3.2. The average number of phagocytosed mass

The results indicated that there was a significant difference between changes in the number of Phagocytosed masses 5 days after intervention in the studied groups ($p < 0.05$). The difference between levamisole and 10 g sumac and the difference between 10 g and 5 g sumac were also significant (Table 2). But there was no significant difference between changes made in the number of Phagocytosed masses 10 days after intervention in studied groups ($p > 0.05$). Therefore, contrary to the fact that the number of phagocytosed mass in levamisole and control groups decreased, this parameter increased in 10 g and 5 g sumac groups which indicates the improvement of this factor. In the study of the effect of alcoholic extract of *Zataria multiflora*, *Satureja bachtiarica* L., *Peucedanum officinale* plants on immunohematological factors of serum in rats showed that there was a significant increase in the number of phagocytosis in the fifth group receiving 400 mg/kg *Satureja bachtiarica* L. extract compared to the control group. However, in other experimental treatments, no significant difference was observed in the number of phagocytosed masses. But in all experimental treatments a relative increase was observed in the

number of phagocytosed masses compared to the control group (Dehkordi *et al.*, 2015). Investigation of the antimicrobial activity of Persian sumac and *Zataria multiflora* against some of the growth-promoting

bacteria showed that sumac compared to *Zataria multiflora* could have better inhibitory effects against *Bacillus cereus* and *Staphylococcus aureus* at lower concentrations (Fazeli *et al.*, 2007).

Table 1. Descriptive results of the immunological factor of "percentage of phagocytosis" in studied groups after three intervals (Mean±SD).

Intervals	Before intervention	5 days after intervention	10 days after intervention
Control	12.50 ± 2.12 ^a	10.50± 2.12 ^a	10.00± 1.41 ^b
Levamisole	18.00± 1.41 ^a	16.50± 0.70 ^a	16.00± 2.82 ^c
Sumac (10 g)	17.00± 5.65 ^a	20.00± 4.24 ^a	20.00± 4.24 ^a
Sumac (5 g)	16.50± 2.12 ^a	17.50± 2.12 ^a	20.00± 2.82 ^a

Column values with the same superscript are not significantly different (P >0.05).

Table 2. Descriptive results of the immunological factor of "number of phagocytosed mass" in studied groups after three intervals (Mean±SD)

Intervals	Before intervention	5 days after intervention	10 days after intervention
Control	18.50 ± 0.70 ^a	14.50± 2.12 ^c	16.00± 1.41 ^a
Levamisole	25.50± 2.12 ^a	28.00± 1.41 ^a	26.00± 2.82 ^a
Sumac (10 g)	29.00± 4.24 ^a	23.50± 7.77 ^b	28.00± 2.82 ^a
Sumac (5 g)	26.50± 2.12 ^a	29.00± 2.82 ^a	26.00± 4.24 ^a

Column values with the same superscript are not significantly different (P >0.05).

3.3. Immunoglobulin (mg/dl)

The results indicated that there was no significant difference between changes made in immunoglobulin 5 days after intervention (p>0.05)but it was significant 10 days after intervention in studied groups (p<0.05). The difference between levamisole and 5 g sumac and also the difference between 10 g and 5 g sumac were significant (Table 3). Also no similar study on this subject has been done before.

In the study of the effect of alcoholic extract of *Zataria multiflora*, *Satureja bachtiarica* L., *Peucedanum officinale* plants on immunohematological factors of serum in rats, there was a relative increase in IGM in all groups. This increasement was significant in the group receiving 400 mg/kg of *Zataria multiflora* (Dehkordi *et al.*, 2015).

During the study of antimicrobial activity of the hydroalcoholic extract of sumac on *Klebsiella pneumonia* in the laboratory, Taha (2013) concluded that after treatment of infected rats with sumac extract, the number of WBCs decreased in normal range after passing 16 days since infection. In addition, the rats

were healthy with normal physiological behavior, whereas WBC rates and other immunological parameters were still high in the rats infected and untreated with sumac extract, after 16 days since infection (Taha *et al.*, 2013).

Zolfaghari *et al.* (2011) study on evaluation and clinical inspection of influence of a herbal combination on the treatment of recurrent labialis herpes showed that combination of this herb with extracts of some other herbs such as Liquorice, geranium, and Dracocephalum can ultimately be useful in the treatment of recurrent herpes (Zolfaghari *et al.*, 2011).

3.5. Albumin

Considering the difference in the results of one-way ANOVA, the results of this study indicated that the changes in albumin 5 and 10 days after intervention in the studied groups did not differ significantly (P>0.05). Compared to similar studies done on antioxidant changes in elderly rats treated with sumac extract (Abbass *et al.*, 2012) it has been noticed that the albumin parameter decreased in the non-receiving groups of sumac extract (24-month old rats) and the

control group (6 month old rats) and it didn't increase significantly in group treated with sumac extract compared to 24-month old rats. In another study, considering the effects of sumac diet on the biochemical and immunohimatological factors in

rabbits, albumin concentration was significantly higher in E3 (1% sumac recipient group) and E4 (1.50% sumac recipient group) versus to the control group (Capcarova *et al.*, 2012). It did not match with the results of this study.

Table 3. Descriptive results of the immunological factor of "immunoglobulins" in studied groups after three intervals (Mean±SD).

Treatments	Before intervention	5 days after intervention	10 days after intervention
Control	38.00 ± 1.41 ^a	45.50± 0.70 ^a	49.50± 3.53 ^c
Levamisol	36.00 ± 2.82 ^a	60.00± 2.82 ^a	86.00± 2.12 ^b
Sumac (10 g)	37.50± 2.12 ^a	52.00± 4.24 ^a	91.00± 9.89 ^b
Sumac (5 g)	39.50± 3.53 ^a	54.00± 4.24 ^a	192.00± 52.32 ^a

Column values with same superscript or no superscript are not significantly different (P >0.05).

Table 4. Descriptive results of serological factor "total protein " in studied groups after three intervals (Mean±SD)

Treatments	Before intervention	5 days after intervention	10 days after intervention
Control	18.50 ± 3.60	6.55± 0.35	6.55± 0.35
Levamisol	8.40 ± 1.55	6.15± 0.35	6.50± 0.84
Sumac (10 g)	7.20± 0.98	6.20± 0.14	6.15± 0.21
Sumac (5 g)	8.10± 0.28	6.45± 0.63	7.75± 2.19

Table 5. Descriptive results of serological factor "Albumin" in studied groups after three intervals (Mean±SD)

Treatments	Before intervention	5 days after intervention	10 days after intervention
Control	4.15 ± 0.49	3.25± 0.07	3.35± 0.07
Levamisol	3.50 ± 0.14	3.10± 0.14	3.10± 0.00
Sumac (10 g)	3.30± 0.14	3.15± 0.07	3.05± 0.07
Sumac (5 g)	3.45± 0.07	3.25± 0.07	3.55± 0.35

4. Conclusion

Taking into consideration the significant positive changes observed in 3 factors and improvement in some of the other factors, the present study has advised to prescribe sumac powder in the diet. It was also found that sumac powder, like levamisole, can increase the activity of the immune system and increase phagocytosis.

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