The Effect of Oregano Essential Oil and *Rhus coriaria* L. on Selected Performance Parameters of Laying Hens

Henrieta Arpášová*, Miroslava Kačániová, Branislav Gálik, Juraj Čuboň, Martin Mellen

Slovak University of Agriculture, 949 76-Nitra, Tr. A. Hlinku 2, Slovak Republic

Abstract

Herbs, spices and their extracts (botanicals) have a wide range of activities. They may have a beneficial effect on the gastrointestinal microflora of animals, performance and quality of animal products. In this experiment the effects of supplementation of the diet for laying hens with oregano essential oil and *Rhus coriaria* L. (sumac) seeds addition on body weight, feed consumption and egg production were studied. Hens of laying hybrid Hy-Line Brown (N=30) were randomly divided into 3 groups (n=10) and fed for 20 weeks with basal diet (BD) with oregano essential oil and *Rhus coriaria* L. supplemented. In the control group hens received feed mixture with no additions. The diets in the first experimental group were supplemented with 1 ml/kg oregano essential oil. The feed for second experimental group of birds consisted of basal diet supplemented with seeds of *Rhus coriaria* L. of the dose at 1% of total feed mixture. Average body weight for the whole period was in the order of the groups 1791.2, 1803.9 and 1843.5 g ($p>0.05$). In the feed consumption per feeding day, per egg, or in the feed conversion were observed statistically non-significant differences compared to the control group ($p>0.05$). Number of eggs per hen during the reporting period was in order of the groups: 135.6, 138.5 and 136.9 pieces, at an average intensity of laying 90.4, 92.34 and 91.26%. The results suggest that the body weight, feed consumption, feed conversion, egg production, egg mass and egg weight were not significantly influenced with oregano oil or *Rhus coriaria* L. addition ($p>0.05$).

Keywords: body weight, egg production, feed consumption, laying hens, oregano essential oil, *Rhus coriaria* L.

1. Introduction

The essential oils have a stimulating effect on animal digestive systems. These effects could be due to the increased production of digestive enzymes and the improved utilization of digestive products through enhanced liver functions [1]. Hertrampf, (2001) [2] reported that essential oils derived from spices and herbs could be successfully used as growth promoters, since they increased the feed intake due to their aromatic characteristics in chickens. Based on the results of the work of several authors, essential oils in poultry affect feed intake, weight gain, nutrient utilization [3], egg weight [4], egg production, body weight of laying hens [5, 6], and feed intake [7].

Oregano (*Origanum vulgare*) belongs to the family Lamiaceae. Can be used as a phytotherapeutic agent as biocídium because essential oil of oregano is toxic against phytopathogenic bacteria and fungi. Active ingredients in oregano can be more widely utilized in anti-inflammatory processes also exhibit antioxidant and anti-tumor activity [8]. For these properties the oregano and oregano extracts used in food and feed. Play a significant role in the inhibition of common food pathogens, as well as their subsequent bioactivation in the body of the recipient.

Rhus coriaria L. is a decorative shrub with edible fruit [9]. The aim of the Chakraborty's et al. study, (2009) [10] was to investigate the protective effects of sumac on the DNA of humans and

* Corresponding author: Henrieta Arpášová
Email: henrieta.arpasova@uniag.sk

animals. The antioxidant effects of the extract of sumac are likely given the cleansing effect, which was observed in *in vitro* experiments. Abbas, (2009) [11] reported that from nutritional view, *Rhus coriaria* L. seeds are rich in gallic acid, benzoic acid and L-ascorbic acid. The seeds of *Rhus coriaria* L. are a very good source of flavones, such as myricetin, quercetin, and kaempferol [12], nitrite and nitrate contents [13]. Sumac extracts have antimicrobial and antioxidant effects [14]. Bacteriostatic effects of sumac were observed [15].

The aim of this work was to observe the influence of oregano essential oil and *Rhus coriaria* L. seeds additions on performance parameters of Hy-Line Brown laying hens.

2. Materials and methods

Animals, diets and treatments

Hens (N=30) of the laying hybrid Hy-Line Brown, 17 weeks old, were randomly divided into 3 groups (n=10) and fed for 20 weeks with diet containing oregano essential oils or *Rhus coriaria* L. seeds.

At the beginning of the experiment, the hens were kept in the three–deck cage technology system, model AGK 2000/616. The technology system was in accordance with requirements specified by the Directive 1999/74 EC. The useful area provided for one laying hen presented 943.2 cm^2. Each cage was equipped with four nipple drinkers; access to feed mixture was *ad libitum*. To equipment of cage belonged roosts, place for rooting in ashes–synthetic grass, nest and equipment for shortening of claws. The layer hens were kept by the standard bioclimatic conditions.

In the control group hens received feed mixture without additions. The diets in the first experimental group were supplemented with 1 ml/kg oregano essential oil (Calendula a.s. Nová Ľubovňa, SR). The feed for second experimental group of birds consisted of BD supplemented with *Rhus coriaria* L. seeds in the dose 1% in total feed mixture. Laying hens accepted fodder *ad libitum*.

All kinds of feed supplements used in the experiment were homogenously incorporated into the feed mixture in the feed mill.

Sample Analysis

During the trial were monitored following performance parameters: body weight of hens (g), egg production (%), egg mass production (kg), feed consumption on the day of feeding (g), feed consumption per eggs (g), feed consumption per kg of produced egg mass (kg). Body weight of hens and feed consumption were determined once a month. Total number of eggs produced and their weights were recorded daily. Experiment lasted 20 weeks.

Statistical analysis

Statistical analysis was done using one–way analysis of variance (ANOVA) with the post hoc Tukey's multiple comparison test in the program SAS.

3. Results and discussion

Body weight, egg production, feed consumption and feed conversion are given in Tables 1 to 4.

In the experimental group with oregano supplement (Table 1), the average body weight compared to the control group was slightly higher ($p>0.05$). In the experimental group with the sumac at 1% concentration was recorded the highest average live weight of chickens among all groups compared to the control group but the difference was only marginally significant ($p>0.05$). Similarly, Kaya et al., (2003) [16] found a insignificant effect on body weight with complement of *Yucca schidigera*. Similarly, insignificant differences reported Yalcin et al., (2009) [17], or Azeke et al., (2009) [18]. On the contrary Hosseini Vashan et al., (2008) [19] recorded a higher live weight gain after food supplements palm oil at a dose of 4.5%.

As is apparent from the values in Table 2, regarding the feed consumption per feeding day were not statistically significant differences between groups ($p>0.05$). Feed consumption per feeding day on average in groups ranged from 119.49-120.83 g. Similarly, the consumption of feed per one egg has been recorded insignificant difference between groups ($p>0.05$). Feed consumption per egg ranged from 130.86-132.17 grams. In both experimental groups was slightly lower feed conversion compared to the control group.

Table 1. Effect of oregano essential oil or *Rhus coriaria* L. seeds addition into laying hens feed mixture on the alterations of Hy-Line Brown laying hens body weight in average for all observed laying period

Groups	Statistical characteristics					p value
	mean	S.D.	CV%	min.	max.	
BD-Control	1791.2	80.83	4.51	1610	1912	
BD+oregano oil 1 ml/kg	1803.9	98	5.43	1596	1967	0.3573
BD+*Rhus coriaria* L. 1%	1843.5	81.70	4.43	1661	1932	0.0501

(p≤0.05)–statistically significant difference

The most favorable conversion rate was in the experimental group with the addition of oregano. With a comparison of the treatment groups to the control group were relatively equal value (p>0.05). The values in the order of Group were: 2.30; 2.26; 2.28 kilograms. Similarly, in the experiments of Güçlü et al., (2003) [20], Niu et al., (2008) [21], respectively Canogullari et al., (2009) [22] feed conversion was not significantly affected by the consumption of feed supplement. Egg production and average weight of all eggs are shown in Table 3.

Table 2. Feed consumption of laying hens of Hy-Line brown strain after addition oregano oil or *Rhus coriaria* L. seeds in average for observed laying period

Groups	Feed consumption (g)		Feed conversion		
	per FD	per 1 egg	kg feed/kg EM	1000 g	
				pcs (60 g)	EM (g)
Control-BD	119.49	132.17	2.30	7.56	434.78
BD+oregano oil 1 ml/kg	120.83	130.86	2.26	7.64	442.47
BD+*Rhus coriaria* L.1%	120.47	131.14	2.28	7.63	438.59
p value	0.9999	0.9867	0.9994		

FD–feeding day; EM–egg mass; (p≤0.05)–statistically significant difference; (p>0.05)–statistically insignificant difference

Table 3. Effect of oregano oil or *Rhus coriaria* L. seeds addition into laying hens feed mixture on the egg production and average egg weight of Hy-Line Brown laying hens in individual groups in average for laying period

Groups	Statistical characteristics						p value
	n	mean	S.D.	CV%	min.	max.	
Control-BD	1356	57.35	5.42	9.45	39.2	76.9	
BD+oregano oil 1 ml/kg	1385	57.10	6.39	11.19	41.3	92.2	0.2905
BD+*Rhus coriaria* L. seeds 1%	1369	58.10	5.57	9.58	30.5	84.4	0.4169

(p≤0.05)–statistically significant difference ; (p>0.05)-statistically insignificant difference

Egg production and egg mass per hen and laying average intensity in all groups during the reporting period, on average, is shown in Table 4.

Table 4. Effect of oregano oil or *Rhus coriaria* L. seeds addition into laying hens feed mixture on the egg production and egg mass production of Hy-Line Brown laying hens in average for laying period

Parameter	Groups		
	Control BD	BD+oregano oil 1 ml/kg	BD+*Rhus coriaria* L.1%
Egg production			
Egg production/hen for 150 days (pcs)	135.6	138.5	136.9
		0.2904	0.4168
Average intensity of egg production (%)	90.4	92.34	91.26
Egg weight (g)			
Average egg weight (g)	57.35	57.10	58.10
Number of eggs into 1 kg	17.29	17.51	17.21
Egg mass production			
FD (g)	51.84	52.72	53.02
per 1 hen (kg)	7.77	7.98	7.95

(p≤0.05)–statistically significant difference; (p>0.05)-statistically insignificant difference

In both experimental groups with complementary oregano and sumac to complement the trend has been a moderate increase in egg production compared with the control group (Table 3), with the most positive impact of oregano essential oil. The values in the order of Group: (1356, 1385 and 1369 pieces). Likewise, Kang et al., (2009) [23] recorded after addition of extract of sumac (*Rhus verniciflua*) slightly higher egg production compared with the control group. Bölükbaşi et al., (2009) [24] with the addition of oil of *Nigella sativa*, respectively Suchý et al., (2010) [5] with the addition of the herbs premix observed improvement of egg production, but no statistically significant difference ($p>0.05$). The results of the Florou-Paneri's et al., experiment [25] showed that the dried rosemary leaves, stems and oregano essential oil present in the feed of laying hens did not affect significantly the production of eggs.

Number of eggs per hen during the experimental period (Table 4) in the control group was 135.6 pieces at an average intensity of laying 90.4%. Number of eggs per hen in the first experimental group with oregano supplement was 138.5 pieces eggs at an laying intensity of 92.33%. In the second experimental group with the addition of *Rhus coriaria* L. seeds were produced 136.91 pcs eggs. The average intensity of laying represented 91.26%. Production of egg mass per hen during monitored laying period was 7.77; 7.98 and 7.95 kg. The average weight of all eggs produced in these groups was in the order of groups 57.35; 57.10 and 58.10 g ($p>0.05$). Sumac addition of 1% concentration in relation to the average weight of the eggs showed positive, although not statistically significant when compared with the control group ($p>0.05$). Also in the group with addition of sumac has been found positive effect on the number of eggs produced, but the differences between the groups were not statistically significant ($p>0.05$). Botsoglou et al., (2005) [26] tested the effect of plant *Sonchus arvensis*, oregano and saffron on performance and egg quality of hens and similarly found insignificant differences in egg weight.

4. Conclusions

The addition of oregano slightly increased egg production, supplement *Rhus coriaria L*. slightly increased egg weight. The results suggest that the body weight, feed consumption, feed conversion, egg production, egg mass and egg weight were not significantly influenced with oregano oil or *Rhus coriaria* L. addition ($p>0.05$).

Acknowledgements

This study was supported by Grant Agency for Science, VEGA of Slovak Republic, Grant No.1/0493/12 and KEGA No 035 SPU–4/2012

References

1. Langhout, P., New additives for broiler chickens, World Poultry-Elsevier, 2000, 16, 3, 22-27.
2. Hertrampf, J. W., Alternative antibacterial performance promoters, Poultry International, 2001, 40, 1, 50-52.
3. Amrik, B. and Bilkei, G., Influence of farm application of oregano on performances of sows, Canadian Veterinary Journal-Revue Veterinaire Canadienne, 2004, 45, 674–677.
4. Abd, E. L., Motaal, A. M., Ahmed, A. M. H., Bahakaim, A. S. A. and Fathi, M. M., Productive Performance and Immunocompetence of Commercial Laying Hens Given Diets Supplemeted with Eucalyptus, International Journal of Poultry Science, 2008, 7, 5, 445-449.
5. Suchý, P., Strakova, E., Mas, N., Serman. V., Vecerek, V. ,Bedrica, L., Lukac, Z. and Horvat, Z., The effect of a herbal additive on performance parameters in layers, Tierarztliche Umschau, 2010, 65, 2, 74-78.
6. Arpášová, H., Fytobiotiká ako náhrada antibiotických stimulátorov rastu a ich vplyv na úžitkovosť a kvalitu vajec sliepok znáškového typu. Vedecká monografia. SPU: Nitra, 2011, 101, ISBN 978-80-552-0555-7
7. Angelovičová, M., Kačániová, M., Angelovič, M. and Lopašovský, Ľ., Per os use of *Thymi aetheroleum* for growth performance of the broiler chickens, Potravinárstvo. roč. 2010, 4, mimoriadne číslo, 127-132.
8. Zeytinoglu, H., Incesu, Z. and Baser, K. H., Inhibition of DNA synthesis by carvacrol in mouse myoblast cells bearing a human NRAS oncogene, Phytomedicine, 2003, 10, 292–299.
9. Nasar-Abbas, S. M., Halkman, A. K. and Al-Haq, M. I., Inhibition of some foodborne bacteria by alcohol extract of sumac (*Rhus coriaria* L.), Journal of Food Safety, 2004, 24, 257–267.
10. Chakraborty, A., Ferk, F., Simić, T., Brantner, A., Dušinská, M., Kundi, M., Hoelzl, C. and Knasmüller, S., DNA-protective effects of sumach (*Rhus coriaria* L.), a common spice: Results of human and animal studies,

Mutation Research-Fundamental and Molecular Mechanisms of Mutagenesis, 2009, 661, 1-2, 10-17
11. Abbas, K. A., Using of Non-Traditional Plants and Spices in Broiler Nutrition, PhD thesis, 2009. pp.185.
12. Mehrdad, M., Zebardast, M., Abedi, G., Koupaei, M. N., Rasouli, H. and Talebi, M., Validated high throughput HPLC method for the analysis of flavonol aglycones myricetin, quercetin, and kaempferol in *Rhus coriaria* L. using a monolithic column, J. AOAC. Int. 2009, 92, 1035-1043.
13. Özcan, M. M. and Akbulut, M., Estimation of minerals, nitrate and nitrite contents of medicinal and aromatic plants used as spices, condiments and herbal tea, Food. Chem., 2007, 106, 852-858.
14. Rayne, S. and Mazza, D. G., Biological activities of extracts from sumac (Rhus spp.): A review, Plant. Food. Hum. Nut., 2007, 62, 165-175.
15. Nasar-Abbas, S. M. and Halkman, A. K., Antimicrobial effect of water extract of sumac (*Rhus coriaria* L.) on the growth of some food borne bacteria including pathogens, International Journal of Food Microbiology, 2004, 97, 63–69
16. Kaya, S., Erdogan, Z. and Erdogan, S., Effect of different dietary levels of Yucca schidigera powder on the performance, blood parameters and egg yolk cholesterol of laying quails, Journal of Veterinary Medicine Series a-Physiology Pathology Clinical Medic, 2003, 50, 1, 14-17.
17. Yalcin, S., Yalcin, S., Erol, H., Bugdayci, K. E., Ozsoy, B. and Cakir, S., Effects of dietary black cumin seed (*Nigella sativa* L.) on performance, egg traits, egg cholesterol content and egg yolk fatty acid composition in laying hens, Journal of the Science of Food and Agriculture, 2009, 89, 10, 1737-1742.
18. Azeke, M. A. nd Ekpo, K. E., Egg yolk cholesterol lowering effects of garlic and tea, Journal of Medicinal Plant Research, 2009, 3, 12, 1113-1117.
19. Hosseini Vashan, S. J., Afzali, N., Mallekaneh, M., Nasseri, M. A. and Allahresan, A., The Effect of Different Concentrations of Safflower Seed on Laying Hen's Performance, Yolk and Blood Cholesterol and Immune System, International Journal of Poultry Science, 2008, 7, 5, 470–473.
20. Güçlü, K. B., Üniversitesi, E., Fakültesi, V. and Dali, A., The Effects of *Yucca schidigera* extract added to quail rations on egg production, egg quality and some blood parameters, Turkisch. Journal of Veterinary and Animal Sciences, 2003, 27, 567-574.
21. Niu, Z., Fu, J., Gao, Y. and LIU, F., Influence of paprika extract supplement on egg quality of laying hens fed wheat-based diet, International Journal of Poultry Science, 7, 2008, 7, 9, 887-889.
22. Canogullari, S., Karaman, M., Erdogan, Z., Baylan, M., KucukguL, A., Duzguner, V. and Kemali Ozugur, A., Effect of garlic powder on egg yolk and serum cholesterol and performance of laying hens, Bulletin of the Veterinary Institute in Pulawy, 53, 2009, 53, 3, 515-519.
23. Kang, H. K., Kang, G. H., Na, J. C.,Yu, D. J., Kim, D. W., Lee, S. J. and Kim, S. H., Effects of feeding *Rhus verniciflua* extract on egg quality and performance of laying hens, Korean Journal for Food Science of Animal Resources, 2009, 29, 5, 610-615.
24. Bölükbaşi, S. C., Kaynar, O., Erhan, M. K. and Urupan, H., Effect of feeding *Nigella sativa* oil on laying hen performance, cholesterol and some proteins ratio of egg yolk and *Escherichia coli* count in feces, Archiv für Geflügelkunde, 2009, 73, 3, 167–172.
25. Florou-Paneri., P, Nikolakakis, I., Giannenas, I., Koidis, A., Botsoglou, E., Dotas, V. and Mitsopoulos, I., Hen performance and egg quality as affected by dietary oregano essential oil and αα-tocopheryl acetate supplementation, International Journal of Poultry Science 2005; 4(7), 449-454.
26. Botsoglou, N., Florou-Paneri, P., Botsoglou, E., Dotas, V., Giannenas, I., Koidis, A. and Mitrakos, P., The effect of feeding rosemary, oregano, saffron and alpha-tocopheryl acetate on hen performance and oxidative stability of eggs, South African Journal of Animal Science, 2005, 35, 3, 143-151.