Acta fytotechn. zootechn., 17, 2014(3): 93–95

Original Paper

The effect of dietary *Rhus coriaria* L. on table eggs yolk nutrients composition

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The aim of the study was to analyze the effect of *Rhus coriaria* L. supplementation in total feed mixture on yolk nutrients composition of laying hens Hy-Line Brown. Hens at 20 weeks of age were randomly divided to two groups (10 hens per group); control group was fed by standard total feed mixture and experimental group was fed by standard feed mixture supplemented with *Rhus coriaria* L. seeds (dosage 1 % in feed mixture). Experiment lasted 21 weeks. During the experiment the eggs were collected 3 times (every 7 weeks after the beginning). After *Rhus coriaria* L. supplementation a tendency ($P > 0.05$) of higher crude protein content in yolks from experimental group of hens was found, significant ($P < 0.05$) differences were found in 3rd collection. *Rhus coriaria* L. addition in total feed mixture significantly ($P < 0.05$) decrease content of crude fat in egg´s yolk, mainly in 2rd collection (628.43 in control vs. 590.37 g kg^{-1} of dry matter in experimental group). Positive effect of analyzed phytogenic additive was found in cholesterol content in egg´s yolk. Significant ($P < 0.05$) lower content of cholesterol in yolk was found after 1st eggs collection (12.56 in control group vs. 11.65 mg kg^{-1} of yolk) and after 3rd collection (13.29 in control group vs. 11.57 mg kg^{-1} of yolk in experimental group). *Rhus coriaria* L. seed supplementation in the diet of laying hens had positive effect on nutrients composition of table egg´s yolk.

Keywords: poultry, nutrition, additives, *Rhus coriaria* L., phytogenics, eggs quality

1. Introduction

Phytogenic feed additives are used in animal nutrition and feeding for their beneficial effects such as higher performance, reproduction and health status (Capcarová and Kolesárová, 2010). Phytogenics are feed additives, plant-derived products used in animal feeding to improve the performance of livestock. Most studies investigate blends of various active compounds and report the effects on production performance rather than the physiological effects (Windisch et al., 2008). The last two decades have seen a substantial increase in the use of aromatic herbs and essential oils as feed additives in animal nutrition (Franz et al., 2010). Positive effect of phytoadditives are determine by application dosage and additive composition (Gálik et al., 2013), they are usable in animal nutrition for better feed conversion ratio and nutrient utilization (Kroismayr et al., 2007 and Li et al., 2007). In laying hens nutrition, feed additives can improve their production and also nutrient composition of eggs, mainly yolk nutrients content. The aim of the study was to analyse the dietary effect of Rhus coriaria L. seeds as a phytogenic additive on yolk nutrient composition in Hy-Line Brown laying hens nutrition.

2. Material and Methods

The experiment was realised in cooperation with the Department of Poultry Science and Small Animal Husbandry. Trial lasted 21 weeks. Hy-Line Brown laying hens were used for the trial. At 20 week of age, total 20 hens were randomly divided to two group, control group (C) and experimental group (E), in each group 10 hens. Hens in both groups were fed by standard feed mixture contained 39.2 % of wheat meal, 23 % of maize, 19.2 % of soybean, 3.5 % of pea, 3 % of rape seed cake, 7 % of soya oil, 7.4 % of calcite and 4 % of mineral premix. Nutritive value of feed mixtures in experiment is show in Table 1. In experimental group, feed mixture for hens was supplemented by *Rhus coriaria* L. in 1 % of dosage. Hens were housed in three-floor cages (943.2 cm^2 per hen) with 16 hrs of light regime. During the experiment the eggs were collected 3 times (every 7 weeks after the beginning of trial). In average yolk samples (after lyophilisation by iLshin Freeze Dryer) content of nutrients by standard laboratory methods (AOAC, 2000) were determined. Gravimetrically content of dry matter (t 103 ±2 °C) and ash (530 ±20 °C), content of crude protein by Kjeldahl method (apparatus ProNitro,

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Faculty of Agriobiology and Food Resources, 2014
http://www.fapz.uniag.sk/
DOI: 10.15414/afz.2014.17.03.93–95

Table 1 Nutritive value of feed mixtures in the trial

	Dry matter	Crude protein	Crude fat	Starch	Ash	Total sugars	Metabolisable energy
	g kg^{-1}	g kg^{-1} of dry matter					MJ kg^{-1} of DM
Group C	920.4	159.2	45.3	456.2	143.3	52.2	11.34
Group E	921.1	170.6	39.8	459.3	126.8	53.2	11.39

Selecta), content of crude fat by Soxhlett-Henkel method (apparatus Soxtec, Tecator) and content of cholesterol by photometrical method (wavelength 546 nm, apparatus UV-VIS Helios, Thermo Spectronic) were analysed.

To calculate basic statistic characteristics, to determine significance of differences and to compare results the analysis of variance, one-way ANOVA and t-test were performed at P <0.05. Results are show as mean±S.D. The SAS statistical software was used (SAS Inc., New York City, U.S.A.).

3. Results and Discussion

There are many papers, which focused on different feed additives for poultry as an alternative for antibiotic growth promoters (Cross et al., 2007; Gálik et al., 2013). Plant extracts, or their ethereal oils are typical for many desirable effects, such as inhibition of pathogen microorganism and stimulation of same desirable physiological processes (Gali-Muhtasib et al., 2006; Yazan et al., 2009). In our experiment we analyzed the effect of a phytogenic additive *Rhus coriaria* L. on yolk nutrient composition during 21 weeks. During the trial, the eggs were analysed three times, every 7 weeks after the experiment start. Results are show in Table 2. We found insignificant (P >0.05) differences in dry matter content in egg´s yolks. In crude protein of egg´s yolk in 1st and 2nd collection we found a tendency (P >0.05) of higher content in eggs of hens fed with *Rhus coriaria* L. supplementation in feed mixture. Significant differences (P <0.05) were found in yolk crude fat content. After phytogenic additive (seeds of *Rhus coriaria* L.) we found significantly lower crude fat content in all collection, mainly in second eggs collection (628.43 g kg^{-1} of dry matter in control group vs. 590.37 g kg^{-1} of dry matter in experimental group). Our results correspond with results published by Arpášová et al. (2010). Authors reported that major effect of a phytogenic additive in hens nutrition is an decrease of crude fat in egg´s yolk. Important factor of phytogenic additive is decreasing of cholesterol in yolk of eggs (Islam et al., 2011; Gálik, 2012). In cholesterol content of egg´s yolk we found significantly lower value (P <0.05) in experimental group (11.65 mg kg^{-1} of yolk) in comparison to control group (12.56 mg kg^{-1} of yolk) in first collection. After 7 weeks of first collection we found a tendency (P >0.05) of lower cholesterol content in yolks from experimental group of hens. After next 7 weeks (3rd eggs collection) we analyzed in eggs of hens from experimental group (control diet) significantly (P <0.05) higher cholesterol content (13.29 mg kg^{-1} of yolk) in comparison to experimental group (*Rhus coriaria* L. supplementation), 11.57 mg kg^{-1} of yolk.

4. Conclusions

In our experiment we found a positive effect of *Rhus coriaria* L. supplementation in laying hen's total feed mixture on qualitative parameters of table eggs production. After supplementation of the additive we found significant (P <0.05) differences in crude fat and

Table 2 Composition of yolk during the trial (mean ±S.D.)

	Dry matter	Crude protein	Crude fat	Ash	Cholesterol
	g kg^{-1}	g kg^{-1} of dry matter			mg kg^{-1} of yolk
1st collection					
Group C	505.43 ±1.595	326.33 ±7.757	628.17a ±4.167	34.9 ±1.552	12.56a ±0.583
Group E	506.67 ±1.161	321.83 ±6.523	620.63b ±1.762	34.13 ±0.971	11.65b ±0.432
2nd collection					
Group C	502.13 ±1.241	311.87±3.485	628.43a±6.391	34.57 ±0.651	11.90 ±0.105
Group E	497.77 ±3.287	331.80 ±11.697	590.37b±9.432	35.40 ±0.917	11.51 ±0.427
3rd collection					
Group C	506.40 ±2.252	303.60a ±1.418	625.27a ±2.479	35.10 ±1.253	13.29a ±0.511
Group E	505.33 ±2.950	325.70b ±4.951	611.13b ±3.758	34.90 ±1.552	11.57b ±0.484

Values with different superscript (for each collection) are significant different at the level P <0.05

Faculty of Agriobiology and Food Resources, 2014
http://www.fapz.uniag.sk/
DOI: 10.15414/afz.2014.17.03.90–92

cholesterol content in yolks. The results revealed that analysed phytogenic additive can positive affect the nutrients composition of table egg´s yolk.

6. Acknowledgements

This study has been supported by the Excellence Center for Agrobiodiversity Conservation and Benefit Plus (ITMS 26220120032), project implemented under the Operational Programme Research and Development financed by European Fund for Regional Development.

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Faculty of Agriobiology and Food Resources, 2014
http://www.fapz.uniag.sk/
DOI: 10.15414/afz.2014.17.03.93–95