EFFECT OF FENUGREEK SUPPLEMENTS TO HIGH FATTY ACIDS DIETS ON LAYER PERFORMANCE

Tatiana Panaite[1*], Maria Gabriela Cornescu[2], Rodica Criste[1]

[1]*National Research Development Institute for Animal Biology and Nutrition - Balotesti, Romania*
[2]*University of Agricultural Sciences and Veterinary Medicine Bucharest, Romania*

Abstract

The study evaluated the effect of fenugreek (Trigonella foenum graecum), leguminous plant with antioxidant properties, supplemented to high fatty acids layer diets. The 6-week experiment used 80 Lohmann Brown layers (59 weeks) assigned randomly to 2 groups (C and E), housed in metabolic cages (2 birds per cage). The birds had free access to the feed and water. They received compound feeds with an inclusion of 5% oleaginous seeds (flax and camelina), characterized by 16.50% CP and 2170 kcal/kg ME. Compared to C, the experimental group E, was treated with 1% fenugreek. Fenugreek was added for its antioxidant properties to protect the oleaginous seeds from peroxidation. This experiment evaluated the influence of the dietary fenugreek on layer performance because the literature gives contradicting reports on this topic. Throughout the experiment we monitored the daily intake, the feed conversion ratio, the laying percentage, whole egg weight. Egg samples (18 samples/group) were collected every 2 weeks with the purpose to determine the weight of egg shell, egg yolk and egg white. The experimental results showed that the group treated with fenugreek (E) had a significantly ($P \leq 0.05$) lower laying percentage (81.722±6.026%) compared to C (84.796±5.342%) and also an average daily feed intake for E (111.974±5.689 gCF/head/day, E) lower ($P \leq 0.05$) compared to C (121.857±6.485 gCF/head/day), without any influence on egg weight.

Key words: fenugreek, layers, oleaginous plants, layer performance

INTRODUCTION

During the last decade, herbs and phytogenic compounds have attracted a lot of attention for their potential role as alternatives to antibiotic growth promoters (AGPs) in monogastric animals [4]. Of great interest nowadays, Fenugreek (*Trigonella foenum graecum*) a multi-functional herb is known for its antifungal, antiviral, anticarcinogenic, anti-diabetic, antileukemic, antipyretic and antimicrobial properties [10]. Some others authors analysed its anti-lithogenic properties [3; 6; 12; 13]. Many researchers [1; 2; 8; 14] studied the use of fenugreek in poultry feeding, due to its antioxidant properties. The results suggested that the fenugreek extracts could act as an effective source of antioxidants, therefore the plant had been incorporated at different levels as feed additives in laying hen nutrition, with antagonistic results reported by the researchers. All productive performances were influenced by the fenugreek rate inclusion into laying hens diets. In this regard, [11] found that fenugreek at the level of 0.05% improved feed conversion and [1] obtained 2.23% increase of egg production and a significantly lower feed intake at 0.5% fenugreek but [8] noticed unlike the previous observations that the use of fenugreek in layer diets in amounts of 1 and 2% had a negative influence on the egg production.

The aim of this study was to evaluate the influence of the dietary fenugreek used in PUFA enriched diets on layer productive performances because the literature gives contradicting reports on this topic.

MATERIAL AND METHOD

Animals

The antioxidant properties of the fenugreek (*Trigonella foenum graecum*), were tested in an experiment conducted for 5 weeks on 80 Lohmann Brown layers (58

*Corresponding author: tatiana.panaite@ibna.ro
The manuscript was received: 17.07.2014
Accepted for publication: 14.09.2014

weeks), assigned randomly to 2 groups (C, E), housed in metabolic cages (birds per cage). The water and feed were supplied ad libitum. Lighting was with electric bulbs and was of up to 16h light, according to the rearing technology, while the microclimate ranged within the limit accepted by the guidebook (temperature: 21.2± 0.74°C and humidity: 45.6±3.71%%). Throughout the experiment, we monitored the bioproductive parameters (average daily intakes, feed conversion ratio, laying percentage, egg weight) and the physical-chemical parameters of the eggs. Every 2 weeks we collected 18 eggs per group and formed 6 average samples per group (3 eggs per sample) in order to determine the physical-chemical quality parameters of the eggs.

Diet

The birds were fed compound feeds which had the same basal structure (Table 1). Besides the conventional feed ingredients, we used flax, camelina and fenugreek seeds, as innovative feeds. Bothe the flax and camelina are oleaginous plants rich in polyunsaturated fatty acids (PUFA). Furthermore, camelina and fenugreek had antioxidant properties, which is important for the diets high in PUFA. Compared to the diet formulation for the control group (C), the diet for the experimental group (E) included 1% ground fenugreek seeds. The diets were balanced as energy and protein levels: 16.235±0.396% (C), 16.474±0.401% (E) protein and 2686.2 kcal/kg ME (C), 2677.08 kcal/kg ME (E) energy. The dietary fat level was 5.77±0.834% (C), and 5.37±0.364 % (E).

The structure of Zoofort A6 was: 1350000 UI/kg vitamin A; 300000 UI/kg vitamin D3; 2700 UI/kg vitamin E; 200 mg/kg vitamin K; 200 mg/kg vitamin B1; 480 mg/kg vitamin B2; 1485 mg/kg pantothenic acid; 2700 mg/kg Acid nicotinic; 300 mg/kg vitamin B6; 4 mg/kg vitamin B7; 100 mg/kg vitamin B9; 1.8 mg/kg vitamin B12; 2500 mg/kg vitamin C; 7190 mg/kg manganese; 6000 mg/kg iron; 600 mg/kg copper; 6000 mg/kg zinc; 50 mg/kg cobalt; 114 mg/kg iodine; 18 mg/kg selenium; 6000 mg/kg antioxidant;

Table 1 Compound feeds formulation

Item	C	E
Corn,%	35.69	35.81
Flax seeds,%	5	2
Camelina seeds,%	2	3
Fenugreek,%	**-**	***1***
Rice bran,%	15	15
Wheat,%	10	10
Rapeseed meal,%	10	10.4
Soybean meal,%	9	9
Gluten,%	2	2
Oil,%	0	0.5
Phosphate,%	1.06	1.06
Calcium carbonate,%	8.7	8.7
Salt,%	0.3	0.3
Methionine,%	0.1	0.08
Lysine,%	0.1	0.1
Choline,%	0.05	0.05
A6 vitamin-mineral premix,%	1	1
Total raw ingredients	**100**	**100**

Compound feed samples were collected from the manufactured batches and analysed for their quality parameters.

Samples and analyses

Feed samples: The physical-chemical methods mused to characterise the raw dietary ingredients and the biological samples, eggs, were: ***dry matter*** determination (by drying in stove at 65°C and 103°C, respectively); ***crude protein (CP)*** using the Kjeldhal method (semiautomatic Kjeltec Auto-1030 Analyser); ***crude fiber*** (solubilisation of the nutritive compounds, FIBERTEC TECATOR); ***ether extractives (EE)*** - (fat extraction in petrol ether, Soxtec System HT); ***crude ash (CA)*** – (calcination); The ***metabolisable energy*** was calculated from the chemical composition.

For the feed samples with a high fat content we use special methods to determine the indicators of fat depreciation: the *fat acidity index* (volumetric, titration with KOH 0.1 N); the *peroxide index* (volumetric, titration with potassium iodide) and the *Kreiss reaction* (condensation reaction between epihydrin aldehyd**e** and fluoroglucine, with the formation of a red compound).

Egg samples: Measurements were performed on *weight of the egg and its components*: white, yolk and shell (Kerm scales, accuracy of 0.001); *colour intensity* on La Roche scale of 1 to 14 measured with an

Egg Analyser TM; *egg freshness* measured with the value of the Haugh index and freshness evaluation points (Egg Analyser TM); *shell thickness* (Egg Shell Thickness Gauge); *shell resistance to breaking* (Egg Force Reader).

Data interpretation

The results obtained during the trial were processed statistically with StatView software.

Due to the use of raw dietary ingredients rich in fats, their quality had to be preserved in time. Thus, we determined the fat degradation indices (acidity, the peroxide index and Kreiss reaction), at the beginning of the trial, at 14 and 28 days (Table 2).

Table 2 Evolution of the degradation indices from the compound feeds

		C	E
Peroxide indicator (ml thiosulfate 0.1 N/g fat);	initial	0.645±0.29	0.57±0.24
	14 days	0.99±0.38	0.91±0.28
	28 days	1.17±0.27	1.105±0.21
Fat acidity (mg KOH/g fat);	initial	51.73±11.16	50.72±9.98
	14 days	57±11.79	55.98±8.80
	28 days	59.17±11.46	60.41±7.04
KREISS reaction	initial	Negative	Negative
	14 days	Negative	Negative
	28 days	Negative/ Doubtful	Negative

The data shown in Table 2 indicate that in group C, after 28 days from the manufacture of the compound feed, forage instability increased, which is also confirmed by the Kreiss reaction. No changes due to the oxidative degradation of fats were noticed in group E, even if the diet was rich in polyunsaturated fatty acids. Most likely, the inclusion of 1% fenugreek in the diet formulation for group E had antioxidant effect and protected the feed components against lipid peroxidation.

Analysing the values obtained for the production parameters (Table 3), one can notice that the average daily feed intake of group C was significantly (P≤ 0.05) different from group E. Feed conversion efficiency was significantly lower than in group E which included fenugreek seeds, besides the flax and camelina seeds. These data are in agreement with those reported by some authors [16] who noticed a lower feed intake and weight gain of the birds fed flax seeds. Similar data were also reported by the others [1; 11] who fed fenugreek seeds to layers and noticed a good feed conversion ratio. Contrary to the data reported by [1] on the production of eggs, the data from Table 3 show that the laying intensity was significantly (P≤ 0.05) lower in group E. Researchers like [7] didn't notice any effect of the flax seeds on the egg production, while [5] observed a lower egg production after the flax seeds have been included in the diet. Similar results were reported by [8] during the trial with 1% and 2% fenugreek in layer diets.

Table 3 Productive performances (average values/group)

Item	**C**	**E**
Average daily feed intake (g/bird/d)	121,857± 6,485 b	111,974 ±5,689 a
Feed conversion ratio (kg feed /kg egg)	1,930± 0,129 b	1,808± 0,141 a
Egg production (%)	84,796± 5,342 b	81,722± 6,026 a
Average egg weight (g)	63,260± 2,918	62,110± 2,990

Note: a = significantly different (P≤0.05) compared to C; b = significantly different (P≤0.05) compared to E

Monitoring the evolution of the production parameters throughout the experiment (Fig. 1), one can notice that there were no significant (P≤0.05) differences between the feed conversion ratios of the two groups in the first week. In week 2, the feed conversion ratio of group C was significantly (P≤0.05) higher than that of group E. The feed conversion ratio of group C was also high in week 4, when it was significantly (P≤0.05) different from group E, the same trend maintaining in week 5. In conclusion, throughout the experiment the feed conversion ratio of group C (flax and camelina seeds) was higher than that of group E (flax, camelina and fenugreek seeds).

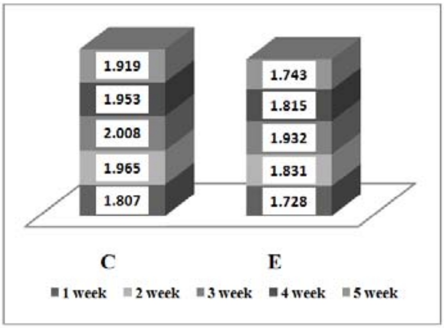

Figure 1 – Evolution of the feed conversion ratio (kg CF/kg egg) throughout the experimental period (average weekly values)

Laying percentage (Figure 2) was different between the two groups even from the first week of the experiment: 78% for group E, significantly ($P \leq 0.05$) lower than in group C, situation which persisted during the second week of the experiment too.

Also Figure 2 shows that the laying percentage of group E was 2% higher than the laying percentage of group C in the third week, and was equal with it in week 4. At the end of the experiment, the laying percentage of group C increased, but it was not significantly higher than in group E. The laying percentage of group E was constantly lower throughout the experiment for group E.

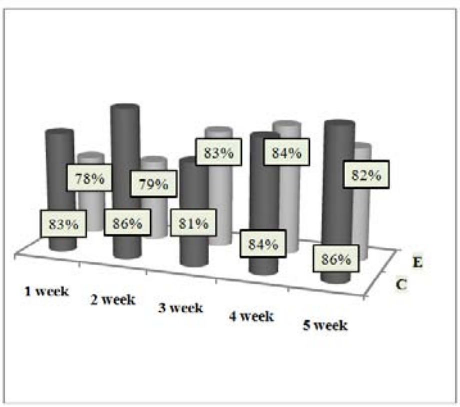

Figure 2 – Evolution of the laying percentage (%) throughout the experimental period (average weekly values)

Regarding the evolution of egg weight (Figure 3), the weekly data show that the data varied randomly from one week to the other in both groups, but there were no significant differences of egg weight between the two groups.

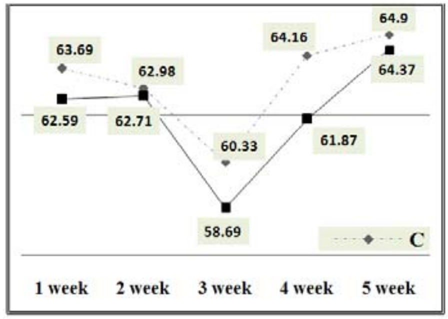

Figure 3 – Evolution of egg weight (g) throughout the experimental period (average weekly values)

Table 4 shows the physical parameters measured on the eggs harvested throughout the experiment. No significant differences between the groups were noticed for the Haugh unit and for the breaking strength of the egg shell.

Table 4 Physical parameters of egg quality (average values for the entire experiment/group)

Item		C	E
Egg weight (g), of which:		63.82±1.93	63.84±2.43
Egg white weight, g		39.53±2.62	39.47±2.81
Yolk weight, (g)		16.29±1.46	16.38±1.15
Eggshell weight, (g)		8.00±0.56	7.99±0.53
Eggshell thickness, mm		0.400±0.05	0.395±0.06
Eggshell breaking strength, kgF		4.327±0.79	4.262±1.12
Haugh units		64.33±9.49	61.05±7.70
Egg freshness, %	AA	21.05	2.63
	A	50.00	52.63
	B	28.95	44.74
	Total	***100***	***100***
Yolk colour		3.632±1.53	3.605±1.57

The weight of the egg and of its components (egg white, yolk and egg shell) didn't vary between the two groups). These findings are in agreement with the data reported by Researcher like [5] who noticed that the use of dietary seeds didn't change the weight of the egg and on the egg yolk.

Similar results have also been obtained by [9] in a study on the effect of 1% and 2% germinated and un-germinated fenugreek seeds given to layers. The diet with 1% germinated fenugreek seeds improved economically egg production without affecting egg quality. Others [1] obtained a 2.23 % increase of egg production compared to the control using 0.5% supplementary fenugreek, without affecting egg quality.

Figure 4 shows the evolution of yolk weight throughout the experiment, which shows that there were no significant differences between the different moments of harvesting.

Yolk weight, for both groups, increased towards the final week of the experiment. Unlike the egg yolk, egg white weight had a random evolution. An increasing trend of egg white weight from the initial harvesting to the final one was noticed for group E, while a different pattern was noticed in group C. Egg white weight after 2 weeks of experiment was higher than in the end of the experiment.

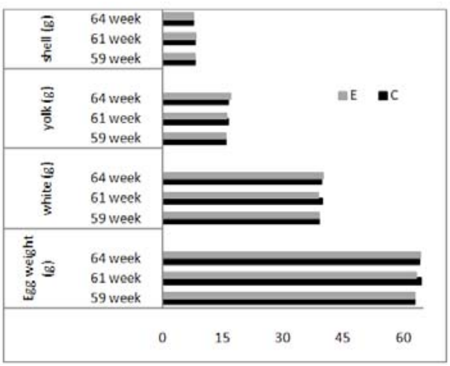

Fig. 4 Evolution of egg and egg components weight (average values/group)

The data in Table 4 show that although group E recorded slightly lower values of the Haugh unit than the control group, the differences are not statistically significant. Large differences were noticed in egg freshness. Thus, group E had 18.42% less “AA” class than group C, while it had 15.79% more class “B” eggs.

No significant differences between the two groups were noticed for eggshell thickness and eggshell breaking strength.

However, our results are not in agreement of [1; 14; 15] who reported that Fenugreek did not have a significant effect on egg production, egg weight and egg mass. The indicator of albumin quality, Haugh unit was significantly increased in 0.5% fenugreek comparing to the control group. When hens fed diet supplemented with fenugreek had numerically highest values of shell thickness and albumen weight percentage [1].

CONCLUSIONS

- The results of this study show that the use of 1% fenugreek as antioxidant included in layer diets with oleaginous seeds (flax and camelina) had an adverse effect on the production parameters.
- This treatment affected the compound feed intake and the laying percentage of group E was 3% lower than that of group C.
- No significant differences were noticed between the two groups regarding the average egg weight.
- The use of 1% fenugreek in the compound feed formulation decreased the bioproductive parameters (average daily feed intake, feed conversions ratio and laying percentage) but didn’t affect egg weight and the weight of egg components.
- On the other hand, fenugreek seeds used as antioxidant stabilized the dietary lipids peroxidation, as confirmed by feed analysis at 28 days by the Kreiss reaction.

REFERENCES

[1] Abaza, I.M., (2007): Effect of using fenugreek, chamomile and radish as feed additives on productive performance and digestibility coefficients of laying hens - Poult. Sci, 27, 199-218.

[2] Abdouli H., Haj-Ayed M. , Belhouane S., Hcini Emna E., (2014): Effect of feeding hens with fenugreek seeds on Laying performance, egg quality characteristics, serum and egg yolk cholesterol, Journal of New Sciences Volume 3(1). Published March, 01, 2014, http://www.jnsciences.org

[3] Acharya, S.N., Basu, S. K. and Thomas, J.E. (2007a): Medicinal properties of fenugreek (Trigonella foenum-graecum L.): a review of the evidence based studies. Pages 81_122 in S. N. Acharya and J. E. Thomas, eds. Advances in

medicinal plant research. Research Signpost, Kerala, India.

[4] Alloui, M.N., A. Agabou and N. Alloui, (2014): Application of herbs and phytogenic feedadditives in poultry production-A Review. Global Journal of Animal Scientific Research. 2(3): 234-243.

[5] Aymond W.M., Van Elswyk M.E., (1995): Yolk thiobarbituric reactive substance and n-3 fatty acids in response to whole and ground flaxseed. Poult.Sci 74:1358-1394

[6] Basu, S. K., Thomas, J. E. and Acharya, S.N. (2007): Prospects for growth in global nutraceutical and functional food markets: a Canadian perspective. Aust. J. Basic Appl. Sci. 1:637_649.

[7] Caston LJ, Squires EJ, Leeson S., (1994): Hen performance, egg quality and the sensory evaluation of eggs from SCWL hens fed dietary flax. Can J anim Sci 74:347-353.

[8] Criste R.D., Panaite T., Bercaru A, Varzaru I., Ropota M., Cornescu G. M., (2013): Study on the use of fenugreek in laying hens diets on egg quality, 19th European Symposium on Poultry Nutrition Potsdam, Germany

[9] Hassan, I.I., A.A. Askar, El-Shourbagy, (2004): Influence of some medicinal plants on performance, physiological and meat quality traits of broiler chicks - Egypt. Poult. Sci., 24: 247-266

[10] Kaviarasan, S., Vijayalakshmi, K. and Anuradha, C. V. (2004): Polyphenol-rich extract of fenugreekseeds protect erythrocytes from oxidative damage. Plant Food. Hum. Nutr. 59 (4): 143_147

[11] Moustafa k El-Kloub, (2006): Effect of using commercial and natural growth promoters on the performance of commercial laying hens. Egypt Poult Sci 26:941-965.

[12] Reddy, R. L. R. and Srinivasan, K. (2009a): Fenugreekseeds reduce atherogenic diet-induced cholesterol gallstone formationin experimental mice. Can. J. Physiol. Pharmacol. 87: 933_943.

[13] Reddy, R. L. R. and Srinivasan, K., (2009b): Dietary fenugreek seed regresses preestablished cholesterol gallstones in mice. Can. J. Physiol. Pharmacol. 87: 684_693

[14] Safaa, H. M., (2007): Effect of dietary garlic or fenugreek on cholestrol metabolism in laying hens - Egypt Poult. Sci. 27: 1207, 1221.

[15] Tollaba, A. A. H., Abd El-Galyl, M. A. and Abd El-Samad, M. H., (2005): The effect of using some herbal additives on physiological and productive performance of two Egyptian chicken strains during winter and summer seasons. Egypt. Poult. Sci., 25: 107 – 123.

[16] Yannakopoulos, A.L., A.S. Tserveni-Gousi and S. Yannakakis, (1999): Effect of feeding flaxseed to laying hens on the performance and egg quality and fatty acid composition of egg yolk. Archives fur Geflügelkunde, 63: 260-263