EFFECT OF A SYNBIOTIC FEED ADDITIVE SUPPLEMENTATION ON LAYING HENS PERFORMANCE AND EGGS QUALITY

Cristina Gabriela Radu-Rusu, I.M. Pop, D. Simeanu

University of Agricultural Sciences and Veterinary Medicine Iasi, Animal Science Faculty, Romania
e-mail: cristina.radurusu@gmail.com

Abstract

The goal of the researches was to assess the effects of dietary usage of a synbiotic product (strain of Enterococcus faecium + fructo-oligosaccharide + certain ficofytic compounds from marine algae) on laying hens production parameters and eggs quality. The biological material, represented by 60 ISA Brown females, 57 weeks old, was divided in two groups: control (C) (n=30) and experimental treatment (E) (n=30). C group was fed with layer standard diet, while E group received the same feed, supplemented with 1‰ synbiotic. Certain traits have been assessed during the 4 weeks of the experiment: hens live weight and feed intake dynamics, feed conversion ratio, laying intensity, egg mass production, eggs and eggshell weight, eggshell thickness, shell index, shell breaking strength, occurrence of eggs with unconformities. The laying hens in the experimental group, whose fed was added with 1‰ synbiotic, gave better yield performances (+2.2% laying intensity; +1.7% egg mass production; -2.0% feed conversion) and improved shell quality (+5.31% weight; +3.4% thickness and breaking strength). Therefore, the usage of probiotic-prebiotic-ficofytic compounds mixture in a single commercial product, as feed additive generated better results related to hens performance, feed valorization, eggs yield, and their quality.

Key words: feed additives, synbiotic, laying hens, productivity, eggs quality

INTRODUCTION

The simplest definition of the synbiotic term describes it as a mixture of a prebiotic and a probiotic [1]. Probiotics are natural products which contain live microorganisms (and sometimes their products, except antibiotics) that induce beneficial effects to host animal, through the action onto the gut microflora. Therefore, the health status, feed conversion and whole production performances should be improved [4]. Prebiotics are described as substances which support probiotic microorganisms development in animals digestive tract [5]. These effects are produced through multiple ways: an improvement of gut microbial balance [3], stimulation of vitamins and digestive enzymes synthesis by digestive tract microbiota [7], immune response fortification [8], usage of non-digestible carbohydrates [6], stimulation of lactic acid and volatile fatty acids production, support of certain bacteriosatatic and bactericide substances synthesis, against the digestive harmful flora [2].

Aim of this research was to evaluate the effects issued from feed usage of a symbiotic product (*Enterococcus faecium* strain + fructo-oligosaccharide + certain ficophyitic compounds from marine algae) on certain productive parameters of laying hens and on eggs quality, as well.

MATERIAL AND METHOD

The experiment was hosted by the Experimental Farm of the Animal Husbandry Faculty in Iasi city, during 28 days.

A flock of 60 laying hens, ISA-Brown hybrid, 57-61 weeks old, was used and accommodated in three levelled pyramidal cage batteries (two hens/ coop).

The fowl were divided in two treatment groups: control and E. The Control group (C) included 30 hens which received a diet based on a corn-soy meal mixture. Group E (30 hens), received a 1‰ synbiotic supplementation of the basal diet.

The lighting program was 16L:8N type. The temperature into the shelter was of 24-28°C and the relative air humidity of 75%.

The feed was given once a day, while the water was permanently assured.

The parameters assessed in our study included: hens' living weight, feed intake and laying intensity dynamics – as productive features; egg weight, eggshell weight, eggshell thickness, shell ratio participation in the whole egg eight, shell index – as eggshell quality parameters; Haugh index – as eggs internal quality trait.

Eggs weight was daily assessed through weighting, using digital technical scales.

The eggs' quality parameters were assessed weekly, on 10 eggs harvested from each group, randomize selected. Eggshell weight and thickness were measured after 24 hours of drying at room temperature. A micrometric device was used to measure the eggshell thickness. Three fragments of shell was taken from sharpen and rounded poles and from the equatorial zone of each egg. The thickness represents the mean of the three mentioned shell sections.

Haugh index was computed accorded to the formula which includes height of the dense albumen (h) and egg's weight (G): $U.H. = 100\log(h - 1{,}7 \times G^{0{,}37} + 7{,}57)$.

Data concerning the entire amount of eggs produced the amount of broken, cracked, rough, pale or deformed eggs were recorded on a daily base.

The experimental values were statistically processed and then the comparisons between means were applied, using a single factor ANOVA algorithm, included within the MsExcel software package.

Economical efficacy has been carried out using data from feeding expenses, from eggs selling incomes, finally achieving the absolute revenue. Other costs (biological material, husbandry expenses, medical treatments, wages etc.), have not been considered, knowing they were identical for both groups during the entire experimental period.

RESULTS AND DISCUSSIONS

Production performances

The morpho-productive performances analysis revealed certain results (table 1):

- birds live weight at the end of experiment was higher (+30 g) in the experimental group, compared to that recorded during experiment onset, which was slightly lower in control group fowl (- 4g).
- improved eggs yield and laying intensity values, while feed intake continuously decreased. Better performances were achieved by E group (+1‰ synbiotic). Thus, daily egg mass production was calculated at 56.61 g egg mass/hen/day achieved by a feed conversion ratio value of 2.036 kg feed/kg egg mass. No statistical significance occurred between control and experimental group means.

Table 1 - Effects of synbiotic product usage in laying hens feed supplementation on their production performances

Studied parameter		Exp. period (week)	Groups	
			Control	E* (1‰ Synbiotic)
Initial hens' body weight (kg/hen)		-	1.752	1.736
Final hens' body weight (kg/hen)		-	1.748	1.763
Average daily feed intake (g/hen/day)		4	113.21	115.24
Egg production (eggs/day/group)		4	25.9	26.6
Laying intensity (mean values)(%)		4	86.31	88.69
Egg-mass production	(g/hen/day)	4	55.83	56.61
	% (C=100)		100	101.4
Feed conversion	(kg feed/kg egg mass)	4	2,103	2,036
	% (C=100)		100	96,81

* basal diet + 1‰ IMBO® (Biomin, Austria)

Physical and morphological eggs quality parameters

Data related to eggs quality are presented in table 2.

Eggs average weight had close values in both groups, across the entire experiment: in C group, mean reached 65.09 g, while in E group, it was calculated at 66.04 g. Although the values were slightly higher for the eggs produced by hens fed with supplemental additive, the observed differences were not statistically significant (table 2).

Shell weight was obviously higher in experimental group, compared to control (+5.31% in E group).

Albumen proportion in whole egg had average values of 65.75% in control group and 64.94% in the experimental one, while *yolk participation* reached 24.97% (control) and 25.43% (E group), respectively. Lower albumen participation in experimental group eggs dues to yolk proportion increase.

Shell proportion in egg structure ranged between 9.63% (experimental group) and 9.27% (control group). Statistical significance occurred between the analysed means.

Table 2.-Effects of a synbiotic product usage in laying hens feed supplementation on egg quality

Studied parameter	Exp. period (week)	Groups	
		Control	E* (1‰ Synbiotic)
Egg weight (grams)	4	65,09	66,04
(%) (C=100)		100	101,46
% yolk in whole egg weight	4	24,97	25,43
(%) (C=100)		100	103,20
% albumen in whole egg weight	4	65.76	64.94
(%) (C=100)		100	98.75
% shell in whole egg weight	4	9.27[a]	9.63[b]
(%) (C=100)		100	103.78
Eggshell weight (grams)	4	6.04	6.35
(%) (C=100)		100	105.31
Shell thickness (mm)	4	0.387	0.400
(%) (C=100)		100	103.35
Shell index	4	7.98	8.31
(%) (C=100)		100	104.13
Eggshell breaking strength (mg/cm^2)	4	89.01[a]	92.00[b]
(%) (C=100)		100	103.36
Haugh index (UH)	4	87.41	88.88
(%) (C=100)		100	101.33

* basal diet + 1‰ IMBO® (Biomin, Austria)
ANOVA: [a b] – different superscripts within the same line: significant differences ([ab]; P<0.05).

Shell thickness presented improved values in experimental group, which meant higher values (+3.35%) in the eggs produced by fowl fed with a supplement of 1‰ synbiotic.

Shell index (shell mass per surface unit) it is easily assessed and is widely used to indirectly estimate shell thickness. These two traits are intensely correlated, knowing that shell thickening leads to an increase of its weight per calculated surface unit. The control group average value (7.98%) was lower to that calculated for experimental group eggs (8.31%).

Haugh index presented close values between both groups (C= 87.71 H.U., E= 88.88 H.U.), considered within the normal range. No statistical significance occurred; therefore the synbiotic additive did not influence eggs internal quality.

Eggshell breaking strength was estimated with the relation including shell thickness and a constant value related to its density, certain values issuing for whole studied period: 89.01 mg/cm^2 in control group and 92.0 mg/cm^2 in E group. The +3.4% difference for shell strength improvement proved to be statistically significant.

Occurrence of morphological shell unconformities. The achieved results revealed that whole proportion of eggs with unconformities varied between 5.6% (group E) and 8.4% (control). Compared with the control group values, proportion of eggs with unconformities was 50% lower in the group fed with 0.1% synbiotic (table 3).

Table 3-Proportion of eggs with shell unconformities

Notice		Control	E* (1‰ Synbiotic)
Eggs yield (pcs.), from which:		725	745
* broken shell eggs	pcs.	14	9
	% from whole yield	1.9	1.2
* shell micro cracks eggs	pcs.	10	9
	% from whole yield	1.4	1.2
* rough shell eggs	pcs.	12	8
	% from whole yield	1.7	1.1
* soft shell or shell less eggs	pcs.	11	9
	% from whole yield	1.5	1.2
* malformed shell	pcs.	14	7
	% from whole yield	1.9	0.9
Total eggs with unconformities	pcs.	61	42
	% from whole yield	8.4	5.6

* basal diet + 1‰ IMBO® (Biomin, Austria)

Economical efficiency

Synbiotic feed additive usage in laying hens feeding also influenced certain economic factors, through feeding expenses and value of produced eggs. Thus, feed expenses across the entire experimental period reached 114.12 RON in control group and 116.81 RON in E group. These were influenced by the overall feed intake values and by feed price/kg which was different and related to additive inclusion proportion (table 4).

Table 4-Economical efficacy of the synbiotic feed additive usage in laying hens feeding

Notice / Group	Control	E* (1‰ Synbiotic)
Price/kg mixed feed (RON**)	1.20	1.21
Price/kg mixed feed (EUR***)	0.38	0.38
Feed intake (kg)	95.10	96.80
Eggs yield (pcs.)	725	745
Eggs sold (pcs.)	664	703
Feeding expenses (RON)	114.12	116.81
Feeding expenses (EUR)	35.67	36.51
Income**** (RON)	199.20	210.90
Revenue (RON)	85.08	94.09
Income (EUR)	62.26	65.92
Revenue (EUR)	26.59	29.41
Revenue difference between experimental and control groups (±%)	-	+10.59

*basal diet + 1‰ IMBO® (Biomin, Austria) **1Kg IMBO = 6.7187 RON; ***according to RNB exchange rate during experimental period, 1 EUR = 3.1994 RON; ****income was calculated using a 0.30 RON/egg selling price

CONCLUSIONS

- Usage of the synbiotic feed additive (1‰) in layinghens feeding induced better production performances in the experimental group (E), compared to the control one, although statistical significance did not occur for the differences between means.
- External eggs quality revealed improved traits in the eggs produced in hens group fed with 1‰ synbiotic, compared to control. Shell thickness increased with 3.35%, while shell breaking strength (mg/cm^2) improved with 3.36%.
- Synbiotic based feed additive led to a decrease in eggs unconformities. Thus, 5.60% more eggs with undamaged shell were produced across the whole period by the hens in the experimental group, compared to the control ones.
- The beneficial effects induced by the synbiotic additive on quantitative and

qualitative eggs production also generated increased income, which meant 10.59 % higher revenue in the experimental group than in control.

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