IMPROVEMENT OF LAYING HEN PERFORMANCES BY DIETARY MANNANOLIGOSACCHARIDES SUPPLEMENTATION

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Abstract

The goals of the study were to assess the effects of prebiotic mannanoligosaccharides feed additive on the performance and egg quality of commercial laying hens approaching the end of the laying period. The trial was setup at the Animal Husbandry Faculty's Experimental Farm in Iasi, Romania, during a 4 weeks period. The biological material consisted in 60 hens, 57 week old ISA Brown. The control group (30 hens) was fed with standard layer mixed feed, meaning a corn-soybean meal basal diet while the experimental treatment (30 hens) classic feed was supplemented with 0.1% prebiotic of mannanoligosaccharides kind (treatment A1). Several parameters were studied: hens living weight and feed intake dynamics, feed conversion ratio, laying intensity, egg mass production, eggs and eggshell weight, eggshell thickness, shell index, shell breaking strength, eggs with unconformities. The laying hens in the experimental group, whose fed was supplemented with prebiotic, gave higher performances, concerning the production parameters (laying intensity: +2.2%; egg mass production: +1.7%; feed conversion: -2.0%) and the shell quality (weight: +3.6%; thickness: +3.9%, breaking strength: +5.9%, eggs unconformities: -55.5%).

Key words: laying hens, mannanoligosaccharides, yield performances, egg quality

INTRODUCTION

The numeric egg production decreases while the hens approach the end of their laying cycle. On the contrary, the weight of the eggs increases. As laying hens become older, the egg volume and the yolk proportion increase, and the albumen proportion and the shell thickness decrease [11]. These undesirable situations are related to some factors such as: shell thickness and shell stiffness, which decrease proportionally with hens ageing [2; 7].

Some previous researches proved that the prebiotic product, which contains mannanoligosaccharides issued from the cell wall of the *Sacharomyces cerevisiae* yeast, could generate beneficial effects, such as fight against intestinal pathogen germs in birds and mammals, through the immune response modulation and through the improvement of the intestinal mucosa structural integrity [9; 10]. Prebiotics also improve the absorption of the nutrients, including macro and microelements, through the intestinal wall [1; 6], increasing meantime the degree of their availability, in order to be used for organism's maintenance and regeneration, as well as for production.

The goal of our study was to evaluate the effects generated by a prebiotic product, which contains mannanoligosaccharides on the quantitative and qualitative eggs production, on the bodyweight and feed intake dynamics of the laying hens approaching the end of their laying period.

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, aged 57-61 weeks, was used and accommodated in three levels pyramidal coops batteries (two hens/ coop).

The fowl were divided in two treatment groups: control and "A". The Control group (C) included 30 hens which received a diet

based on a corn-soy meal mixture (table 1). The "A" group (30 hens), received a 0.1% Bio-Mos® supplementation of the basal diet.

The lighting program was 16L:8N type. The temperature into the shelter reached 24-28°C and the relative air humidity 75%. The feed was given once a day, while the water was permanently provided.

The parameters assessed in our study included: hens live 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 property.

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, randomly 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 were 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.

Eggshell breaking strength have been indirectly assessed, using the algebraic product between eggshell thickness value and a constant of its density (230), according to the recommendations found in literature [11]. The calculated value has been expressed in mg force/cm^2 shell.

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

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.

RESULTS AND DISCUSSIONS

Production performances

The achieved results, concerning yield performances, showed improved values in experimental group. Thus, the average amount of eggs produced per period increased and, as a consequence, the laying intensity was also improved, while the feed intake decreased (table 1). The best results were achieved by the A group (+0,1% prebiotic), with an egg mass yield of 54.73 g/hen/day, with an average intake of only 2,064 kg feed to obtain 1 kg egg mass. However, the differences found between control and experimental group were statistically insignificant.

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

Studied parameter		Exp. period (weeks)	Groups	
			Control	A* (0.1+Prebiotic)
Initial hens' body weight (kg/hen)		-	1.752	1.748
Final hens' body weight (kg/hen)		-	1.709	1.761
Average daily feed intake (g/hen/day)		4	113.21	112.98
Egg production (eggs/day/group)		4	725	741
Laying intensity (mean values)(%)		4	86.31	88.21
Egg-mass production	(g/hen/day)	4	53.83	54.73
	% (C=100)		100.00	101.67
Feed conversion ratio (FCR)	(kg feed/kg egg mass)	4	2.103	2.064
	% (C=100)		100.00	98.15

* basal diet + 0.1% Bio-MOS® (Alltech inc., USA)

Egg production quality

The data concerning the quality of the eggs issued from the laying hens belonging to the three used groups are presented in table 2.

Table 2
Effects of prebiotic product usage in laying hens feed supplementation on egg quality

Studied character		Exp. period (weeks)	Groups	
			Control	A* (+0,1% Prebiotic)
Egg weight	(grams)	4	65.09	65.38
	(%) (C=100)		100	100.44
% shell in whole egg weight		4	9.27 [a]	9.57 [b]
	(%) (C=100)		100	103.18
% albumen in whole egg weight		4	65.76	65.42
	(%) (C=100)		100	99.56
% shell in whole egg weight		4	24.97	25.01
	(%) (C=100)		100	101.19
Eggshell weight	(grams)	4	6.04	6.26
	(%) (C=100)		100	103.64
Shell thickness (mm)		4	0.387	0.402
	(%) (C=100)		100	103.87
Shell index		4	7.98	8.24
	(%) (C=100)		100	104.38
Eggshell breaking strength (mg/cm^2)		4	89.01 [a]	92.63 [b]
	(%) (C=100)		100	105.94
Haugh index (H.U.)		4	87.71	87.72
	(%) (C=100)		100	100.13

* basal diet + 0.1% Bio-MOS® (Alltech inc., USA)
[a,b] – significant differences between means on the same row, with different superscripts ([ab]; P>0.05).

Average egg weight was found, during the entire period, between 65.09 g and 65.38 g values, the differences between treatments being insignificant.

Eggshell weight increase of the mean values of this character was observed in experimental groups, during weeks 1, 2 and 3, the differences between experimental and control groups becoming statistically significant during the 4th week of the experiment. Eggshell weight was obviously higher in the experimental treatment, comparing to the control one (+3.6% in A group).

Albumen proportion in whole egg was recorded across the entire experimental period with average values of 65.75% in control group and 65.42% in the experimental group, fed with 0.1% prebiotic supplementation (A group), while *yolk proportion* reached 24.97% (control) and 25.01% (A group). Lower albumen participation in whole egg formation could be noticed in experimental group, compared to the control one, basing on the yolk participation increasing. *Eggshell proportion* reached values of 9.6% in experimental group (A), compared to 9.3% in control group, also existing significant statistic differences between these means.

Shell thickness (mm) have been also improved in the experimental group, compared to the control one. Therefore, shell thickness increased with 3.9% at the eggs produced by the fowl of whose feed was 0.1% supplemented with prebiotic.

Shell index revealed that eggs weight per surface unit recorded an evolution slightly similarly to that of the shell weight.

The Haugh Index presented close values for all groups (M=87.71 U.H., A=87.82 U.H.); the experimental did not significantly affect this parameter;

Incidence of the shell morphologic anomalies

The achieved results revealed that the proportion of eggs with shell unconformities from whole eggs yield varied between 5.4% (A group) and 8.4% (control group) (table 3).

Comparing to the control group values, the proportion of the eggs with unconformities was 55.6% reduced in the group fed with 0.1% supplemental prebiotic (table 3).

The better results obtained for the eggshell quality parameters could due to the prebiotic influence on the metabolic activity of the beneficial bacteria colony within the layers' intestine, which positively influenced mineral absorption rate, especially those of Ca^{2+} and Mg^{2+} [8].

Table 3
Proportion of the eggs with unconformities from whole eggs production

Notice		Control	A* (+0.1% prebiotic)
Total amount of eggs:		725	741
* intact eggshell	pcs.	14	10
	%	1.9	1.3
* cracked eggshell	pcs.	10	7
	%	1.4	0.9
* rough eggshell	pcs.	12	9
	%	1.7	1.2
* eggs with soft shell or without shell	pcs.	11	8
	%	1.5	1.1
* deformed eggshell	pcs.	14	6
	%	1.9	0.8
Total eggs with unconformities	pcs.	61	40
	%	8.4	5.4

* basal diet + 0.1% Bio-MOS® (Alltech inc., USA)

The benefits generated from the usage of the mannanoligosaccharide type prebiotic have been also revealed in other researches from 2004 [3; 4]. Their results underlined the positive influence of this feed additive on the eggs yield (+2%) and on the FCR, as well (decreasing with 6 p.p.).

Other researches, published in 2005 [5], showed that mannanoligosaccharides usage in laying hens feeding produced beneficial effects on the eggs yield (+2.5%) and FCR (-1.5%); the casualties have been also reduced, from 3.2% to 1.6%, while the amount of eggs with morphologic anomalies decreased from 2.5 to 1.7%, counted on the entire yield basis.

CONCLUSIONS

Production indexes have been influenced by the usage in laying hens feeding of 0.1% prebiotic of mannanoligosaccharide kind, although statistical significance did not occur. Thus, compared to the control group, the experimental treatment A (+ 0.1% prebiotic), gave higher results for egg mass yield (+1.7%), while the FCR decreased with 1.85%.

Concerning the external eggs quality, improved results have been acquired in the group fed with supplemental 0.1% prebiotic. Shell thickness increased with 2.8%, while the shell breaking strength was also improved (+3.6%).

The usage of the mannanoligosaccharide prebiotic led to the decreasing of the unconformities eggs amount. Therefore, for the entire analysed period, the amount of eggs with intact shell was 5.60% higher in experimental treatment vs. reference group.

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