THE IMPACT OF THE USE OF MICROBIAL PHYTASES IN THE POULTRY RATION FOR EGG PRODUCTION

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Abstract

The study was carried out to see the impact of replacing a portion of mineral phosphates by use of microbial phytase in poultry rations for eggs and the impact of this substitution in production indicators and cost of production. In broad terms of production were taken in evidence two batteries with about 58,000 head of layers between January and February 2011. Layers were hybrid Hy-Line W 36 in both batteries, with the respective age 39-40 weeks. The same feed ration were used for both batteries with the only difference for the battery no. 3 was involved enzyme while in battery no. 7 was used high amounts of bicalcique phosphate (20% Ca and 20% P). For layers of battery No.3 was added to the ration 0,06% phosphorus enzyme with content of 750,000 UF (Phytase Unit) and only1,401% phosphate mineral, while the layers of battery no. 7 had phosphate ore 1,964%. So with additional 450 UF for the layers of battery no. 3 was replaced 0,563% phosphate. At the end of the study no differences were found between batteries for eggs production, feed consumption per egg, and layers mortality. There were no effects on eggs weight and shell thickness of their shells which resulted to be respectively 63,18 – 67,60 gr and 339-362 micron. Strength of the eggshell was 2976 gr/cm^2 in the battery with the enzyme and 3146 gr/cm^2 in the battery that received only phosphate mineral.

Key words**:** phytase, layers, eggshell's strength, eggshell' thickness.

1. Introduction

It is recognized the key role of phosphorous in the composition of animal skeletal .In poultry it is a main ingredient of egg shell participating in several process of metabolism related with; energy, carbohydrates, amino-acids, fats. The lack or insufficiency of phosphorous in poultry ration causes the rachitisme and influencing in the strength of egg shell which is an important quality for the marketing and economic effectiveness.

It is known also the fact that kernel of cereals and their by-products and vegetal oil processing by products used in high amount (50-80%) in poultry ration, not only contains different amount of P but its presence in their composition is in the form of indigestible phytase by digestible liquids of monogastric. Consequently the large part of phosphorous of plant origin in the poultry ration is eliminated with droppings causing a disorder in the organism as well as pollution of the environment.

Also the phytase of feed can be introduced in combination to provide indigestible mixture with some minerals like: Ca, Zn, Mn and Cu as well as amino-acids making them not absorbed.

These are the reasons that in the composition of poultry rations are used as source of phosphorous mainly the phosphates with animal origin and those mineral with a digestibility of 80-98 %. But the elimination with droppings of phytic phosphorous and minerals in the last years has created concerns for the pollution of environment and for these reasons in many developed countries are defined legislative constraints regarding their use in the rations of animals.

During the last decades in order to influence in the assimilation of phosphorous with vegetal origin in the market are launched and used several type of microbial enzymes to contribute in the assimilation of phytic phosphorous increasing their digestibility with 30-50 % and reducing the use of mineral phosphates which are with higher cost [9, 11, 13]. These microbial ingredients contains different amount of enzymes which are measured with Phytasic Unit (UF) per kg.

The purpose of this study was to view the impact on production and cost of eggs of the replacing of one part of mineral phosphate with microbial phytase in the ration of laying hens.

From the studies of several authors for the effects of the replacing of mineral phosphates with microbial phytase it was noticed their effectiveness when they are used in the appropriate ratio [9, 10]. Even in

Albania, during 1995-2000 are carried out a series of trials with poultry and pigs with positive results [15].

2. Material and Methods

The study was carried out in the condition of commercial production putting in trial two batteries with 58.000 head of laying hens, in a poultry farm in Durres district, for the period January- March 2011.The laying hens were in both batteries hybrid Hy-Line W36 of age 40-44 weeks. For both flocks was used the same feeding rations with only difference that in the battery no.3 it was included in diet enzyme, whereas in the battery no.7 was used only higher amount of monobicalcim phosphate with a content 20 % Ca and 20 % P (Table 1). For laying hens of battery no.3 it was supplemented in the ratio 0.06 % phosphorous enzyme with a content 750.000 UF (Phytase Unit) and only 1.401 % mineral phosphate, whereas in the laying hens of battery no.7 only mineral phosphate in the amount of 1.964 %. So with the supplement of 450 UF in the battery no.3 was replaced with 0.563% phosphate.

In the literature [9] it is indicated that 500 UF/kg in nutritive diet can replace around 0.1 % mineral phosphorous. As it can be noticed in the table 1 in the battery no.3 the amount of digestible phosphor reached 0.35 %, whereas in the battery no.7 was 0.45 % without the calculation of the impact of phytase from the use of which is forecast to ensure 0,1 % of phosphorous in the diet.

Table 1. The calculated nutrient concentration of diet (%)

Indicators	Battery No. 3	Battery No. 7
Enzyme % (Natrufos 750UF)	0.06	------
Phosphate % (mono bicalcique)	1.401	1.964
Crude Prot %	14.96	14.92
EM/ K/kal/Kg	2650	2650
Calcium %	3.87	3.90
Digestible phosphorous %	0.350	0.450
Lysine %	0.800	0.800
Met+ Cystine %	0.680	0.680

During the trial was taken notes and was follow the dynamic of: egg production, weight of eggs, the losses, thickness of egg shell and the resistance in breaking, which was included in the local study for the first time. The weight of eggs was measured with electronic balance, the thickness of egg shell with electronic micrometer and the resistance of egg shell (g weight/ cm^2) with a simple equipment which measured the strengthening of eggs putting determined weights (diapason 50 gr) up in the breaking [13].

After conclusion all the data's was processed with well known system of mathematic processing such as ANOVA and STATGRAPHICS Centurion.

3. Results and Discussions

From the data's processed through the application of two processing methods results that the indicators taken in the study at the beginning and during the trials are presented in table 2.

Egg production. From the data's of table 2 it seems there are no essential differences in the percentage of egg production before and during the trial. In the battery no.3 where the laying hens have taken a ratio with less phosphate the production for both periods was equal. In the laying hens of battery no.7 who have taken only phosphate it seems that during the trial period there is a tendency of reduction of production, but completely not verified. In fact although the phosphorous generally plays a role in the egg production its impact for this indicator can be appeared or not in the case of its complete lack or differentiated insufficiency from recommended norms [9, 10, 13]**.** The impact of its presence in the ration is more emphasized in the thickness and particularly in the strength of egg shell. As it is above mentioned from our study could be concluded that the partial replacing of mineral phosphates with phosphatic enzyme in the ration of laying hens has not an impact in the egg production. In the same conclusion has resulted in our country the previous studies [15] and in their trials pointed out that ''the partial replacing of phosphates as a source of phosphorous with the supplement of microbial phytase has not an impact on the intensity of egg production".

The feed consumption per egg for the both group of laying hens in trial has remain unchangeable, higher around 5 g /egg in the laying hens of battery no.7, but without changes among the initial period and those of trial, although for this indicator the influence of phosphorous participation in the ration is not

sensitive. So the presence of microbial phytase in the amount used has not brought improvement in the digestibility and physiological effectiveness.

The percentage of damages has remained also unchangeable between the groups before and during the trial. In the laying hens of battery no.7 the percentage of damages was higher than battery 3 (2,32% vs 1,98 % for battery 3) as result of infection of flock from colibacillosis, however there were no changes for both batteries before and during the period of trial. In order to see the impact of changes in the ratio, during the trial period, in the impossibility to determine the amount of Ca and P in the bones, we have carried out several tests putting in the ground some laying hens from the two batteries, from cages in the ground to see if they would be able to move based on the assumption of the impact of changes in the bones. But in any of batteries were not observed individuals which regained oneself and the movement. So indirectly we reached in the conclusion that the changes carried out in the ratio had no negative impact on the skeleton.

Table 2. Indicators before and during the trial

No.	Indicators	Before the trial		During the trial		Differences	
		Battery no.3	Battery no.7	Battery no.3*	Battery no.7**	Verified	Not verified
1	Egg production (%)	81.58	78.40	81.90	77.65	-----	NV
2	Damages (%)	1.92	2.37	1.93	2.30	------	NV
3	Gr. feed /egg	129.3	134.4	129.9	134.5	-------	NV
4	Egg weight (gr)	66.36	63.14	67.60	63.18	-------	NV
5	Thickness of shell (mm)	0.343	0.339	0.346	0.362	-------	NV
6	Strength egg (gr/cm^2)	2916	2973	2910	3143	-------	NV

**Battery 3- in the ration phosphate + enzyme; **Battery 7-only phosphate*

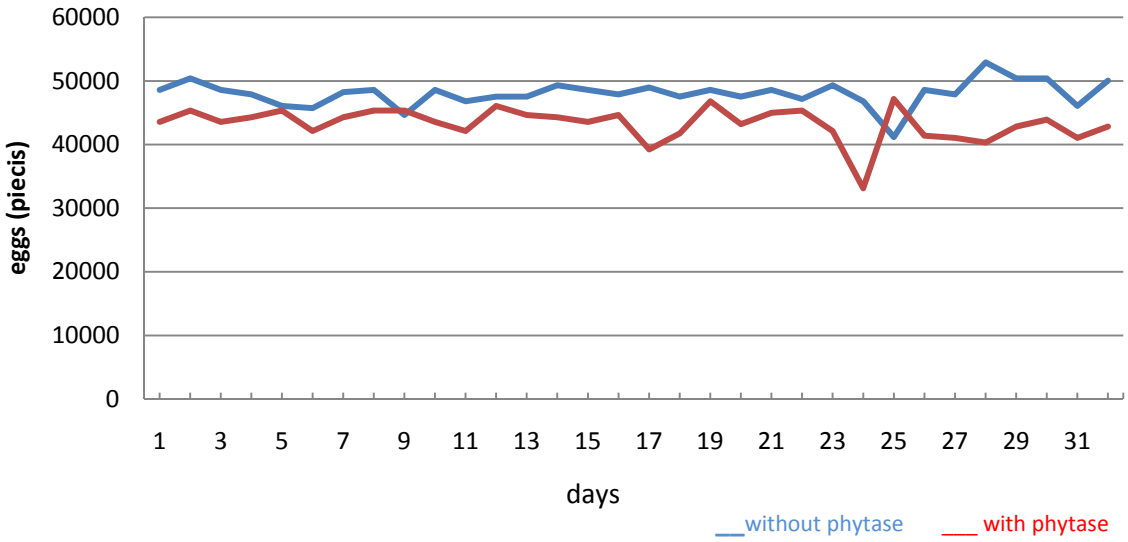

Figure 1: Egg Production

The weight of eggs. As can be seen from the data's, there was not essential changes verified between the groups. The egg weight in general has maintained the standard before the trial for both groups. The impact of phosphorous on the weight is insignificant taking into account that the weight of egg in general is an indicator which is more influenced from hybrid (genetic factor) and the age of hens and less influenced from nutritive factors [13]. Even other authors have reached in such conclusion [6].

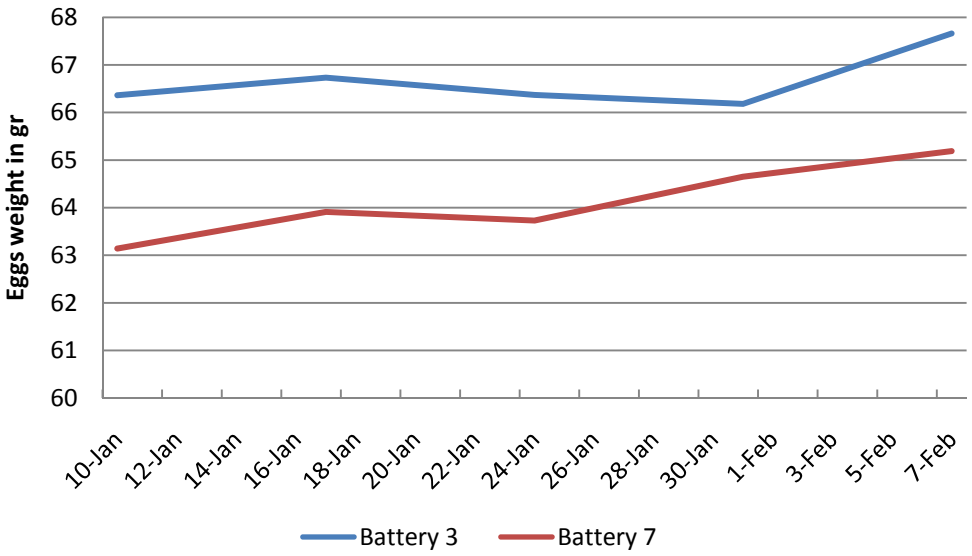

Figure 2: Weight of eggs in both batteries

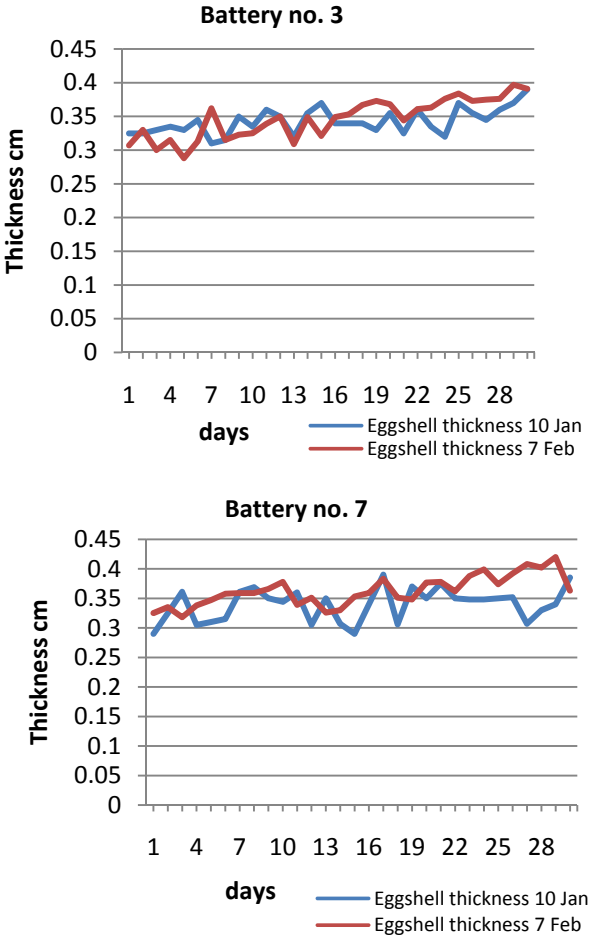

Figure 3. Thickness of shell for both batteries

The thickness of egg shell is an essential indicator for the eggs for market and is related mainly with the participation of Ca, P, and Vitamin D3 in the feed ration .From the data's obtained resulted it is varied in the limits of 343-346 microns in the eggs of the group who took enzyme and 346-362 microns in the group who took only phosphate. It seems at the first sight that there is an impact of improvement in the laying hens of battery no.7 but this is more a tendency not verified statistically (ts=0.345 and 0.435)

The strength of shell. Its measurement was carried out for the first time in local studies. It expresses the surface resistance of egg toward the shock through the weights up to breaking and is measured with the aptitude of egg shell to afford gram weight/cm^2 of its surface. Less resistant is the egg against this shock more weak and fragile is. For hybrid with different genetic origin the standard of breaking are different. So for example, brown color eggs have more resistant egg shell comparing with those of white color of egg shell. The hybrid tested in our experiment Hy-Line W-36 produce eggs with white color of egg shell.

In our trial, the strength has reached 2976 gr/cm^2 in the laying hens of battery no.3 with phytase and 3146 gr/cm^2 in the laying hens of battery no.7 with mineral phosphate. So, with an improving tendency for the group of laying hens who took only phosphate but not statistically verified (Stnd =0.348-1.557).

The parameters taken in our study for this indicator are lower than recommended commercial standard of the hybrid guide for strong eggs which are 3200-3500 gr/cm^2. For our trial could be confirmed that the partial replacing of mineral phosphate with

phosphatic enzyme has not an verified impact on the strength of egg shell which is a parameter with an impact on such indicator.

Economic effectiveness. Due to the fact that the company where the study was carried out was interested for economical efficiency of this replacing, the calculation was carried out and on the economical effect of replacing of 0.543 % of mineral phosphate with enzyme resulted:

In the laying hens of battery no.7 it was used 0.53 % more phosphate in those of battery no.3 more 0.06 % enzyme. Referring of their purchase price from the company resulted:

Phosphate less 0.53 % in the battery no.3 x 65 LEK /kg=0.325 LEK/kg feed

Enzyme more 0.06 in the battery no.3x 125 LEK =0.075 LEK/kg feed.

So, less than 0.259 LEK, resulted the cost of 1 kg feed in the trial group. Knowing that it was consumed 60 t of feed (daily consumption) we have 60 t x 30 days/month =1800 t x 250 LEK per ton less= 450.000 LEK (3214 EURO) less feed expenses per month. So the partial replacing of mineral phosphate with enzyme has given a better economical effect on the cost of feed of egg production.

Naturally we think that the percentages of the replacement of phosphate with enzyme must be made well studied as can happen undesirable effects on the egg indicators when are not respected the ratio of replacement as the enzyme can influence in the utilization of a part of phytic phosphorous of feeds and not in its overall presence on it.

4. Conclusions

From the trial of two hybrids laying hens Hy-Line W-36 of the age of 40-44 weeks after carrying out the experiment the partial replacement of mineral phosphate (0.563 %) with microbial phytase 750.000 UF (supplement 0.06% of the ration) ensuring around 1 % of absorbed phosphor of the ration through better absorption of the feed in the diet from the use of microbial enzyme it comes out in these conclusion.

-It was not noticed verifying differences between the groups for egg production, feed consumption per egg and damages in the laying hens.

-It was not noticed an impact on the egg weight and thickness of their egg shell which resulted to be respectively 63.18 g and 339-362 micron.

-The strength of egg shell expressed in the weight per cm^2 of egg shell surface varied from 2976 g/cm^2 in the group enzyme up to 3146 g/cm^2 per surface in the group who took only mineral phosphate.

As a conclusion, could be said that the partial replacing of mineral phosphate by use of microbial phytase enzyme had no impact on the productive indicators and egg shell quality indicators.

5. Acknowledgments

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