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THE BONES QUALITY OF FATTENING CHICKENS DURING THE FEEDING WITH DIFFERENT SOURCES OF PHOSPHORUS[1]

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Abstract: The examination had for its aim to compare the utilization of phosphorus in diets for chickens from different sources: di-calcium-phosphate, mono-calcium-phosphate, without and with addition phytase enzyme, at lower level of mentioned sources of phosphorus. The examination was done on 440 chicken of Arbor Acres starin, divided into 4 groups (per 110 chickens in group) considering the different sources of phosphorus: K-control group (di-calcium-phosphate-DKP 2%), O-I group (mono-calcium-phosphate-MKP 1,4%), O-II (di-calcium-phosphate-DKP 1%+0,10% of phytase) and O-III (mono-calcium-phosphate-MKP 0,7%+0,10% phytase). The experiment lasted for 42 days.

As criterion of phosphorus utilization in this study some variables of bone`s quality (content of ash, calcium and phosphorus in ash). The results of examination show: that the biggest content of femur`s ash is found at chickens of O-III group (for 1,95% bigger tahn chickens of K-group) and the least percent of femur`s ash. O-II group of chickens also had the biggercontent of ash than the chickens of K and O-I group. The content of calcium and phosphorus in ash was bigger at chickens whose diet had phytase (P>0,05).

We can state that the chickens of O-III and O-II group, taht gained per diet phytase (0,10%) at lower level of mineral sources of phosphorus (di-calcium-phosphate and mono-calcium-phosphate) reached better quality of bones. The differences of average values among examined groups were statistically significant (P<0,05) and statistically highly significant (P<0,01).

Key words: chickens, sources of phosphorus, phytase, quality of bones, ash.

Introduction

The industrialize of broiler production give the opportunity to increase the chickens meat production for more than four time here in our country, and also in the world for last three decades (*Pavlovski and Mašić, 1994*).

Only the appropriate diet can enable realization of high genetic potential of poultry (the better feed utilization, decreased fattening duration, reaching the high ending body weights). Further, reaching for the chickens meat of beter nutritional quality, what is going to be the main aim of animal diets in future time.

The mavement for natural and healthy food, during the last years, is developing as much in Europes as in USA. The consumers take more care about theway how the food they eat, has been produced.

Also, the attention is on the problems considering the remains of pesticides, drugs and mycotoxins (*Jensen, 1997, Moran, 1997*), as wek as welfare of animals. The intesive growth and high finishing body weights of chickens, however made zhe disproportional developing of body weight and skeleton.

That resulted in weakness and various deformity of legs as well as increased breaking strength of bones.

The problem of decreasing firmness of chickens bones makes great losses to broiler`s industry. The consequences are: the increased mortality and decreased quality of carcass during the conventionaly dresssed carcass (*Mohamed et al., 1991*).

Having in mind all mentioned, the problem of bone`s firmness is very current lately. From the feeding viewpoint the calcium and place take the calcium and phosphorus, referring to its adequate quantity in diet (*Khan, 1995, Georgievski, 1982*). They make (calcium and phosphorus) the main structural components of bones. Something about 80% of phosphorus get into the structure of bones in the form of hydroxiaphatite.

The necessary quantities of phosphorus in diet, the animals take out of raw materials of total feeding mixtures and added mineral sources of phosphorus.

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The diets for chickens are mostly made out of plant nutrient which have significant quantities of phosphorus, but 50-80% of that phosphorus is strongly connected into phytate (*Vogt, 1992*) which can not be disassembled by endogenous enzyme of chickens. Because of that reason we have to add phosphorus out of inorganic sources.

The application of mineral phosphorus sources in diet of animals brings a risk to life of animal and people. They are determined as great cause of environment pollution because they are secreted by excrement. The raw phosphate is particular risk because of its fluoride content. The fluor is toxic element and also can cause cancer.

Taking these facts into consideration the new access is forcing it self on lately considering using the mineral phosphorus sources in diet of animals. The aim is decreasing of level of mineral phosphorus sources or total exper from diet. At those formulation of diet the enzyme phytase is added, that per its hydrolytic action makes available the phosphorus in phytate from plant nutrition for monogastric animals and poultry.

The biological value of phosphorus sources can be determined through out production traits, but the most of authors give the priority over determination of biological value on the basic of bones ash content, content of calcium and phosphorus in blood, as well as biomechanical traits of bones (*Nimmo et al., 1980, Sanders et al., 1992, Radović et al., 2004).*

The aim of these examinations was the scientific establishing facts about influence of different phosphorus sources, meaning dicalcium phosphate and mono calcium phosphate, without or with addition of phytase enzyme (at decreased level of mineral sources of phosphorus), to the quality of fattening chicken bones.

Material and method

The biological adoption of phosphorus from different sources, without and with addition of phytase enzyme at decreased level of mineral sources of phosphorus in diets for fattening chickens, was examined during the feeding experiment. As criteria of utilization of phosphorus, biomechanical traits of chickens' bones were observed (tibia, humerus, femur).

In the beginning of the experiment, 440 of one day old chickens, Arbor Acres strain, were housed. The four experimental groups (per 110 chickens) were formed and divided into 4 cages, physical divided, considering different feeding treatments. The chickens were individually weighted, and the groups were united per average body weight. The standard technology of fattening was applied during 42 days.

The experimental groups (K, O-I, O-II, O-III) of the chickens were fed with full feeding mixture made of the same raw material content. The only difference was the source of phosphorus in diet.

In diet of the control group (K)as the phosphorus source, dicalcium phosphate (2%) was used, O-I group mono calcium phosphate (1,4%), O-II group dicalcium phosphate (1%) with addition of phytase enzyme (0,10%) and O-III group mono calcium phosphate (0,7%) with addition of phytase (0,10%).

For the experiment the phytase enzyme was used made in American company "Alltech" icn. This phytase is fermenting essence of small fungus Aspergillus niger (effects 125 (FYT)/g of in level of 0,10%-1kg/ton, added in mixtures and then mixed with total feeding mixtures.

At the end of the experiment, after sacrifices, out of each group, on the pattern of 8 chickens (4 female and 4 male): humerus, femur and tibia on the right side of the body singled oneself out for determination of biomechanical traits of bones. Measuring were done on the totally of 96 bones (24 bones per each examined group). Femur is used for determination of ash, calcium and phosphorus content. The analysis was done at chemical laboratory of Research Institute for Animal Husbandry Faculty of Agriculture in Novi Sad.

The existence of statistically significance was determined by analysis of variant, F-test as group test and Lsd-test for some comparison, for level of difference 5% and 1% in both tests.

Results and discussion

The content of ash in bones is one of the significant indicators that show how to make phosphorus from food useful and it is used for calculation of biological utilization of phosphorus out of some nutrient. The content of ash calcium and phosphorus is determined at chickens 6 weeks old, and gained values are shown in table 1 and figure 1.

Table 1. The content of ash, calcium and phosphorus and relation of Ca:P in femur of chickens

Variables Parametar	Group	Sources of P	$\bar{X}$ $\bar{X}$	Sd Sd	KV CV
Ash % Femur %	K	DKF	54,62	0,94	1,72
	0-I-	MKF	54,90	1,01	1,84
	0-II-	DKF+phyt.	56,09	1,24	2,22
	0-III-	MKF+phyt.	56,57	1,14	2,01
Ca % Femur	K	DKF	25,97	1,30	5,03
	0-I-	MKF	26,18	0,66	2,47
	0-II-	DKF+phyt.	26,18	1,68	6,43
	0-III-	MKF+phyt.	26,88	1,60	6,12
P % femur	K	DKF	9,11	0,64	7,02
	0-I-	MKF	9,09	0,52	5,78
	0-II-	DKF+phyt.	9,14	1,12	12,32
	0-III-	MKF+phyt.	9,18	0,45	5,24
Ca:P Femur	K	DKF	2,85:1		
	0-I-	MKF	2,88:1		
	0-II-	DKF+phyt.	2,86:1		
	0-III-	MKF+phyt.	2,92:1		
	*ash * P < 0,05 * pepeo **P < 0,01				

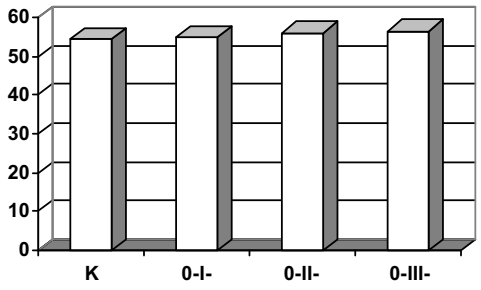

Figure 1. The content of ash in femur (%)

Out of shown data we can see that the ash content of bones was from 56,57% (O-III group) to 54,62% (K-group), O-II (56,09%) and O-I group (54,90%).

Beside the ash content very important indicator is also content of calcium in bones. Data from table 1 and figure 2 show that the biggest content of calcium had O-III group (26,88%) after wards O-II and O-I group with some values (26,28%) and at the end K-group (25,97%).

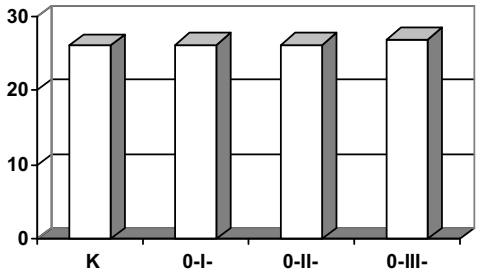

Figure 2. The content of calcium in femur (%)

The phosphorus utilization can be determined on the base of phosphorus content in bones. As for as phosphorus content the order was like this: O-III group (9,18%), O-II (9,14%), K- (9,11%) and O-I (9,09%) (table 1, figure 3).

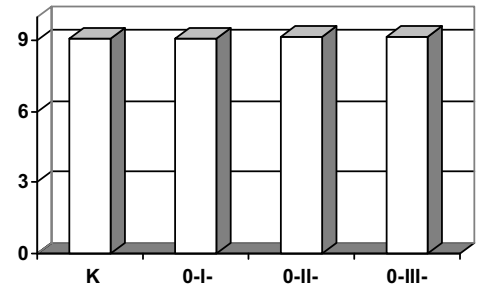

Figure 3. The content of phosphorus in femur (%)

In regard to mineral content the relation of calcium: phosphorus is very significant, which is in normal conditions at healthy animal about 2:1. ratio of calcium : phosphorus in femur of chickens in these examinations was from 2,85 (K-group) to 2,92 (O-III group) (table 1).

When we observe the results of Table 1 we can see that the biggest content of femur bones ash was at chickens of O-III group, bigger for 1,95% than chickens of K-group, with the beast percent of ash, O-II had for 0,28% bigger value of bones ash than K-group. The differences of average values between examined groups were statistically significant ($P<0,05$) (O-II and K-group and O-II and O-I). Statistically highly significant ($P<0,01$) among O-III and K-group and O-III and O-I group.

The young chickens are very sensitive during the first 3-4 weeks of life to deficiency of calcium and phosphorus in diet. That has most effects to % (percent) of ash in bones, meaning content of calcium and phosphorus in ash.

From Table 1 we can see that O-III group had the biggest content of calcium for 0,91% more than K-group, with the least content of calcium O-II and O-I group had the some values for calcium in bones, meaning for 0,21% more than K-group ($P>0,05$).

The content of phosphorus was the biggest at O-III group (for 0,09%) bigger from O-I group with the lowest content of phosphorus. There fore, O-II for 0,05 and K-group for 0,02% more than O-I group ($P>0,05$).

We can confirm having in mind the statements of literature, that the various authors gained different values that consider the content of ash in bones, calcium and phosphorus.

Orešnik et al (1976) at chickens Hybro which gained per diet dicalcium phosphate, confirmed the content of ash in bones 41,18%, calcium 15,27% and phosphorus 8,31% what is something lower than the results gained in this experiment. *Georgievski (1972)* states the values for calcium 17,25% and phosphorus 8,25%. *Vetesi et al.* (1998) when adding the phytase in diet for chickens that gained lower lever of unorganic phosphorus out of di-calcium-phosphate, confirmed the bigger percent of tibia`s ash. *Broz et al.. (1994)* with increasing level of phytase (125, 250 or 500 FYT/kg of diet) at lower level of mineral phosphorus sources, notice the increasing of positive effects and percent of tibia`s ash. *Kiiskinen et al. (1994)* announce taht with addition of 1000 FYT/g phytase in diet for chickens, without addition of mineral phosphorus source, the adequate mineralization of bones can be provided.

Harter-Dennis (2000) announce that the addition of 11 500 PTU/kg of diet when the level of digestable phosphorus is decreased to 0,35-0,25%, caused the increasing of bone`s ash percent (P<0,05).

Conclusion

On base of results gained in this examination and comparing with examinations of mentioned authors, we can conclude that they are in agreement. Data of many authors, who also used phytase in chickens diet at lower level of unorganic phosphorus, show bigger content of bones ash.

In this examination O-III and O-II group of chickens that gained phytase per diet and lower level phosphorus mineral sources (O-II di-calcium-phosphate and O-III mono-calcium-phosphate) had the statistically highly significant (P<0,05) and statistically highly significant (P<0,01) and bigger percent of bone`s ash. Also, the biggest content of calcium and phosphorus in bones had O-III group of chickens, but there was not any statistical significance.

The conclusion is: phytase added in diets for chickens improved the phosphorus utilization from phytate. Following results point out to that: the percent of bone`s ash, content of calcium and phosphorus in ash that are very sensitive criterion for evaluation of phosphorus utilization from diet.

KVALITET KOSTIJU PILIĆA U TOVU PRI ISHRANI RAZLIČITIM IZVORIMA FOSFORA

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Rezime

Istraživanje je imalo za cilj da se uporedi iskoristivost fosfora u ishrani pilića iz različitih izvora: dikalcijum-fosfata, monokalcijum-fosfata, bez i sa dodatkom enzima fitaze, pri sniženom nivou pomenutih izvora fosfora. Ispitivanje je obavljeno na 440 pilića provenijence Arbor Acres, podeljenih u 4 grupe (po 110 pilića u grupi), obzirom na različit izvor fosfora: K-kontrolna grupa (dikalcijum-fosfat-DKF 2%), O-I (monokalcijum-fosfat-MKF 1,4%); O-II (dikalcijum-fosfat-DKF 1%+0,1% fitaze) i O-III (monokalcijum-fosfat-MKF 0,7% + 0,1% fitaze). Ogled ishrane trajao je 42 dana.

Kao kriterijum iskoristivosti fosfora u ovom radu prikazani su neki parametri kvaliteta kostiju (sadržaj pepela, kalcijuma i fosfora u pepelu). Rezultati istraživanja pokazuju: da je najveći sadržaj pepela butne kosti konstatovan kod pilića O-III grupe (za 1,95%) veći od pilića K-grupe, sa najmanjim procentom pepela butne kosti. O-II grupa pilića takođe je imala veći sadržaj pepela u odnosu na piliće K- i O-I grupe. Sadržaj kalcijuma i fosofra u pepelu bio je veći kod pilića čiji je obrok sadržao fitazu (P>0,05).

Konstatujemo da su pilići O-III i O-II grupe, koji su hranom dobijali fitazu (0,10%) pri sniženim nivoima mineralnih izvora fosfora (dikalcijum-fosfat ili monokalcijum-fosfat) postigli bolji kvalitet kostiju. Razlike srednjih vrednosti između ispitivanih grupa bile su statistički značajne (P<0,05) i statistički visoko značajne (P<0,01).

Ključne reči: pilići, izvori fosfora, fitaza, kvalitet kostiju, pepeo.

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