Phytase as a factor of improving broilers growth performance and environmental protection

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ABSTRACT
The aim of this work was to find out the possibility how to increase the availability of phytic phosphorous and, at the same time, decrease phosphorous excretion through faeces into the environment when using phytase in broilers fed diets based on corn, soybean and sunflower meal with reduced level of phosphorous added. In all feeding periods of broilers, the group fed trial mash II with reduced phosphorous level and phytase had higher body weight by 2.0 - 18.7% during the trial, better feed conversion by 7.0% at the end of the trial and by 17.7% at the end of the second week, mortality lower by 16.7% and decrease of phosphorous level in faeces by 5.4 to 22.4 during the trial. The positive production results obtained in broiler feeding have shown that phytase added affected the increase of availability of trial mashes based on corn, soybean and sunflower meal with reduced level of phosphorous added.

Keywords: broilers, feed utilization, phytase, phosphorous excretion, weight gain

INTRODUCTION
Phosphorous is an important feed ingredient and is supplied to animals in needed amounts through raw material and added phosphates. Vegetable feeds contain significant amount of this mineral, however, 50 - 80% of phosphorous is bound in phytates, that cannot be broken down by endogenous enzymes in poultry (Anon, 1997). As a consequence, phosphorous from vegetable sources is poorly digested and cannot meet nutritional requirements of poultry regardless the fact that cereals, leguminous and oilseed plants contain 1 - 5% phytate. In order to become available to broiler chicks, phosphorous from vegetable sources must be hydrolyzed, with phytase as a catalyst, to inositols and inorganic phosphates which are readily absorbed in digestive tract (Annison, 1993).

Through supplementation of microbial phytase to the monogastric animals about 50% of phytic phosphorous may be released (Anon, 1997). Results of numerous experiments have shown that degradation of phytate by phytase has two-fold positive effect – release of phosphorous and release of minerals,
proteins and digestive enzymes by releasing phosphorous from phytate molecule, phosphorous supplementation in diets may be considerably reduced or even cancelled, thus leading to the reduction of phosphorus excretion (Kornsbak, 1998), with beneficial effects on the environmental issues.

First research works regarding usage of phytase in animal feed were conducted some thirty years ago, but without wider application in field conditions. As the result of rising environmental concerns and more stringent environmental regulations, however, research work related the production and application of phytase in animal feed has been intensified in recent years.

The aim of this paper was to find out the possibility of increasing availability of phytic phosphorous and, at the same time, decrease phosphorous excretion through faeces into the environment by using phytase in broilers fed diets based on corn, soybean and sunflower meal with reduced level of supplemented phosphorous.

MATERIAL AND METHODS

The effect of phytase in broiler chicken feeding was examined. The first trial was carried out at the farm “Topiko” in Bačka Topola. This trial involved 2000 day-old chicks of commercial strain hybro housed in 2 battery pens (1000 birds in each treatment group) under controlled ambient conditions. The trial lasted 42 days. Birds had ad libitum access to feed and water. Composition of trial diets for both groups and for both feeding periods (1-28 days and 28-42 days) is shown in Table 1. Premix supplemented with phytase enzyme (200 [g/t feed] “phytase novo” activity 500 [fyt/kg] produced by the Danish company Nordisk” a/s Bagsvaerd) was added in the trial mash during both feeding periods. During the trial the effect of phytase supplementation on health status and mortality was evaluated. Feed consumption and body weight of broilers were measured weekly (days 7, 14, 21, 28, 35 and 42) and following production parameters were determined: average body weight, average daily feed intake and feed utilization (weight gain [g] / feed consumed [g]). These data were statistically processed by analysis of variance and the differences were tested for significance (Hadživuković 1973).

Another trial was conducted at the laboratory of the faculty of technology in Novi Sad with avian broilers. Broilers were assigned in two groups of 30 birds each and housed in battery cages with facilities for control of temperature and humidity. The chicks received the same diets as in the first trial in Bačka Topola. Composition of trial diets is shown in Table 1. The trial lasted 42 days. Birds had free access to feed and water. Apart from monitoring the production parameters as in the trials in Bačka Topola, faeces were collected and average samples were taken once a week for determination of phosphorous content by AOCS method (1984) in this second experiment.
RESULTS AND DISCUSSION

The effects of dietary supplementation of phytase in broiler diets with reduced level of additional dicalcium phosphate on production parameters were evaluated.

Results for body weight in the first trial conducted in Bačka Topola are shown in Fig. 1. In all feeding periods, broilers fed trial mashes II with reduced phosphorous level and supplemented phytase gained larger body weight. This body weight increasing ranged from 2.0-18.7%. The highest increasing (18.7%) was at the end of the second week of the trial and that is statistically very significant increasing (p < 0.01).
Figure 1 Broiler chickens body weight

Mortality rate was lower in the group fed trial diet II (5.5% in group receiving trial diet I and 4.55% in the group receiving trial diet II).

Figure 2 Feed utilization
Results for feed utilization (weight gain [g] / consumed feed [g]), for the same trial in Bačka Topola are shown in Fig. 2. Trial diet II demonstrated better feed availability in broilers, particularly at the end of the first and second week when feed utilization was higher by 13.8%, i.e. 17.7% in relation to the group receiving trial diet I. These both results show statistically very significant increasing in feed utilization (p < 0.01). At the end of the trial, feed utilization of trial diet II was higher by 7% as compared to the trial diet I without phytase.

Production parameters obtained in the second trial differ by absolute values, but have shown rather comparable moving trends. As regards environmental protection dimension in this second experiment, trial mash II showed more positive results in relation to the trial mash I. Results shown in Fig. 3 demonstrate reduced phosphorous level in faeces of broilers fed trial mash II during the entire feeding period, from 5.4% to 22.4%. The highest reduction (22.4%) was in the second week of the trial and that is statistically very significant reduction (p < 0.01).

All obtained results are in conformity with the results of numerous researchers indicating that with the addition of various phytase preparations in differently formulated diets, this enzyme improves availability of phytic phosphorous and other nutrients (Annison, Choct 1993, Mitchell 1993, Cantor 1995, Sebastian et al. 1996.) and reduces phosphorous excretion (Simons 1993, Kornsbak 1998, Vetesi et al. 1998).
CONCLUSIONS

On the base of the investigations performed it was found that the broiler groups fed trial diets with reduced phosphorous level and phytase had: higher body weight; better feed utilisation; lower mortality and lower phosphorous content in faeces.

Taking into account positive production parameters it can be concluded that phytase addition resulted in enhanced availability of nutrients from trial diets based on corn, soybean and sunflower meal with reduced level of phosphorous added.

REFERENCES

Anon, Phytase novo in animal feeds, Novo Nordisk, animal trial report b 1046a-gb

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