PHYTASE AS A FEED ADDITIVES, THAT IMPROVES PERFORMANCE PARAMETERS OF WEANED PIGLETS IN EXTENSIVE FARM CONDITIONS

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ABSTRACT

Interest in phytase for monogastric animals take place in regions, where soil and groundwater pollution due to animal wastes is a serious problem and phosphorus is a major concern. Indeed, plant phytate is the major form of plant phosphorus and phytate phosphorus itself has low availability. The majority of the phosphorus in cereal grains and oilseed meals is organically bound as phytic acid or phytate. This form of phosphorus is nutritionally unavailable to non ruminant animals due to the lack of phytase in their digestive tract. As a result swine and poultry diets must be supplemented with highly available, inorganic sources of phosphorus to meet their phosphorus requirements. The poor bioavailability of phosphorus in the natural feedstuffs along with high dietary levels of supplemental phosphorus result in higher levels of fecal P compared with ruminant animals. Non ruminant animals intrinsic phytase which is necessary for hydrolysis of phytate present in the plant feedstuffs. However many fungi, bacteria and yeast can produce this enzyme. The aim of this study was to test the effects of the microbial phytase (NATUPHOS) on the performance parameters and faecal excretion phosphorus of weaned piglets in extensive farm condition. The microbial phytase preparation (*Aspergillus niger*, NATUPHOS) was supplemented to a basal ration 750 FTU/kg feed and the effects on growth performance of weaned piglets were studied. The supplementation of microbial phytase improved slightly daily weight gain, feed conversion ratio and reduces the amount of inorganic phosphorus needed to maximize growth and bone mineralization and markedly reduces fecal excretion of phosphorus. Overall a positive effect of the microbial phytase on performance parameters was observed. The P-excretion in the faeces was reduced by 20- 25%.

Keywords: Microbial phytase, performance parameters, P- reduction, weaned piglets.

INTRODUCTION

Nowadays, pollution is a serious threat to all parts of our environment, including the soil, ground water and surface water (Fodor and Szabo 2005, Borici et al., 2005).

Excessive animal manure and fertilizer inputs do cause various environmental problems, including the accumulation and elevated leaching and runoff of nutrients (N and P) and heavy metal to ground water and surface water (W. de Vries et al., 2005). Groundwater contamination by nitrate-nitrogen and eutrophication of surface waters by phosphorus originating from land application of fertilizers and animal manure are well documented in some most populated areas like, Durres, suburb of Tirana, Lushnja (Bregasi and Veizaj, 2007, Sulce and Veizaj 2006).

Nonpoint source nutrient pollution of ground water and surface water by agriculture is a major, longstanding environmental issue in the United States (Sims 2005). This is particularly true in areas where animal production has been geographically concentrated. Nutrient surpluses, usually due to imports of feed and fertilizer far in excess of exports in crops and animal products, lead to the buildup on nutrients in soils and increase the likelihood of poorly timed applications of manures. It is now widely accepted that a fundamental tenet of agro-environmental policy must be restoring nutrient balance on farms, especially those referred to as 'concentrated animal feeding operations' (CAFO-s). To achieve nutrient balance on farms or in watersheds requires a number of political, social, economic and logistic challenges.

For the utilization of phytate phosphorus, minerals and trace elements bound in phytic acid complexes, hydrolysis of the ester-type bonded phosphate groups of phytic acid by phytase is necessary (Rimbach et al., 1994). Phytases (mio-inositol hekxakisphosphate-phosphohydrolase) belong to a special group of phosphatases which are capable of hydrolyzing phytate to a series of lower phosphate esters of myo-inositol and phosphate. Two types of phosphates are known: 3-phytase (EC 3.1.3.8) and 6-phytase (EC 3.1.3.26), indicating the initial attack of the susceptible phosphate ester bond.

With the industrial production of phytase, application of this enzyme to pig's diet to increase P availability and improve animal performance, as well as reducing environmental pollution has gained widespread attention. The beneficial effects of supplementary phytases on P digestibility and animal performance have been well documented (Rao et al., 1999, Ravindran et al., 1999).

The efficacy of any enzyme preparation depends not only on the type, inclusion rate and level of activity present, but also on the ability of the enzyme to maintain its activity in the different conditions encountered through the gastrointestinal tract and the conditions used for the pre-treatment of a feedstuff or diet. To evaluate an enzyme preparation, it's important to characterize the enzymes in terms of pH stability, behavior during technological processing of feeds resistance to proteolytic attack and stability of the enzyme within the digestive tract of the host animal (Igbasan et al., 2000). The aim of this study was to test the effects of the microbial phytase (NATUPHOS) on the performance parameters and faecal excretion phosphorus of weaned piglets in extensive farm condition.

METHODOLOGY

Forty piglets (Large White x Landras) of four litters were transferred to flat-decks and allocated to 2 groups (A and B) with 20 animals (10 male and 10 female), respectively. Four piglets from different litters (1 male and 1 female), with the same body weight were housed in every box (experimental unit). The litter origin was taken into account, avoiding that piglets from the same litter were allocated in the same treatment. There were five replications per control group and five also per treated group. The control group (A) was feed with a balanced diet, containing mono calcium phosphate. The experimental group (B) was feed with low level of phosphorus, without inorganic phosphorus. All the phosphorus in this group originates from soybean meal. This group was supplemented with NATUPHOS phytase 750 FTU/kg feed.

Ambient room temperature was maintained at 17-22^{0}C for three first weeks and lowered by 1^{0}C for each week thereafter. The ventilation also was provided to ensure good air quality. The basal diet mainly contained maize and soybean meal and the nutrient contents met or

exceeded nutrient requirements recommended by NRC. The diets were offered ad-libitum and animals had free access to water.

Table 1. The calculated nutrient concentration of diet.

Nutrient concentration (g/kg feed)		
	Control group (A)	**Experimental group (B)**
ME (MJ/kg)	12.10	12.20
Crude protein	180.0	183.1
Crude fibre	38.6	38.5
Calcium	6.9	6.5
Phosphorus	6.1	4.3
Lysine	2.0	1.9
Metionine+Cystine	6.3	6.4

During six weeks experimental period Body Weight (BW), Daily Weight Gain (DWG) and Feed Conversion Ratio (FCR, kg feed/kg Body Weight Gain were measured weekly. Data are presented as arithmetic means with standard deviation of the mean (Mean ± SD). One-way analysis of variance and Student's *t*-test ($P<0.05$) were performed to test the differences between two groups.

RESULTS AND DISCUSSION

Feeding phytase NATUPHOS was slightly improved the production parameters respectively: Final Body Weight (FBW) by 2.11% and Daily Weight Gain (DWG) by 3.42%, compare with control group.

Table 2. The effect of phytase on production parameters

Parameters		Control group	Experimental group
Production	n[1]	X ± SD	X ± SD
-Initial BW, kg	20	7.80 ± 1.01	7.76 ± 1.07
-BW 6th week [2]		23.6 ± 2.20	24.1 ± 2.30
DWG, g [3]		376.1 ± 13	389.0 ± 14
FCR [4]		1.92 ± 0.35	1.85 ± 0.30

[1] Number of animals, (20 piglets/ every group, at the beginning of the experiment)
[2] BW at the end of the trial.
[3]DWG for whole experimental period.
[4]FCR for whole experimental period.

Feed Conversion Ratio (FCR) was reduced (-3.64%) to compare with control group, but the differences were not significant. The P-excretion was reduced by 20-25%, provided that pig's diets can be supplemented with an economical and efficacious level of phytase that will allow all of the supplemental inorganic P to be removed from the diet.

The effect of microbial phytase use as a partial replacer of the bicalcium phosphate in the layers and weaned piglets, aiming a better utilization of the phytic phosphorus and decrease of the environment pollution was documented (Piu et al., 2008). Utilization of microbial phytase (Natuphos) on the nutritive ration of weaned piglets (28 days old), was accompanied with improved performance parameters. In the experimental group, treated with Natuphos (750 FTU/kg), the excreted phosphorus amount in the dropping is decreased by 6.8%, while

the excreted nitrogen amount is decreased by 5.2%. So, there is a positive output towards the minimizing of the environmental pollution with non degradable Phosphorus and Nitrogen. (Cromwell & Coffey 1991) concluded that a 50% reduction of excreted phosphorus would mean that 100.000 fewer tons of phosphorus would be excreted into the environment annually in the United States. Obviously, this could have a major impact and would be especially significant in countries, where livestock production is restricted because of environment pollution.

The dosage of enzymes depends by the phytase activity and total phosphorus of cereals used in nutritive ration. (Delia et al., 2011) provides a first estimate of phytase activity, phytate and total phosphorus of some cereals grown in Albania and used in non-ruminant feed rations. It is only an estimate, because the magnitude of the "phytate problem" in terms of nutrient management in agricultural and livestock production is very important. According to the results of this paper Albanian cereals were classified like cereals all over the world. The results of this study showed that phytase activity was not related to total phosphorus or phytate content, whereas phytate was related to total P content.

CONCLUSIONS

Agricultural techniques and animal rest is a serious problem for soil and water pollution, especially in the areas with a big concentration of livestock farms. The situation is more problematic, when we add the fact that there is not government law to not allow the distribution of animal manure in everywhere. In such situation, It's difficult to have control on the quantity of phosphorus and nitrogen in the arable soil and ground water.

An original solution is the utilization of microbial phytase on the nutritive rations of non ruminant animals. Nowadays, phytase supplementation is considered as a good way to reduce phosphorus excretion in non ruminant animals.

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