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SIGNIFICANCE OF USAGE OF PHYTASE IN POULTRY NUTRITION

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Abstract: First commercialised in 1991, phytase is now present in over 60% of monogastric feed, and possibly even in a higher percentage of poultry diets. Since first commercial utilisation, phytase has mainly been considered to be a tool to increase phosphourus (P) availability/digestibility from vegetable sources and so reduce the inclusion of higher cost P sources. Here, phytase releases the P bound in the phytate molecule, increasing the availability/digestibility of this mineral to the animal. Thus, increasing the inclusion rate of phytase would be expected to release additional P from the indigestible feed phytate and consequently allow an even greater substitution of higher cost P sources. When phytases act on the phytate molecule, they also increase the solubility of the phytate while reducing its anti-nutritional effect. Phytate is known to be an anti-nutrient, affecting an increase in mucus production and the loss of amino acids, altering patterns of sodium secretion into the gut and influencing the absorption of minerals.
Keywords: Phytase, Poultry feed, Phosphorous, Feed efficiency.

Introduction

Phytate is the major form of phosphorus found in cereal grains, beans and oilseed meals feed to poultry birds. Approximately 61–70% phosphorus found in poultry diet ingredients is in the form of phytate phosphorus. Some microorganisms do produce phytase, most frequently the *Aspergillus* genus. The monogastric animals like poultry birds are unable to utilize this phytate phosphorus, as they lack endogenous phytase, which necessitates in the addition of inorganic feed containing phosphates to poultry diets in order to meet the phosphorus requirements of poultry (Yu *et al*, 2004). It has also been suggested that phytase in poultry diets improves gut health as indicated by reduced secretions from the gastrointestinal tract (GIT) which consequently improves the efficiency of utilization of energy. The main objective of this current review therefore is to determine the effect of dietary phytase feed additives on the broiler performance.

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Phytase from bacteria, fungi, and yeasts

Inclusion of fungal phytase in diets for poultry and swine has resulted in considerable improvement in phosphorus retention. When at least 1000 U/kg of fungal phytase is included in corn/SBM-based diets of pigs, phosphorus retention was increased from 52 to 64%. Similarly, phosphorus retention by broilers was improved from 50 to 60% by supplementing diets with a fungal phytase. Efficacy of phytase supplementation, however, is dependent on microbial source, form of the enzyme (coated, size of the particle, etc.), temperature, and pH optima of the enzyme, diet mineral concentration (Ca, Fe, Mg, Cu, and Zn), ingredients used in the diet, diet manufacturing methodology, form of the diet (pelleted, mash, or liquid), location of addition of phytase (post-pelleting or mixer), type and level of vitamin D metabolites, disease status of the animal, and other factors. Commercial phytases are typically produced using recombinant DNA technology. For example, a bacterial phytase gene has recently been inserted into yeast for commercial production. Recent gene insertion technology has greatly improved functional use of phytases by improving their thermostability, pH specificity, and resistance to break-down by other digestive enzymes in the animal.

Mechanism of Action

Phosphorus is predominately stored in mature seeds as a mineral complex known as phytin. The molecule in its uncomplexed-state is referred to as phytic acid, consists of a sugar (similar to glucose) called myo-inositol, to which phosphate (PO_4) groups are covalently linked. The bioavailability of this phytate phosphorus is generally very low for pigs and poultry, because they lack the capability to utilize P in this form. Only enzymes such as phosphatases and phytases are able to liberate phytate-bound phosphorus from the inositol ring and make it available to monogastric animals. The variation in phytate phosphorus content in feed materials may also affect their phosphorus availability. Phytase releases these phosphates from the inositol ring. Release of this phosphorus depends on the pH condition of the intestine.

Phytase *Vs* feed efficiency in broilers

Some researchers have noted an improvement in feed efficiency ratios (Broz, 1994). This increased feed efficiency is usually explained by a lower feed intake. Also, others did not found any improvement in feed efficiency (Huyghebaert, 1996). An increase in bodyweight gain or improvement in feed efficiency could be caused by a higher utilization of other ingredients such as protein, starch (energy) or other minerals. Other minerals (cations) can be complexes by phytate, making them unavailable to the animal. Phytase has been reported to improve the digestibility of calcium and positive reports on the utilization of minerals. Some researchers, however, have found no effect on iron availability (Biehl., 1997) and that phytase even decreases copper availability. Conversely, there are also indications that not only essential minerals are released. Some reports show an increase in the cadmium content of the liver or kidney when using phytase.

Phytase supplementation of layer diets

NRC (1994) recommendation of 250 mg non-phytate-P/hen/day is excessive. This may be complicated by the failure to recognise the contribution of digestible phytate-P in layers contend that the benefits of phytase supplementation of layer diets are 'still under discussion'. However, Van der Klis *et al*. (1997) demonstrated the efficacy of phytase in layers in a study in which an HPLC method was used to determine phytate. These researchers reported that in maize–soy diets, containing 2.4 g phytate-P kg−1, 500 FTU phytase activity kg−1 substantially increased ileal degradation of phytate (0.661 versus 0.081). Lim *et al*. (2003) concluded that phytase supplementation improved egg production and reduced percentages of broken and soft eggs and P excretion. However, it was concluded that dietary levels of Ca and non-phytate-P could significantly influence the effects of phytase supplementation. It is possible that phytase enhances Ca availability and Ca influences phytase efficacy. It may be instructive to focus attention on the effects of dietary Ca levels when evaluating phytase supplementation of layer diets. Also, it may be possible to reduce additional nutrient specifications in association with phytase supplementation which would be economically advantageous.

Conclusion

This review suggests that phytase supplementation had some positive effect on the growth performance, feed efficiency, protein/amino acid digestibility, energy utilization, mineral retention and bone growth of broilers during the whole growth period.

REFERENCE

[1] Biehl, R.R. (1997) Iron bioavailability in soybean meal as affected by supplemental phytase and 1a - hydroxycholecalciferol. Poultry Science 76:1424-1427.

[2] Broz, J. (1994) Effects of supplemental phytase on performance and phosphorus utilisation in broiler chickens fed a low phosphorus diet without addition of inorganic phosphates. Br. Poultry Sci. 35:273-280.

[3] Huyghebaert, G (1996) Effects of dietary calcium, phosphorus, Ca/P-ratio and phytase on zootechnical performances and mineralisation in broiler chicks. Arch. Geflugelk. 61:53-61.

[4] Lim, H.S., Namkung, H., Paik, I.K., 2003. Effects of phytase supplementation on the performance, egg quality,and phosphorus excretion of laying hens fed different levels of dietary calcium and nonphytate phosphorus. Poult. Sci. 82, 92–99.

[5] National Research Council, 1994. Nutrient Requirements of Poultry, nineth revised ed. National.

[6] Van der Klis, J.D., Versteegh, H.A.J., Simons, P.C.M., Kies, A.K., 1997. The efficacy of phytase in corn–soybean meal-based diets for laying hens. Poult. Sci. 76, 1535–1542.

[7] Yu, B., Jana, Y.C., Chungb, T.K., Leea, T.T., Chioua, P.W.S., 2004. Exogenous phytase activity in the gastrointestinal tract of broiler chickens. Anim. Feed Sc. Tech., 117: 295–303.