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Subhash Kumar
Department of Animal Nutrition, College of Veterinary and Animal Science, Bikaner, Rajasthan, India

Dinesh Jain
Department of Animal Nutrition, College of Veterinary and Animal Science, Bikaner, Rajasthan, India

Tara Bothra
Livestock Production and Management, College of Veterinary and Animal Science, Bikaner, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, India

T Sharma
Department of Animal Nutrition, College of Veterinary and Animal Science, Bikaner, Rajasthan, India

RK Dhuria
Department of Animal Nutrition, College of Veterinary and Animal Science, Bikaner, Rajasthan, India

R Nehra
Department of Animal Nutrition, College of Veterinary and Animal Science, Bikaner, Rajasthan, India

UK Prajapat
Department of Animal Nutrition, College of Veterinary and Animal Science, Bikaner, Rajasthan, India

SS Siyag
Department of Animal Nutrition, College of Veterinary and Animal Science, Bikaner, Rajasthan, India

Mangesh Kumar
Department of Animal Nutrition, College of Veterinary and Animal Science, Bikaner, Rajasthan, India

Correspondence
Subhash Kumar
Department of Animal Nutrition, College of Veterinary and Animal Science, Bikaner, Rajasthan, India

Effect of phytase supplementation in maize–soybean based feed on tibia bone characteristic of broiler chickens

Subhash Kumar, Dinesh Jain, Tara Bothra, T Sharma, RK Dhuria, R Nehra, UK Prajapat, SS Siyag and Mangesh Kumar

Abstract
An experiment of 42 days with 150 one day-old broiler (Vencobb) chicks was conducted to determine the effect of supplementation of different levels of phytase enzyme on tibia characteristics of broilers fed on phosphorus deficient maize-soybean based rations. A total of 150 chicks were grouped into five treatments (two replicates in each treatment), each containing 30 chicks and designated as C, T_1, T_2, T_3 and T_4. An experimental ration was formulated containing low available phosphorus (0.28%) than the normal requirement 0.45% as per BIS specifications (2007). Broiler starter and finisher ration contained 21.45 and 19.10 percent crude protein, respectively. Ration containing low available P was fed in control group without any supplementation while, other treatments *i.e.* T_1, T_2, T_3 and T_4 were supplemented with phytase enzyme at the levels of 250, 500, 750 and 1000 FTU/Kg feed, respectively. It was concluded that phytase supplementation at any level did not have any significant effect on tibia weight and tibial measurements. Significant effect was found on supplementation of phytase at the level of 500FTU/kg phytase or more as compared to rest of groups.

Keywords: Broiler, Phytase, FTU (Phytase unit), tibia, phosphorus

1. Introduction
Poultry rearing is a traditional practice in India. Poultry contributes to improved human nutrition and food security by being a major source of high quality protein in form of eggs and meat. Feed represents the major cost of poultry production, constituting up to 70 percent of the total rearing cost. Most poultry diets are primarily composed of plant based ingredients. Poultry ration are formulated from a mixture of ingredients, including cereal grains, cereal by-products, plant protein sources, fat, animal by-products, minerals, vitamins, crystalline amino acids and feed additives. In respect to growth and development of poultry, phosphorus (P) is an essential mineral element. In plants, phosphorus is present in different forms such as attached to organic molecules like phospholipids and proteins but most is present as part of the phytic acid molecule. Ruminant animals are able to break phytate-P complex through phytase enzyme produced by micro-organisms present in their rumen but mono-gastric animals are not efficient to use phytate form of P because they lack endogenous phytase enzyme in their gastro-intestinal tract. In order to meet the P needs of the birds, it is usual practice to add inorganic P at the time of diet formulation. However, additional inorganic phosphorus supplementation can increase feed cost since, phosphorus is usually listed as the third most expensive nutrient in poultry diets after energy and protein.
The enzyme phytase (myo-inositol-hexa-phosphate-phosphorhydrolase) catalyses the stepwise hydrolysis of inositol hexa-phosphate to inorganic phosphate and myo-inositol via InsP5 to InsP1. (Nelson *et al*. 1971) [5] incorporated microbial phytase to a corn-soybean based diet low in phosphorus and observed an increased tibia ash content indicating enhance utilization of phytate-P present in diet.

2. Material Method
In the present study, a total of one hundred and fifty (150) one day-old, unsexed, apparently healthy broiler chicks were purchased from commercial hatchery. All birds were distributed randomly and equally in five groups. Each group having 30 birds was further divided into 2 replicate having 15 birds in each.

Bands were applied at wings on 3rd day of age for proper identification. Broilers were vaccinated against Ranikhet (F_1 strain) and Infectious bursal disease at the age of 4th and 14th days respectively as per routine schedule. Diet included: C-basal diet with no supplementation; T_1 basal diet supplemented with 250 FTU/kg diet; T_2 basal diet supplemented with 500 FTU/kg diet; T_3 basal diet supplemented with 750 FTU/kg diet and T_4 basal diet supplemented with 1000 FTU/kg diet. Fresh and dry wheat straw was used as bedding material. Identical standard management practices regarding brooding, feeding, watering and disease control etc. were followed for each group during study. The broiler starter and finisher feed contained 21.45% and 19.10% crude protein as tabulated in Table 1. A diet deficient in available P (0.28%) was offered to chicks during experimental period. Different ingredients for experimental ration were purchased from local market. Two birds per treatment were taken randomly to study tibia bone measurements. Birds were individually weighed, slaughtered, feathered and eviscerated. The left tibia was removed and cleaned of all adhering flesh, extracted with petroleum spirit (boiling point 60-80 ^{0}C) using Soxhlet apparatus and dried. After recording the overall length and width of tibia by vernier caliper, bones were oven dried at 105 ^{0}C to the constant weight. The dried fat-free bones were ashed in a muffle furnace at 600 ^{0}C for 6 hours. The total ash was determined as per AOAC (2005) [1].

Table 1: Nutrient composition of experimental starter and finisher ration (% DM basis).

Ration	Dry matter	Crude protein	Crude fiber	Ether extract	Nitrogen free extract	Total ash	Available P
Starter ration	90.94	21.45	5.37	4.08	62.52	6.58	0.28
Finisher ration	90.70	19.10	4.96	4.73	64.06	7.15	0.28

3. Result

The data of tibia weight, tibia measurements and tibia ash percent of broilers supplemented with various levels of phytase enzyme have been presented in Table 2. Tibia weight and length were recorded as 5.06 g and 9.91cm in C, 5.18 g and 9.98 cm in T_1, 5.19 g and 9.52 cm in T_2, 5.36 g and 9.76 cm in T_3 and 5.40 g 9.48 cm in T_4 groups, respectively. Tibia width at mid shaft, proximal end and distal end was recorded as 0.85 cm, 2.22cm, and 1.73 cm in C, 0.89 cm, 2.51 cm and 1.79 cm in T1, 0.84 cm, 2.39 cm and 1.75 cm in T2, 0.88 cm, 2.36 cm and 1.87 cm in T3 and 0.87 cm, 2.68 cm and 1.78 cm in T4, respectively. Tibia ash percent in C, T_1, T_2, T_3 and T_4 treatment groups was recorded as 36.86, 39.06, 39.96, 40.60 and 40.56 percent, respectively. Statistical analysis of data revealed no-significant difference in tibia weight, length and diameter at shaft and at proximal and distal end of tibia in different treatment groups. Numerically highest tibia ash percent was recorded in T_3 group, which was statistically comparable with T_4, T_2 and T_1 but significantly higher than control group.

Table 2: Effect of phytase enzyme supplementation on tibia characteristics in broiler chicks.

Main effects	Tibia – Parameters					
	Tibia weight (g)	Tibia length (cm)	Tibia width at mid shaft (cm)	Tibia width at proximal end (cm)	Tibia width at distal end (cm)	Tibia ash %
C	5.06	9.91	0.85	2.22	1.73	36.86^a
T_1	5.18	9.98	0.89	2.51	1.79	39.06^{ab}
T_2	5.19	9.52	0.84	2.39	1.75	39.96^b
T_3	5.36	9.76	0.88	2.36	1.87	40.60^b
T_4	5.40	9.48	0.87	2.68	1.78	40.57^b
SEM	0.28	0.34	0.03	0.18	0.07	0.62
a, b - Means superscripted with different letters differ significantly from each other.						

The results obtained of tibia weight, length and width are in line with findings of El-Sherbiny *et al.* (2010) [3] who recorded no significant improvement on phytase supplementation in broiler rations. The obtained results of tibia ash percent are in line with findings of El-Sherbiny *et al.* (2010) [3] who reported significant improvement in tibia ash percent by supplementation of phytase @ 500 FTU/KG level in broiler ration.

4. Conclusion

It can be concluded based on results obtained in present study that there was no significant difference in different tibia bone parameters *i.e.* bone length, weight and diameters at any level of inclusion of phytase enzyme in broiler diets. However, the inclusion of 500 FTU phytase kg-1 or more significantly improve tibia ash percent in broiler chicks.

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