International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; 9(12): 326-328
www.biochemjournal.com
Received: 01-09-2025
Accepted: 05-10-2025

M Manobhavan
Assistant Professor, Department of Animal Nutrition, Madras Veterinary College Vepery, Chennai, Tamil Nadu, India

AV Elangovan
Principal Scientist, ICAR-National Institute of Animal Nutrition and Physiology, Adugodi, Bangalore, Karnataka, India

Corresponding Author:
M Manobhavan
Assistant Professor, Department of Animal Nutrition, Madras Veterinary College Vepery, Chennai, Tamil Nadu, India

Effect of super dosing of phytase enzyme on carcass traits of broiler chicken

M Manobhavan and AV Elangovan

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i12e.6497

Abstract
This study sought to assess the impact of phytase super dosing on broiler carcass characteristics. The experiment consist of 168 straight run broiler chicks were randomly allocated into four dietary treatment groups, each comprising six replicates with seven birds per replicate. The dietary treatments were: one positive control diet without phytase (Group I) and three low phosphorus diets supplemented with phytase at 500, 2500, and 5000 FTU/kg feed (Groups II, III and IV, respectively). The feeding trial was conducted for 35 days. At the end of the experiment, two birds per replicate were slaughtered for carcass trait analysis. Birds receiving higher phytase levels (Groups III and IV) showed significantly ($p<0.05$) greater body and carcass weights. These findings suggest that supplementing super doses of phytase in low-phosphorus diets can enhance growth performance and carcass characteristics in broiler chickens.

Keywords: Broiler, carcass traits, phytase, super dosing

Introduction

Phosphorus ranks as the third most high-priced nutrient in poultry diets, following energy and protein. Majority of the plant-based phosphorus are bound to phytic acid, which poultry cannot efficiently break down due to limited endogenous phytase production (Bedford, 2000) [1]. As a result, a lot of the phytate phosphorus remains unused and ends up being excreted in the chicken's manure. Phytic acid is considered an anti-nutritional factor because of its strong chelating ability, which interferes with the absorption of minerals and other nutrients (Joudaki *et al.*, 2023; Oliveira Borges *et al.*, 2025) [7, 12]. Exogenous phytase enzyme is added to poultry diets at a standard dose of 500 FTU/kg to replace about 0.12% of dietary phosphorus. Recently, super dosing of phytase has gained attention for its potential to release greater amounts of phosphorus, reduce residual phytate and produce lipotropic compounds that support improved nutrient absorption. These benefits include enhanced amino acid utilization, protection of the intestinal lining, lower epithelial cell turnover and reduced metabolic burden in broilers (Cowieson *et al.*, 2011; Walk *et al.*, 2013; Manobhavan *et al.*, 2016; Farhadi *et al.*, 2017; Raut *et al.*, 2018; Morgan *et al.*, 2016; Lima *et al.*, 2021) [3, 18, 10, 4, 15, 11, 9]. The present study aimed to investigate the impact of phytase super dosing in phosphorus-deficient diets on carcass traits in broiler chickens.

Materials and Methods

The experiment was carried out at the National Institute of Animal Nutrition and Physiology (NIANP), Bengaluru, India, using a completely randomized design involving four dietary treatments in broiler chickens. A total of 168 birds were divided into four dietary treatment groups. Each dietary treatment had six replicates and each replicates had seven chicks. The dietary treatments consisted of one positive control diet, Group I without any phytase enzyme (0.45% available P during starter and 0.40% during finisher phase), and three negative control diets-Group II, III, IV (0.32% available P during starter and 0.28% during finisher phase) were supplemented with commercial phytase @ 500, 2500 and 5000 FTU/kg diet, respectively. The trial period was divided into two phases: starter (1 to 21 days) and finisher (22 to 35 days). The diets were based on corn/soybean meal (Table 1), which allowed for the constant inclusion of the majority of ingredients with the exception of dicalcium phosphate.

Excel-based feed formulation was used to create the diets, which were based on the Nutrient Requirement of Poultry published by ICAR (2013) [5] using Excel-based feed formulation. At experimental livestock unit of institute, chicks were housed in battery cages as groups in random manner, fitted with heating arrangements, feeders, waterer and dropping trays, with 24 hr light, proper air ventilation and reared under standard managemental conditions.
At the end of the trial, two birds from each replicate (12 per treatment group, totaling 48 birds) were randomly selected and humanely euthanized via cervical dislocation to evaluate carcass characteristics. The study was approved by the Institutional Animal Ethics Committee. Data were statistically analyzed using one-way ANOVA suitable for a completely randomized design, with treatment means compared using Tukey's HSD test. Statistical significance was set at $p \leq 0.05$ (SPSS Version 20.0, SPSS Inc., Chicago, USA).

Table 1: Ingredient and nutrient composition of experimental diets during starter (1-21 days) and finisher (22-35 days) age

	Starter (1-21 days)		**Finisher (22-35 days)**	
	NP	**LP**	**NP**	**LP**
Ingredient composition, as fed basis (%)				
Maize	58.2	58.35	61.05	61.08
Soybean meal	36	36	32.5	32.5
Sunflower oil	2	2	2.5	2.5
Limestone	1	1.6	1	1.7
Di-calcium phosphate	1.75	1	1.5	0.75
Celite	0	0	0.5	0.5
Salt	0.35	0.35	0.35	0.35
Lysine	0.35	0.35	0.1	0.1
Methionine	0.13	0.13	0.1	0.1
Vitamin mineral premix*	0.25	0.25	0.25	0.25
Nutrient composition (%)				
ME (kcal/kg)**	3007	3012	3064	3064
CP	22.22	22.33	19.35	19.91
Lysine**	1.47	1.47	1.13	1.13
Methionine**	0.50	0.50	0.45	0.45
Calcium	1.09	1.07	1.01	1.03
Total phosphorus	0.757	0.630	0.696	0.568
Phytate phosphorus	0.312	0.312	0.298	0.298
Available phosphorus**	0.445	0.318	0.397	0.269

*Trace mineral premix, 1g/kg; Vit. Premix, 1 g/kg and Choline 0.5 g/kg.
Trace mineral premix supplied (mg/kg diet): Mg, 300; Mn, 55; I, 0.4; Fe, 56; Zn, 30; Cu, 4.
The vitamin premix supplied (per kg diet): Vitamin A, 8250 IU; Vitamin D_3,1200 ICU; Vitamin K, 1 mg; Vitamin E, 40 IU; Vitamin B_1, 2 mg; Vitamin B_2 4 mg; Vitamin B_{12}, 10 mcg; niacin, 60 mg; pantothenic acid, 10 mg.

NP-Normal Phosphorus diet
LP-Low Phosphorus diet
** Calculated

Results and Discussion

The results obtained during the trial were presented in the Table 2.

Table 2: Body weight and Carcass traits of broiler chicken at 35 days of age

Groups **Traits**	**Group I** **Positive control**	**Group II** **Com Phytase 500**	**Group III** **Com Phytase 2500**	**Group IV** **Com Phytase 5000**
Body weight (kg)	1.504^a±0.03	1.463^a±0.05	1.775^b±0.04	1.806^b±0.04
Carcass weight (kg)	1.101^a±0.02	1.044^a±0.04	1.296^b±0.02	1.310^b±0.04
Breast weight (g)	253.843^a±7.57	240.769^a±9.62	294.533^b±10.53	303.328^b±9.32
Thigh weight (g)	147.270^a±5.44	135.785^a±8.07	180.187^b±5.63	180.970^b±5.93
Drumstick weight (g)	141.338^a±3.63	131.933^a±5.08	166.536^b±4.07	166.291^b±4.83
Back weight (g)	190.643^a±10.36	171.245^a±6.33	225.928^b±8.67	240.880^b±8.91

Each value is the mean of 12 observations
Mean bearing different superscript within a row differ significantly ($p<0.05$)

Broilers fed in the group III and IV ate more and gained more ($p<0.05$) than chicks fed in the group I and II during the trial period. The highest body weight was noticed in group IV (1.806±0.04 kg) and lowest in group II (1.463±0.05 kg). The carcass weight of broiler chicken was significantly higher in group IV receiving phytase 5000 FTU/kg diet and lower in group II receiving phytase 500 FTU/kg diet. The cut-up parts (breast, thigh, drumstick, back) weight followed the same trend of carcass weight.

In alignment with the present findings, Jain (2021) [6] observed a significant improvement ($p>0.01$) in the final body weight of broiler chicks supplemented with phytase at 500 FTU (T_1) and 1000 FTU (T_2) compared to the control group (T_0). Additionally, Broch *et al.* (2018) [2] reported that broiler growth performance responded to phytase supplementation in a quadratic manner ($p<0.05$) from day 1 to 42, with optimal results for body weight gain, feed consumption and feed conversion ratio achieved at inclusion levels of 2051, 1992 and 2101 FTU/kg, respectively. According to Shirley and Edwards (2003) [17], high-dose phytase supplementation may offer beneficial effects through three main mechanisms: enhanced phosphate release or rebalancing of phosphorus to calcium ratios, reduced residual phytate to mitigate anti-nutritional effects and production of myo-inositol, which has vitamin-like or lipotropic properties due to the breakdown of phytate into more soluble lower esters.

Lima *et al.* (2021) [9] recorded that varying levels of phytase (FTU) supplementation had a significant influence on carcass traits, particularly thigh yield ($p = 0.027$) and breast yield ($p = 0.032$). Their findings suggested that inclusion of 1500 FTU/kg and 1000 FTU/kg phytase resulted in the highest thigh and breast yields, respectively, in 45-day-old broilers. Similarly, Jain (2021) [6] observed a significant improvement in carcass characteristics of Kadaknath birds with phytase supplementation. Key parameters such as edible carcass yield, breast and thigh portions, meat and bone weights and meat-to-bone ratio were significantly enhanced (p>0.01) in the phytase-treated groups, with the T_2 group (1000 FTU) demonstrating superior performance compared to the non-supplemented control.

On the other hand, phytase supplementation improved leg quarter yield but had no effect on overall carcass yield or breast weight, according to Scheideler and Ferket (2000) [16]. Similarly, Pillai *et al.* (2006) [13] observed that the inclusion of fungal phytase at 600 FTU/kg in a low-phosphorus diet resulted in carcass yield, breast and thigh weights comparable to those in the normal phosphorus control group. Supporting these findings, Juncqueira *et al.* (2011) [3] reported that supplementing low-phosphorus diets with 750 and 1000 FTU/kg of phytase did not significantly affect carcass yield; however, leg and thigh weights were lower than the control group, while breast weight showed some improvement. More recently, Prabhuraja *et al.* (2024) [14] noted no significant differences (p>0.05) in carcass characteristics including dressing percentage, thigh yield, breast and drumstick, abdominal fat content and weights of internal organs such as the heart, liver, proventriculus and gizzard between the control and phytase-supplemented low-phosphorus groups, as well as among the various phytase-supplemented groups.

Conclusion

This study demonstrated that incorporating high levels of phytase (2500 FTU) into a low-phosphorus diet offers greater benefits compared to the standard phytase inclusion level (500 FTU) in broiler nutrition. The results suggest that super dosing phytase in phosphorus-deficient diets positively influences both body weight and carcass yield in broiler chickens.

Acknowledgment

The financial support received from Department of Biotechnology; Government of India is thankfully acknowledged.

References

1. Bedford MR. Exogenous enzymes in monogastric nutrition and their current value and future benefits. Anim Feed Sci Technol. 2000;86:1-13.
2. Broch J, Nunes RV, Eyng C, Pesti GM, Souza C, Sangallia GG, *et al.* Effect of dietary phytase super dosing on broiler performance. Anim Feed Sci Technol. 2018;244:56-65.
3. Cowieson AJ, Wilcock P, Bedford MR. Super-dosing effects of phytase in poultry and other monogastrics. Worlds Poult Sci J. 2011;67:225-235.
4. Farhadi D, Karimi A, Sadeghi Gh, Rostamzadeh J, Bedford MR. Effects of a high dose of microbial phytase and myo-inositol supplementation on growth performance, tibia mineralization, nutrient digestibility, litter moisture content, and foot problems in broiler chickens fed phosphorus-deficient diets. Poult Sci. 2017;96(10):3664-3675.
5. ICAR. Nutrient requirement of animal-poultry. NIANP Publication. India; 2013.
6. Jain A. Effect of phytase supplementation on production performance and economics of Kadaknath chickens. Indian J Anim Sci. 2021;91(11):953-956.
7. Joudaki H, Aria N, Moravej R, Rezaei Yazdi M, Emami-Karvani Z, Hamblin MR. Microbial phytases: properties and applications in the food industry. Curr Microbiol. 2023;80(12):374.
8. Junqueira OM, Duarte KF, Assuena V, Filardi RDS, Laurentiz ACD, Praes MFFM. Effect of phytase supplementation on performance, bone densitometry and carcass yield in broiler chicks. Acta Sci Anim Sci. 2011;33:301-307.
9. Lima GS, Lima MR, Gomes GA, Cavalcante DT, Guerra RR, da Silva JHV, *et al.* Super dosing of bacterial phytase (EC 3.1.3.26) in broiler diets with reduced levels of digestible amino acids. Livest Sci. 2021;253:104714.
10. Manobhavan M, Elangovan AV, Sridhar M, Shet D, Ajith S, Pal DT, *et al.* Effect of super dosing of phytase on growth performance, ileal digestibility and bone characteristics in broilers fed corn-soya-based diets. J Anim Physiol Anim Nutr (Berl). 2016;100(1):93-100.
11. Morgan NK, Walk CL, Bedford MR, Scholey DV, Burton EJ. Effect of feeding broilers diets differing in susceptible phytate content. Anim Nutr. 2016;2(1):33-39.
12. Oliveira Borges S, Petrolli TG, Hannas MI, Bernardes RD, de Oliveira CH, Dias KMM, *et al.* Effects of phytase supplementation on broiler chickens fed nutrient-deficient diets. Livest Sci. 2025;301:105823.
13. Pillai PB, Connor-Dennie TO, Owens CM, Emmert JL. Efficacy of an *Escherichia coli* phytase in broilers fed adequate or reduced phosphorus diets and its effect on carcass characteristics. Poult Sci. 2006;85:1737-1745.
14. Prabhuraja N, Umesh BU, Indresh HC, Krishnamurthy TN, Dakshith PL. Effect of phytase supplementation on carcass characteristics and visceral organ weights in broilers. Int J Vet Sci Anim Husb. 2024;9(3):364-367.
15. Raut S, Dhumal M, Nikam M, Khose K. Influence of super dosing of phytase enzyme on performance of broiler chicken. Int J Livest Res. 2018;8(7):220-231.
16. Scheideler SE, Ferket PR. Phytase in broiler rations—effects on carcass yield and incidence of tibial dyschondroplasia. J Appl Poult Res. 2000;9:468-475.
17. Shirley RB, Edwards HM. Graded levels of phytase past industry standards improves broiler performance. Poult Sci. 2003;82:671-680.
18. Walk CL, Bedford MR, Santos TS, Paiva D, Bradley JR, Wladecki H, *et al.* Extra-phosphoric effects of super doses of a novel microbial phytase. Poult Sci. 2013;92:719-725.