International Journal of Veterinary Sciences and Animal Husbandry 2024; 9(3): 364-367

ISSN: 2456-2912
VET 2024; 9(3): 364-367

www.veterinarypaper.com
Received: 22-03-2024
Accepted: 27-04-2024

Prabhuraja N
M.V.Sc Scholar, Department of Poultry Science, Veterinary College Hebbal, Bengaluru, Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, Karnataka, India

Umesh BU
Associate Professor, Department of Livestock Farm Complex, Veterinary College Shivamogga, Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, Karnataka, India

HC Indresh
Assistant Professor, Department of Poultry Science, Veterinary College Hebbal, Bengaluru, Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, Karnataka, India

Krishnamurthy TN
Professor and Head, Department of Poultry Science, Veterinary College Hebbal, Bengaluru, Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, Karnataka, India

Dakshith PL
M.V.Sc Scholar, Department of Poultry Science, Veterinary College Hebbal, Bengaluru, Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, Karnataka, India

Corresponding Author:
Prabhuraja N
M.V.Sc Scholar, Department of Poultry Science, Veterinary College Hebbal, Bengaluru, Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, Karnataka, India

Effect of phytase supplementation on carcass characteristics and visceral organ weights in broilers

Prabhuraja N, Umesh BU, HC Indresh, Krishnamurthy TN and Dakshith PL

Abstract
An experimental study was conducted to assess the impact of phytase enzyme supplementation on, carcass characteristics and visceral organ weights in 120 Cobb broilers over a period of 42 days. The study comprised four distinct dietary treatments they are control group T_1 (0.45% available phosphorus) as per Bureau of Indian standards 2007, low phosphorous diet T_2 (0.35% available phosphorus + 0.01% Phytase 5000 FTU), low phosphorus diet T_3 (0.30% available phosphorus + 0.02% Phytase 5000 FTU) and low phosphorus diet T_4 (0.25% available phosphorus + 0.03% Phytase 5000 FTU). The result revealed that there is no significant difference ($p>0.05$) in carcass traits like dressing percentage, thigh yield, breast yield, drumstick yield, abdominal fat percentage and visceral organs like heart, liver, proventriculus and gizzard between control group and phytase supplemented low phosphorus groups and also among phytase supplemented low phosphorus groups. In conclusion, the phytase supplementation in low phosphorous diet may not affect the percent live weight of carcass traits and visceral organs.

Keywords: Broilers, phytase, available phosphorous, carcass characteristics, visceral organs

Introduction
The poultry industry grapples with the substantial economic strain of feed costs, which exceed 70% of total production expenses, particularly impacting the sustainability of operations, especially in developing countries (Sharifi *et al*., 2012) [12]. Crafting poultry feed necessitates meticulous ingredient selection to ensure optimal nutrient balance. Plant-derived components like cereals, grain legumes, and oilseed meals constitute the primary feed constituents, with grains typically comprising 50-70% of poultry diets (Cowieson, 2006; Amer, 2014) [8, 4].
However, challenges arise from phytate, the principal phosphorus source in poultry feed, constituting 61–70% of phosphorus content in feed ingredients (Aureli *et al*., 2011) [5]. Poultry's inefficiency in utilizing phytate phosphorus due to the lack of endogenous phytase necessitates inorganic phosphate supplementation (Yu *et al*., 2004) [15].
Phytic acid negatively affects mineral ion bioavailability and protein structure, leading to reduced nutrient absorption and digestibility (Kumar *et al*., 2010) [10]. To address this, microbial phytase is added to broiler diets, enhancing nutrient availability by breaking down phytate (Mukhtar, 2013) [11].
In summary, while phytate poses challenges to poultry nutrition and production, microbial phytase supplementation mitigates its adverse effects, enhancing nutrient availability and improving the overall feed quality. This ensures healthier broilers and potentially higher-quality poultry meat.

Materials and Methods
A research investigation involved one-hundred-and-twenty-day-old Cobb broiler chicks to explore strategies for enhancing feed quality and leveraging the genetic potential of the birds to minimize phosphorus excretion. The selection of Cobb birds aimed to optimize feed efficiency and genetic traits conducive to reduced phosphorus output. The chicks were carefully weighed and then randomly allocated into four experimental treatments, with each treatment comprising three replicates, and each replicate housing ten chicks. From hatch until six weeks of age, the chicks were raised in a deep litter system, provided with ad-libitum

access to feed and water, and managed according to standard protocols. The study adhered to the guidelines and approved by the Institutional Animal Ethics Committee of KVAFSU, Bidar, Karnataka with approval number VCH/IAEC/2023/07. The phytase enzyme used in the study (Zymo-phytase) produced from *Aspergillus niger* contains 5000 Fungal Thermal Units (FTU) per kilogram and was sourced from STS Biotech Pvt Ltd, Mysuru.

In accordance with the BIS-2007 recommendations, standard broiler pre-starter, starter, and finisher rations were formulated and prepared using readily available feed ingredients. The control group (T_1) was provided with a diet containing 0.45% available phosphorus. Meanwhile, the treatment groups (T_2, T_3, and T_4) received low-phosphorus diets supplemented with varying levels of phytase enzyme (0.35% available phosphorus + 0.01% Phytase 5000 FTU, 0.30% available phosphorus + 0.02% Phytase 5000 FTU, and 0.25% available phosphorus + 0.03% Phytase 5000 FTU, respectively). These formulations aimed to assess the impact of phosphorus levels and phytase supplementation on broiler performance and phosphorus utilization.

Carcass traits

Carcass characteristics such as dressing percentage, drumstick yield, thigh yield, abdominal fat and the weights of visceral organs such as the heart, liver and proventriculus were recorded. This was achieved by euthanizing two birds from each replication at the end of the experiment. The results were expressed in terms of grams per hundred grams (g / 100g).

Before slaughter, the birds were undergoing a 12 - hour fasting period with access only to ad-libitum drinking water. The live weight of the birds was recorded, and humane slaughter methods were employed. This involved severing the jugular vein and carotid artery on one side of the neck, allowing bleeding for 1 – 2 minutes, scalding at 54° C for two minutes, mechanical defeathering for 30 - 60 seconds and dressing at the atlanto - occipital joint with legs at the hock joint. Evisceration involved making a split opening at the abdominal area to remove the gastrointestinal tract, separable fat and edible and non-edible organs. Dressing percentage was calculated as a percentage of live body weight. The dressing percentage, representing the proportion of eviscerated carcass weight to pre-slaughter live weight, is calculated by multiplying the eviscerated carcass weight in grams by 100 and then dividing by the pre-slaughter live weight in grams. The weight of the drumstick portion from each slaughtered bird across all treatments was measured to assess the impact of phytase supplementation. The drumstick yield percentage, which indicates the proportion of drumstick weight to pre-slaughter live weight, is calculated by multiplying the drumstick weight in grams by 100 and then dividing by the pre-slaughter live weight in grams. The weight of the thigh, separated at the thigh joint was measured to evaluate the influence of phytase supplementation. The thigh yield percentage, denoting the proportion of thigh weight to pre-slaughter live weight, is computed by multiplying the thigh weight in grams by 100 and then dividing by the pre-slaughter live weight in grams. The weight of the breast, separated from the slaughtered bird was measured to study the effect of feeding phytase. The breast yield percentage, indicating the proportion of breast weight to pre-slaughter live weight, is calculated by multiplying the breast weight in grams by 100 and then dividing by the pre-slaughter live weight in grams. The weight of the fat form the abdomen, including fat surrounding the gizzard, bursa, cloaca and adjacent muscles was recorded and expressed as a percentage of the live weight of the corresponding bird. The abdominal fat percentage, representing the proportion of abdominal fat weight to pre-slaughter live weight, is determined by multiplying the abdominal fat weight in grams by 100 and then dividing by the pre-slaughter live weight in grams.

Relative visceral organ weights

At the end of experiment, two birds from each replication across all treatment groups were euthanized and expressed in term of percent to examine the impact of feeding phytase. The average weight of the heart without the pericardium was calculated and results were expressed as a percentage of the average live body weight. The heart weight percentage, denoting the proportion of heart weight to pre-slaughter live weight, is calculated by multiplying the heart weight in grams by 100 and then dividing by the pre-slaughter live weight in grams. The average weight of the liver without the gall bladder was computed and results were expressed as a percentage of the average live body weight. The liver weight percentage, indicating the proportion of liver weight to pre-slaughter live weight, is computed by multiplying the liver weight in grams by 100 and then dividing by the pre-slaughter live weight in grams. The average weight of the gizzard excluding feed contents and internal lining membrane was calculated and expressed as a percentage of the average live body weight. The gizzard weight percentage, representing the proportion of gizzard weight to pre-slaughter live weight, is determined by multiplying the gizzard weight in grams by 100 and then dividing by the pre-slaughter live weight in grams. The average weight of the proventriculus excluding feed contents and internal lining membrane was calculated and expressed as a percentage of the average live body weight. The proventriculus weight percentage, indicating the proportion of proventriculus weight to pre-slaughter live weight, is calculated by multiplying the proventriculus weight in grams by 100 and then dividing by the pre-slaughter live weight in grams.

Statistical evaluation

The experimental design utilized in this study followed a completely randomized design (CRD) with one-way analysis. Data pertaining to various parameters of the biological trial were analysed using the standard methodology outlined by Snedecor and Cochran (1994) [13], and statistical analysis was conducted using SPSS 20 software. Mean differences among treatments were assessed using Tukey's Range Test, with significance set at $P \leq 0.05$.

Results

Carcass traits

On the 42nd day of the experiment, the mean dressing percentage (%) in groups T_1, T_2, T_3 and T_4 were 64.40, 66.20, 66.33, and 66.11 percent, respectively. The statistical analysis revealed no significant ($P > 0.05$) difference in dressing percentage among treatment groups.

The mean thigh yield (% of live weight) in groups T_1, T_2, T_3 and T_4 on the 42nd day was 9.86, 9.64, 9.53, and 9.96, respectively. Analysis of variance (ANOVA) revealed no significant ($p>0.05$) difference in thigh yield among the treatments.

At the end of experiment the mean breast yield (% of live weight) in groups T_1, T_2, T_3 and T_4 on the 42nd day was 27.05, 26.88, 27.37, and 26.74, respectively. Statistical analysis revealed no significant (p>0.05) difference in breast yield among different treatment groups compared to control group.

The percentage of mean drumstick yield (% of live weight) in groups T_1, T_2, T_3 and T_4 was 8.90, 8.27, 8.85, and 8.64, respectively. ANOVA indicated a no significant (p>0.05) difference in drumstick yield among different treatments.

The mean percentage of abdominal fat percentage at the end of the experiment was 0.930, 0.948, 0.952, and 0.966 in groups T_1, T_2, T_3 and T_4, respectively. ANOVA revealed a no significant (p>0.05) difference in the mean percentage of abdominal fat among different treatment groups compared to control group.

Visceral organ weight

The relative weight of heart (% of live weight) among different treatment groups was 0.470 (T_1), 0.489 (T_2), 0.457 (T_3), and 0.469 (T_4). Statistical analysis indicated no significant difference (p>0.05) in relative heart weight among all the treatment groups.

At the end of experiment the relative liver weight (% of live weight) in groups T_1, T_2, T_3 and T_4 on the 42nd day was 1.69, 1.66, 1.67, and 1.65, respectively. ANOVA revealed a no significant (p>0.05) difference in relative liver weight among all the groups compared to the control group.

At the end of experiment the relative weight of gizzard (% of live weight) in groups T_1, T_2, T_3 and T_4 on the 42nd day was 1.79, 1.75, 1.79, and 1.78, respectively. ANOVA revealed a no significant (p>0.05) difference in relative gizzard weight among all the treatment groups.

The relative weight of proventriculus (% of live weight) among different treatment groups was 0.361 (T_1), 0.386 (T_2), 0.387 (T_3), and 0.365 (T_4). Statistical analysis indicated no significant difference (p>0.05) in relative weight of proventriculus among all the groups compared to the control group.

Discussion

The phytase supplemented groups had no significant difference (p>0.05) on dressing percentage, thigh yield, breast yield, drumstick yield and abdominal fat in terms of percent live weight and visceral organs like heart, liver, gizzard and proventriculus in terms of percent live weight compared to control group at the end of the experiment (42nd day). The findings of the present results were in agreement with Al-Harthi, M. A. (2017) [2] came to the conclusion that the dressing percentage, the percentage of abdominal fat and the ratios of internal body organs, such as the liver, heart, pancreas and gizzard to live body weight, were all not affected by the amount of olive cake (5 or 10%) and the types of multi-enzymes along with 0.5 and 1 g / kg phytase in 504 male Ross 308 broilers fed with 0.496% available phosphorus in all treatments. The present study results were in agreement with de Freitas *et al*. (2019) [9] who investigated the effects of different levels of phytase (500, 1000 and 1500 FTU / kg) in diets with different levels of calcium (0, 0.165, 0.215 and 0.245% reduced diet), available phosphorus (0, 0.150, 0.195 and 0.225% reduced diet) and sodium (0, 0.035, 0.045 and 0.053% reduced diet) in different stages of 900 male Cobb 500 broilers and concluded that there was no significant difference in carcass percentage, breast yield, drumstick + thigh yield, abdominal fat percentage and internal organs proventriculus, gizzard and heart percentage in different levels of phytase compared to control and also findings of the present results were in agreement with Sobhi *et al*. (2023) [14] examined the effects of phytase and β-xylanase enzymes in 300 Ross 308 broiler chickens and the data of the current study revealed that the dietary supplementation of phytase 5000 or 10000 FTU attained no significant impact on the dressing percentage, breast yield, drumstick yield and thigh yield compared to the control group with standard level of available phosphorous. Phytase supplementation in broiler diets suggest that phytase may not have a substantial impact on carcass traits or organ development in broiler chickens. This implies that incorporating phytase into broiler diets does not adversely affect meat yield or the relative weights of visceral organs.

Conclusion

The conclusion drawn from the results is phytase enzyme supplementation at different level (0.01%, 0.02% and 0.03% phytase 5000 FTU) in low phosphorous diet could not affect the percent relative weight of dressing percentage, thigh yield, breast yield, drumstick yield and abdominal fat in terms of percent live weight and visceral organs like heart, liver, gizzard and proventriculus.

Conflict of Interest

Not available

Financial Support

Not available

References

1. Ahmed F, Rahman MS, Ahmed SU, Miah MY. Performance of broiler on phytase supplemented soybean meal-based diet. International Journal of Poultry Science. 2004;3(4):266-271.
2. Al-Harthi MA. The effect of olive cake, with or without enzymes supplementation, on growth performance, carcass characteristics, lymphoid organs and lipid metabolism of broiler chickens. Brazilian Journal of Poultry Science. 2017;19:83-90.
3. Ali SA. Efficacy of supplementation of phytase enzyme to broiler diets with or without di-calcium phosphate on performance and economic appraisal. Egyptian Poultry Science Journal. 2021;41(2):317-331.
4. Amer AM. Effect of phytase enzyme supplementation in deficient phosphate diet on broiler performance and some blood traits. International Journal of Science and Nature. 2014;5:341-345.
5. Aureli R, Faruk MU, Cechova I, Pedersen PB, Elvig-Joergensen SG, Fru F, *et al*. The efficacy of a novel microbial 6-phytase expressed in *Aspergillus oryzae* on the performance and phosphorus utilization in broiler chickens. International Journal of Poultry Science. 2011;10(2):160-168.
6. BIS. Bureau of Indian Standards, Poultry Feeds Specification., 5th revision, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi-11, c2007.
7. Butani JB, Parnerkar S. Role of microbial phytase in broiler nutrition-a review. Journal of Livestock Sciences. 2015;6:113-118.
8. Cowieson AJ, Acamovic T, Bedford MR. Supplementation of corn–soy-based diets with an *Eschericia coli*-derived phytase: effects on broiler chick performance and the digestibility of amino acids and metabolizability of minerals and energy. Poultry Science. 2006;85(8):1389-97.
9. de Freitas HB, de Souza-Nascimento KMR, Kiefer C, Gomes GA, Dos Santos TT, Garcia ERM, *et al.* Graded

levels of phytase on performance, bone mineralization and carcass traits of broiler fed reduced dicalcium phosphate. Asian-Australian Journal of Animal Science. 2019;32(5):691.
10. Kumar V, Sinha AK, Makkar HP, Becker K. Dietary roles of phytate and phytase in human nutrition: A review. Food Chemistry. 2010;120(4):945-959.
11. Mukhtar AM, Mariam AEY, Mohamed KA. Feeding broiler chicks on diets containing 15% Prosopis pods flour supplemented with microbial phytase enzyme on the performance and carcass characteristics. Journal of Current Research in Science. 2013;1(2):113-117.
12. Sharifi MR, Shargh MS, Hassani S, Senobar H, Jenabi S. The effects of dietary nonphytate phosphorus levels and phytase on laying performance and egg quality parameters of Japanese quails (*Coturnix coturnix Japonica*). Archiv Fur Geflugelkunde. 2012;76(1):13-19.
13. Snedecor GW, Cochran WG. Statistical Methods. Edn. 6th., Iowa state university press, Ames, Iowa, 1994.
14. Sobhi BM, Morsi AS, Ahmed ZSO, Gamal AM, Fahmy KNED. The potential Enhancing Effect of both Phytase and Î²-xylanase Enzymes on Performance, Bone Mineralization and Nutrient Absorption in Broiler Chicken. Journal of Advanced Veterinary Research. 2023;13(5):806-814.
15. Yu B, Jan YC, Chung TK, Lee TT, Chiou PWS. Exogenous phytase activity in the gastrointestinal tract of broiler chickens. Animal Feed Science Technology. 2004;117(3-4):95-303.

How to Cite This Article
Prabhuraja N, Umesh BU, Indresh HC, Krishnamurthy TN, Dakshith PL. Effect of phytase supplementation on carcass characteristics and visceral organ weights in broilers. International Journal of Veterinary Sciences and Animal Husbandry. 2024;9(3):364-367.