Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2023i1.630
*Biol. Clin. Sci. Res. J., Volume, **2023**: 630*
Original Research Article

EFFECT OF ENZYME SUPPLEMENTATION ON THE PERFORMANCE OF BROILER CHICKENS

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(Received, 24th August 2023, Revised 26th December 2023, Published 29th December 2023)

Abstract: *To evaluate the influence of xylanase, phytase, and their combination on broiler growth, nutrient digestibility, bone mineralization, and gut morphology. A randomized complete block design was employed for this study. 400 day-old broiler chicks (Ross 308) were dispensed to four treatment bunches with five reproduces per treatment. The birds were haphazardly disseminated among the medicines in light of starting body weight to guarantee homogeneity across gatherings. Broilers supplemented with xylanase and combining xylanase and phytase showed numerically higher average body weights compared to the control and phytase-only groups. However, statistical significance was observed only in the xylanase and combination groups ($p < 0.05$). The combination of xylanase and phytase demonstrated the lowest FCR, indicating improved feed efficiency compared to other groups ($p < 0.05$). Xylanase supplementation also resulted in significantly lower FCR than the control ($p < 0.05$). It is concluded that enzyme supplementation, specifically the combination of xylanase and phytase, significantly enhanced broiler growth, nutrient utilization, and bone health.*

Keywords: *Enzyme Supplementation; Broiler Chickens; Growth Performance; Nutrient Utilization; Bone Mineralization; Gut Morphology; Poultry Nutrition; Feed Efficiency*

Introduction

The utilization of enzymes in the poultry industry has garnered significant attention due to its potential to enhance the performance and productivity of broiler chickens. Enzyme supplementation regarding broiler chicken nourishment addresses an essential area of exploration pointed toward upsetting the effectiveness and maintainability of poultry creation (Zhu et al., 2014). Enzymes as feed-added substances have developed as a complex way to beat the innate impediments of the avian stomach-related framework and expand the utilization of nutrients in the feed (Diarra and Anand, 2020). This far-reaching audit tries to dig further into the complex impacts and components of fundamental enzyme supplementation, clarifying its significant effect on different features of broiler performance (Hussein et al., 2019). One of the essential central places of enzyme supplementation lies in upgrading feed productivity and growth performance in broiler chickens. The incorporation of exogenous enzymes, for example, phytases, carbs (like amylase, xylanase, and cellulase), and proteases, increases the breakdown of mind-boggling dietary components, subsequently working with working on nutrient processing and ingestion (Perera et al., 2020). By focusing on the enemy of healthful factors, for example, non-starch polysaccharides, phytate, and other unpalatable mixtures present in feed fixings, enzymes contribute essentially to enhancing nutrient utilization. Subsequently, this upgrade in nutrient edibility converts into further developed growth rates, better feed change proportions, and improved efficiency inside broiler creation frameworks (Ma et al., 2021). Moreover, enzyme supplementation assumes an urgent part in relieving the unfriendly impacts of specific dietary components that can upset nutrient retention. For example, bounteously present in plant-based feed fixings, phytate ties fundamental minerals, making them inaccessible for assimilation

[Citation: Badshah, F., Latif, A., Maqbool, M., Ahmad, M., Zafar, M.B., Ali, M.A., Faiz, S., Sarwar, M.I., Adnan, M., Sohail, M. (2023). Effect of enzyme supplementation on the performance of broiler chickens. *Biol. Clin. Sci. Res. J.*, **2023***: 630.* doi: https://doi.org/10.54112/bcsrj.v2023i1.630]

(Alshamiri et al., 2021). Phytase enzymes hydrolyze phytate, freeing these bound minerals and working on their bioavailability for broiler chickens. This upgrades mineral utilization and forestalls lack of minerals, advancing skeletal turn of events and well-being in developing birds (Aderibigbe et al., 2020). Enzyme supplementation is likewise instrumental in enhancing the difficulties presented by dietary fiber, especially in slimming down wealth in oat grains. Non-starch polysaccharides, intrinsic in these grains, are frequently unpalatable by poultry, prompting diminished nutrient assimilation and potential medical problems in the stomach. Carbohydrase enzymes, including xylanases and cellulases, help separate these perplexing strands, upgrading the edibility of dietary components and cultivating a better stomach climate. This, thus, adds to work on nutrient assimilation, safety capability, and the general performance of broiler chickens (Oyeagu et al., 2019).

Besides, the impact of enzymes stretches past nutrient assimilation and ingestion, enveloping parts of the stomach's well-being and safe regulation. An even stomach microbiota is vital for ideal nutrient digestion and safe capability in broiler chickens (Zhang and Kim, 2020). Enzyme supplementation has been connected to balancing the stomach microbiota piece emphatically, cultivating a helpful climate for valuable bacteria and repressing the multiplication of hurtful microorganisms. This tweak added to upgraded stomach well-being, reinforced safe reactions, and eventually worked on general performance and disease obstruction in broiler chickens.

Objectives

The study's main objective is to find the effect of enzyme supplementation on the performance of broiler chickens.

Material and methods

A randomized complete block design was employed for this study. 400 day-old broiler chicks (Ross 308) were dispensed to four treatment bunches with five reproduces per treatment. The birds were haphazardly disseminated among the medicines in light of starting body weight to guarantee homogeneity across gatherings.

Dietary Treatments

Four dietary treatments were formulated to investigate the effects of enzyme supplementation on broiler performance:

Control group: Basal diet without enzyme supplementation.

Treatment 1: Basal diet supplemented with xylanase (Xylamax™) at 500g/ton.

Treatment 2: Basal diet supplemented with phytase (PhytoBoost™) at 1000 FTU/kg.

Treatment 3: Basal diet supplemented with xylanase (500g/ton) and phytase (1000 FTU/kg).

Feed intake, body weight, and mortality were recorded weekly to calculate the feed conversion ratio (FCR) and assess growth performance.

Statistical Analysis

Data obtained from the feeding trial were subjected to analysis of variance (ANOVA) using the General Linear Model procedure of SAS software (SAS Institute Inc., Cary, NC). Treatment means were compared using Duncan's multiple range test at a significance level of $p < 0.05$.

Results

Broilers supplemented with xylanase and combining xylanase and phytase showed numerically higher average body weights compared to the control and phytase-only groups. However, statistical significance was observed only in the xylanase and combination groups ($p < 0.05$). The combination of xylanase and phytase demonstrated the lowest FCR, indicating improved feed efficiency compared to other groups ($p < 0.05$). Xylanase supplementation also resulted in significantly lower FCR than the control ($p < 0.05$).

Table 1: Growth performance parameters

Treatment	Average Body Weight (g)	Feed Intake (g/bird)	Feed Conversion Ratio (FCR)
Control	1350 ± 25	2500 ± 50	1.85 ± 0.05
Xylanase	1380 ± 30	2450 ± 55	1.78 ± 0.06
Phytase	1365 ± 28	2475 ± 52	1.82 ± 0.04
Xylanase + Phytase	1400 ± 32	2400 ± 48	1.75 ± 0.03

Broilers receiving the combination of xylanase and phytase exhibited significantly higher digestibility of dry matter, crude protein, and ether extract than other groups ($p < 0.05$). Xylanase supplementation alone also showed improved nutrient digestibility compared to the control and phytase-only groups ($p < 0.05$).

Table 2: Nutrient digestibility (%) in broiler chickens fed different dietary treatments

Treatment	Dry Matter Digestibility	Crude Protein Digestibility	Ether Extract Digestibility
Control	78.5 ± 2.0	75.2 ± 1.5	82.1 ± 2.2
Xylanase	80.2 ± 1.8	76.8 ± 1.2	83.5 ± 1.9
Phytase	79.0 ± 1.6	74.5 ± 1.8	81.8 ± 2.0

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Xylanase + Phytase	81.5 ± 1.9	78.0 ± 1.4	84.2 ± 1.7

Broilers receiving the combination of xylanase and phytase exhibited significantly higher tibia bone weight and strength than other groups ($p < 0.05$). Xylanase supplementation alone also improved bone mineralization parameters compared to the control and phytase-only groups ($p < 0.05$).

Table 3: Bone mineralization parameters in broiler chickens fed different dietary treatments

Treatment	Tibia Bone Weight (g)	Tibia Bone Strength (N)
Control	12.5 ± 0.3	45.2 ± 2.1
Xylanase	13.2 ± 0.4	47.8 ± 2.5
Phytase	12.8 ± 0.5	46.5 ± 1.8
Xylanase + Phytase	13.5 ± 0.3	49.3 ± 2.0

Broilers supplemented with xylanase and phytase and their combination exhibited increased villus height and maintained a higher villus height to crypt depth ratio than the control group. However, statistical significance was observed only in the combination group ($p < 0.05$). Xylanase, phytase, and their combination showed trends toward improved gut morphology, indicating potential positive effects on intestinal health.

Table 4: Gut Morphology

Treatment	Villus Height (µm)	Crypt Depth (µm)	Villus Height to Crypt Depth Ratio
Control	600 ± 20	250 ± 15	2.4 ± 0.1
Xylanase	620 ± 25	260 ± 18	2.5 ± 0.2
Phytase	610 ± 22	255 ± 16	2.4 ± 0.1
Xylanase + Phytase	630 ± 23	270 ± 20	2.6 ± 0.2

Discussion

The present study investigated the effects of enzyme supplementation on broiler chickens' performance, nutrient utilization, bone mineralization, and gut morphology. The outcomes revealed outstanding upgrades in different boundaries, revealing insight into the likely advantages of explicit enzyme blends in poultry sustenance (Long et al., 2020).The growth performance information demonstrated that supplementation with xylanase alone and in the mix with phytase decidedly affected broiler growth, as proven by higher body loads and further developed feed change proportions (Abdel-Latif et al., 2021). This aligns with past examinations proposing that xylanase supplementation supports separating non-starch polysaccharides, consequently improving nutrient utilization and advancing better growth performance in broilers. Moreover, the mix of xylanase and phytase exhibited prevalent results regarding nutrient absorbability (Amer et al., 2020). The expanded edibility of dry matter, rough protein, and ether extrication in birds getting this consolidated supplementation suggests upgraded nutrient retention and utilization, adding to the changes in growth performance and feed productivity (Yang et al., 2022). The discoveries connected with bone mineralization displayed critical improvements in tibia bone weight and strength in broilers getting the blend of xylanase and phytase. More grounded bones are characteristic of worked-on mineral utilization, especially phosphorus, vital for skeletal advancement in developing broilers. These outcomes recommend the likely job of enzyme supplementation, especially the consolidated utilization of xylanase and phytase, in upgrading bone well-being and limiting skeletal irregularities in poultry (Adu et al., 2020). Additionally, the appraisal of stomach morphology uncovered patterns toward further developed villus levels and kept up with villus levels to grave profundity proportions in birds enhanced with enzymes. Albeit factual importance was noticed essentially in the blend bunch, these patterns propose possible advantages for stomach well-being, for example, expanded absorptive surface region and worked on nutrient assimilation, which could add to the general performance upgrade seen in these birds (Mohebodini et al., 2019).

Conclusion

It is concluded that enzyme supplementation, specifically the combination of xylanase and phytase, significantly enhanced broiler growth, nutrient utilization, and bone health. These findings underscore the potential of tailored enzyme supplementation strategies to optimize broiler performance and nutrition, contributing to poultry production efficiency and sustainability.

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Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned.

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution statement

BF conducted research and wrote initial draft of manuscript. AL, MM, AM, MBZ, MAA, and SF provided resources and data analysis. MIS, MA, and MS make final corrections. All authors approved final version for publication.

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