Effect of Exogenous Xylanase Enzyme in Reduced Energy Diet on Carcass Characteristics of Broiler Chickens

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***Abstract*— The aim of this study was to investigate the effects of exogenous enzyme xylanase supplemented with an energy restricted diet on carcass characteristics of broiler chickens. Two hundred one-day-old Ross 308 broilers were randomly divided into four groups (50 birds each) with two replicates each. The control group (T1) was fed a diet based on corn and soybean meal. The second group received a low energy diet (200/kcal) (T2). In the third trial, xylanase (250 g/t) was fed with a low energy diet (200/kcal) (T3). The fourth treatment fed a basal diet + xylanase enzyme (250g/ton) (T4). The carcass characteristics and edible tissue of gizzard, liver and heart in the T4 and T3 groups showed a significant improvement (P≤0.05) compared to the other groups. In conclusion, addition xylanase enzyme with a low-energy diet augmented broiler chickens' productivity, improved carcass characteristics and edible tissue organ.**

***Keywords* — Xylanase enzyme, reduced energy and carcass characteristics.**

INTRODUCTION

Commercially, the expenses of feed can make up about 60 to 70 percent of the overall costs for raising broilers during a production cycle. As a result, cutting down on feed expenses while ensuring the health and performance of the broilers will certainly have a beneficial effect on the costs of broiler production cycles [1].

Corn has been the primary dietary component for poultry. Recently, problems like supply issues and price variability of corn have been Minimizing the production costs of feed is a significant obstacle. As such, the poultry industry has attempted alternative strategies that revolve around the efficient utilization of dietary nutrients while taking into account economic and environmental factors during production. One method is to add feed enzymes to augment the nutritional value of broiler feeds and reduce the negative environmental consequence of disposal waste.

Non-starch polysaccharides, or NSPs, are molecules that degrade the nutritional value of cereals, starches, and other plant materials. Cereal cell walls, which are commonly employed to produce energy in animal feeds, have a maximum of 15% soluble and 15% insoluble NSPs in their composition [2]. Poultry do not have endogenous compounds that inhibit the hydrolysis of pentosan NSPs in complex cereals, such as gluconate. B. arabinosyl. As a result, the addition of exogenous enzymes to food has been demonstrated to be a cutting-edge mechanism for cost-savings. Exogenous enzymes can break down NSPs, which increases the digestibility and availability of nutrients.

NSP hydrolases, including xylanases, are now commonly available and constitute over half of the worldwide enzyme market for feeds. Xylanases have the ability to break the 1,4βD xylosidic bond in the xylan structure, this bond is separated from the rest of the xylose units. The disintegration of components from the cell wall offers energy and amino acids to support poultry's nutrition. Additionally, the oligosaccharides derived from the conversion of arabinoxylan have prebiotic effects, these effects have been observed in the growth of broiler chickens. [6].

There is ample evidence that the addition of NSP hydrolases to grain-based diets is one of the most important

strategies for improving growth and nutrient digestion in broiler chickens. Studies have shown that the addition of xylanase to feed improves nutrient digestibility while maintaining gut health by reducing nutrient availability in the animal's intestine, this would reduce the potential for pathogenic bacteria to grow. This supplement increases the efficiency of feed components by improving the production of meat and eggs, and increases the total amount of feed consumed. As a result, the objective of this study was to determine the effectiveness of xylanase at a concentration of 250 g/ton in a low-energy broiler feed (200 kcal/ kg) and to investigate the effects of the enzyme on the carcass traits.

MATERIALS AND METHODS

Ethical approve:

According to the ethical code number UOK.VET.HE. 2024.109 from the Scientific Council of the Department of Pathology, College of Veterinary Medicine, University of Kerbala, Iraq.

Experiment design and dietary treatment

200 one-day-old broiler chickens (Ross-308) from a commercial hatchery were allotted into 4 groups of 50 chickens each. Each group was split into two replicates with 25 birds in each. The control group (T1) is given the basal diet plus a corn-soybean diet. Treatment (T2) fed reduced energy diet (200 kcal/kg). Treatment (T3) fed xylanase enzyme (250 g/ton) in reduced energy diet (200 kcal/kg). Treatment (T4) fed basal diet with xylanase enzyme (250 g/ton). The finel BW was taken. The carcass without feather, carcass without visera, carcass with edible organ (gizzard, liver, and heart) and the weight of edible tissuse for each individuals (gizzard, liver, and heart).

Table 1: Ingredients and nutrients composition of broiler starter diets from 1-15 days and grower from 16-35 days

Ingredient (%)	Starter	Starter Reduced energy diet	Grower	Grower Reduced energy diet
Yellow corn	52.1	51.2	59.1	60.3
Soybean meal	40.2	40.5	32.6	32.4
Vegetable oil	2.9	0	4	0
Limestone	1.6	1.6	1.3	1.3
MCP[1]	0.6	0.6	0.4	0.4
Premix[2]	2.5	2,5	2.5	2.5
Antitoxin	0.1	0.1	0.1	0.1
Sand	0	3.5	0	3
Total	100	100	100	100
Calculated chemical composition				
energy	2900	2700	3000	2800
Crude protein (%)	23	23	20	20
Calcium	0.96	0.96	0.83	0.83
Av. Phosphorus	0.54	0.54	0.44	0.44
Av. Lysine	1.3	1.3	1.14	1.14
Av. Methionine	0.65	0.63	0.62	0.60
Av. Threonine	0.87	0.82	0.77	0.70
Electrolyte	289	280	249	232

1.MCP1 GREENPHOSP/22.7% (monocalcium phosphate), which has a calcium content of 16,7%, BAF, the company that distributes animal feeds, has a presence in Adana, Turkey.

2. Composition of Premix2: Vitamins 6,000,000 IU; Vitamin D3 1,500,000 IU; Vitamin E 15,000 mg; Riboflavin 3,000 mg; Pantothenic acid 7000 mg; Niacin 25000 mg; Folic acid 500 mg; and vitamin B12 15,000 mg (from Anmedica, Horb, Germany). Each kilogram of premix contains 4 trace elements that are incorporated into its composition: 120,000 milligrams of Mn, 80,000 milligrams of Zn, 90,000 milligrams of Fe, 15,000 milligrams of Cu, and 1,600 milligrams of Me. These ingredients are all provided by Animedica, Horb, Germany.

RESULT & DISCUSSION

Carcass characterization:

At the end of the experiment (35 days), the results of this study showed significant increases ($p \leq 0.05$) in live weight as well as feathered and eviscerated carcass weight.We observed an increase in the weights of the heart, liver, and gizzard in the T4 and T3 groups compared to the other groups, as shown in Table (2).

Table 2: Effects of xylanase enzyme in reduced energy diet on carcass characteristics/ (mean ± SD).

Groups / Parameter g.	T1	T2	T3	T4
Live body Wight	1762.52 ±20.21 C	1649.2 ±39.1 D	1876.31 ±62.55 B	1991.4 ±46.06 A
Carcass Without feather	1592.52 ±20.21 BC	1477.2 ±43.12 D	1672.31 ±47.84 B	1778.4 ±46.06 A
Carcass Without visra	1277.52 ±20.21 C	1172.2 ±40.86 D	1362.31 ±47.74 B	1464.4 ±46.12 A
Carcass with edible	1369.7 ±22.08 C	1262.6 ±43.87 D	1465.3 ±36.57 B	1557.4 ±46.06 A
Gizzard	39..08 ±1.29 C	38.32 ±1.39 D	41.72 ±1.1.25 AB	42.52 ±1.16 AA
Liver	36.12 ±0.77 C	33.17 ±1.14 D	38.17 ±1.32 AB	39.02 ±1.40 A
Heart	11.72 ±.37 C	10.12 ±.24 D	12.67 ±0.39 AB	13.12 ±0.23 A

* Different letters between groups in the same row showed a significant difference at ($p \leq 0.05$).

As shown in Table 2, live weight, carcass traits and edible organ weights at 35 days of age increased when fed 250 g/t, which may be due to increased feed intake, reduced digestate viscosity and improved nutrient digestion.. This is consistent with the research [7,8] which showed that the addition of NSP degrading enzymes to poultry feeds, including xylanase in

corn and soy in wheat, can enhance the degradation of arabinoxylan.

Researchers have found that the addition of wheat to poultry feeds increases intestinal viscosity. This is due to the presence of NSP, a complex carbohydrate that hinders the digestion and absorption of nutrients [9]. Exogenous enzymes, especially xylanases, can break down NSPs, especially arabinoxylans, into smaller, more digestible molecules. This releases bound nutrients, improves bird performance, litter quality and bird health, and potentially reduces production costs [10]. Researchers Seyedoshohadaei *et al.* [11] concluded that the addition of xylanase to wheat-containing feeds can reduce intestinal viscosity and improve intestinal health, which is reflected in broiler performance.

Xylanases can enhance phytase activity by increasing the permeability of wheat aleurone cell walls [12], This releases phytic acid that is bound to starch and crude protein [13]. Broilers are fed high energy diets to improve nutrient utilization and achieve maximum growth. [14]. However, although xylanases can improve productivity when added to low-energy diets, the effect is not significant [15].

Broilers eat more feed and grow faster than laying hens. This suggests that the higher threshold for IGF-1 to induce anorexia in broilers may be one of the reasons for their rapid growth [16]. Plasma IGF-1 concentrations in broilers are higher than those in domestic chicken breeds, and serum IGF-1 concentrations in fast-growing broilers are higher than those in slow-growing broilers [17]. The use of a cocktail of enzymes including xylanases can improve live weight, carcass characteristics, and edible organ weights. The IGF-1 gene stimulates proliferation, differentiation, and metabolism of various muscle cell lineages [18].

Body weight gain is a direct result of improved feed conversion efficiency. When enzymes improve nutrient digestion, nutrients become better available, allowing for faster and more effective body weight gain, and improved growth. The study indicated that adding multiple enzymes including xylanase to feed could contribute to improving growth rate, as it delivers nutrients more efficiently to the bird. This leads to faster weight gain, which is of great economic benefit in the livestock production industry. This was in agreement with [20].

On the other hand, the improvement in carcass characteristics could be due to the addition of xylanase to the corn feed. This could improve fat and starch digestibility by improving resistant starch digestion, improve cell wall access by reducing cell wall integrity, reduce endogenous enzyme production, and alter the gut microbial community by producing prebiotic-like oligosaccharides. Our results are consistent with those of [19], which showed that the improvement in live weight and carcass quality was due to xylanase supplementation.

CONCLUSION

There was an improvement in live body weight, carcass characteristics and edible tissues weight broilers fed xylanase enzame in reduced-energy diet (250 g/ ton) in the treatment groups (T4) and (T3) relative to the control group. Adopting a reduced-energy diet will save feed costs.

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