Original Research

Effect of Lysozymes, Antibiotics and Probiotics on Growth Performance and Biochemical Parameters in Broiler Chickens

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Abstract

The objective of present study was to determine the comparative effect of lysozymes with enrofloxacin and Lactobacillus as growth promoters in broiler chickens. Two hundred-day old broilers were selected and randomly divided into four treatment groups. Each group had five repeats with 10 birds in each replication. Treatments with lysozyme, enrofloxacin and Lactobacillus improved the growth performance, but feed conversion ratio was poor. Body weight and feed conversion ratio were increased by 2.94% and 2.91%, respectively in lysozyme supplemented group as compared to control group. It was more or less similar with enrofloxacin and Lactobacillus supplemented group. Biochemical parameters (activity of lysozyme, total protein, blood glucose, cholesterol, AST and GPT) of birds were also measured and it was observed that lysozymes improved the health performance and immune functions of broiler chickens and can be used as an alternative to growth promoters like antibiotics and probiotics.

Key words: Antibiotic, Broiler Chickens, Lysozyme, Probiotics

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Introduction

Use of antibiotic as growth promoters in poultry feed for several years led to the development of antibiotic resistant pathogens (Abdul *et al.*, 2019; Dar *et al.*, 2012; Gordon and Taylor, 1954; Gong *et al.*, 2002). Lysozymes can be a potential alternative (1, 4-β-N-acetylmuramidase). It cleaves the glycosidic bond between the N-acetylmuramic acid and N-acetylglucosamine in bacterial peptidoglycan which is an important component of cell walls (Grossowicz and Ariel, 1983), thus it provides protection against bacterial infection. Lysozyme with an alternative to antibiotics for poultry is relatively limited. Zhang *et al.* (2006) conducted an in vitro experiment to find an effective dose of lysozyme for controlling Clostridium perfringens and they found that 200 µg/ml dose completely inhibited the growth of *Clostridium perfringens*

and thereby inhibited production of α-toxin which caused the lesions associated with necrotic enteritis (NE). A follow up study by Zhang *et al.* (2010) evaluated a radiant energy-treated lysozyme antimicrobial blend to control NE in broiler chickens. This blend at a level of 200 ppm was as effective as commonly used antibiotics (bacitracin methylene salicylate (BMD)) for treatment of NE in the broiler chickens. Liu *et al.* (2010) found that 40 ppm of exogenous lysozyme effectively reduced the number of *Clostridium perfringens* in the ileum of broilers and prevented intestinal lesions. The aim of present study was to evaluate comparative effect of lysozyme with antibiotic and probiotic on the growth performance and biochemical parameters of broiler chickens (Jin *et al.*, 1998).

Materials and Methods

Trials were conducted using four groups. Two hundred-day old broilers were selected and randomly divided in four treatment groups. Each group had five repeats and 10 birds in each replication. Diets were isocaloric and isonitrogenous within the starter (days 0-14) and finisher (days 15-42). The diets were fed in mash form throughout the trial. The four treatment groups were: control (no growth promoters), lysozyme (350-400 mg/ton), antibiotic (enrofloxacin-10 mg/kg body weight) and probiotic (*Lactobacillus* culture) groups. Diets were formulated to meet or nutrient requirements and analysed as shown in Table 1 (AOAC, 2005).

Table 1: Ration composition of broiler starter and finisher ration

Ingredients	Starter (g)	Finisher (g)
Corn	558.2	586.6
Soyabean meal	371.7	341.5
Oil (veg)	27	34
Dicalcium Phosphate	19.2	17.2
Limestone	12.2	11
Salt (NaCL)	4.5	4.5
Choline chloride	2.6	2
DL- Methionine	2.2	1.1
Mineral premix	2	2
Vitamin Premix	0.2	0.2
L- Lysine HCL	0.3	0
Total	**1000.1**	**1000.1**

In this experiment, birds were mass weighed per pen on days 0, 21, and 42. The feed remaining in the feeders was weighed on each day. The daily consumption and feed conversion ratio (FCR) was calculated. At the end of the trial, blood samples from 10 birds in each group were collected for biochemical analysis. Biochemical parameter like total protein, total cholesterol, blood glucose, aspartate transaminase (AST) and glutamatepyruvate transaminase (GPT) were estimated (AOAC, 2005). All data were statistically analysed using IBM SPSS 20 software (version 20.0).

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Results and Discussion

Growth Performance

The growth performance of each group is presented in Table 2.

Table 2: Effect of various treatments on growth performance of broiler chickens

Items	Control	Lysozyme group	Antibiotic group	Probiotic group
Initial body weight (0^{th} day)	44.63 ± 0.50	43.74 ± 0.81	43.81 ± 0.23	44.19 ± 0.31
21 days body weight	472.97 ± 3.90	521.61 ± 5.16[a]	482.51 ± 3.28[a]	497.86 ± 1.41[a]
42 days body weight	2140.96 ± 6.59	2203.22 ± 1.87[b]	2156.55 ± 9.97	2188.52 ± 4.94[b]
FCR	2.06 ± 0.13	2.12 ± 0.11[c]	2.08 ± 0.09	2.11 ± 0.13[c]

[a] Data are significantly different from control group ($p < 0.05$); [b] Data are significantly different from Control and antibiotic group ($p < 0.05$); [c] Data are significantly different from Control and antibiotic group ($p < 0.05$)

There was significant improvement in body weight of treated groups as compared to control. Improved performance in feed conversion ratio was also observed in treated groups. The body weight and FCR were increased by 2.94% and 2.91%, respectively in lysozyme supplemented group as compared to control group. It was more or less similar with probiotic supplemented group. In antibiotic treated group, there was increase in body weight with no significant difference in FCR as compared to control. Similar observations were found by Abdel-Latif *et al.*, 2017 and Torki *et al.*, 2018, where growth performance and intestinal micro biota were improved in birds fed with lysozymes.

Biochemical Parameters

The biochemical parameters were found as shown in Table 3.

Table 3: Biochemical parameters of various treatment groups

Group Name	Biochemical Parameters					
	Lysozyme (µmol/L)	Total Protein (g/L)	Blood glucose (mg/dL)	Total Cholesterol (µmol/L)	AST(µ/L)	GPT(µ/L)
Control	2.84± 0.11	19.66± 0.76	177.99± 1.22	3.49± 0.12	177.32± 1.91	24.08± 0.31
Lysozyme group	3.66± 0.05a	27.56± 1.7a	176.27± 0.71	2.64± 0.05a	184.22± 0.79a	24.36± 0.85
Antibiotic group	2.72± 0.16b	20.85± 1.29b	174.67± 1.25	3.46± 0.05b	181.22± 3.63	16.3± 0.41ab
Probiotic group	2.96± 0.09b	23.65± 0.38ab	177.21± 1.49	3.37± 0.08b	184.59± 0.79a	17.42± 0.07ab

[a] Significant as compared to Control group ($p<0.05$) for individual parameters; [b] Significant as compared to Lysozyme treated group ($p<0.05$) for individual parameters

Presence of lysozyme activity was found more in lysozyme treated group as compared to control group (28.73%). It was observed in present study that the amount of protein was found significantly ($p < 0.05$) high in lysozyme treated group as compared to others (40.18%, 32.18% and 16.53% more as compared to control, antibiotic and probiotic group, respectively). There was no significant influence of different treatments on blood glucose level. Serum cholesterol level was found to be significantly ($p < 0.05$) lower

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in lysozyme treated group as compared to control which suggests that lysozymes are effective in reducing fat deposition in broiler birds. Liver function parameters like AST and GPT were also measured in birds and there was no influence of different treatments on AST., although GPT levels in antibiotic and probiotic treated groups were found to be less as compared to control, which is indicative of liver function abnormality. Similar findings were observed by Rahman *et al*., 2013, where probiotics and enzymes treatment improved haematological parameters of broilers.

Conclusion

Supplementation of lysozymes in broiler ration could improve the growth performance (Gong *et al.,* 2017). It also improves blood biochemical indices which leads to better health performance and immune functions of broiler chickens. Hence, lysozyme may be used as an alternative to growth promoters, like antibiotics which will avoid drug resistance in the human being who eats the broiler meat.

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