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Research Article

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Effect of Citric Acid, Non Starch Polysaccharide Degrading Enzymes and Their Combination on Growth Performance of Broilers

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ABSTRACT

An experiment was conducted to assess efficacy of citric acid, non starch polysaccharide degrading enzymes (NSPDE) and their combination on growth performance of broiler diet from zero to six weeks of age. One hundred and sixty day-old broiler chicks were randomly allotted to five dietary treatment groups viz., T1, T2, T3, T4 and T5 with four replicates of eight chicks each, in a completely randomized design. The birds in T1 (control) group was fed with standard broiler ration (SBR) formulated as per BIS (2007). SBR with oxytetracycline (0.5 g/kg) was fed to birds in T2, SBR with citric acid (10 g/kg) in T3, SBR with NSPDE (0.1 g/kg) in T4 and SBR with combination of citric acid and NSPDE for birds in T5. The results of the study showed that the mean body weight of birds was not significantly different between treatments. Mean daily feed consumption of birds (0-6 weeks) was significantly (P<0.05) higher in antibiotic group (T2) and other treatment groups was statistically comparable with control group. Non significant FCR values were shown by all growth promoter supplemented groups compared to control group. Net profit per bird was found to be higher in enzyme fed group.

Keywords: *Antibiotic, Citric acid, Non starch polysaccharide degrading enzymes, Growth promoter*

INTRODUCTION

Demand for broiler meat is high but, limited availability lead producers to increase the production. Hence growth promoters are used to increase the performance of birds. The various growth promoters include acidifiers, phytogenics, probiotics, prebiotics, enzymes, synbiotics, hyperimmune egg antibodies, antimicrobial peptides, bacteriophages, electrolytes, some vitamins, minerals and other supplements. The objective of supplementing organic acids as additives in poultry feed is to decrease the pH of intestinal tract which inturn enhances the growth of favorable bacteria and suppress the pathogenic bacteria, thereby reducing the antibiotic usage (Haq et al., 2017). The alteration in the intestinal pH lead to reduced pH in the bacteria which brings the inherent metabolic functions to a halt and increases the toxic anion concentration which disrupts the cell membrane of the bacteria (Biggs & Parsons, 2008).

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An alternative method is the inclusion of dietary enzymes which enhances the energy, protein and phosphorus utilization thereby decreasing the feed cost. The various enzymes include β-glucanase, xylanase, cellulase, arabinoxylanase, phytase, and mannanase (Kocher et al., 2000). In corn-based diets, arabinoxylans is one of the major constituent of non starch polysaccharides, which increases viscosity of the digesta. Therefore, the digestability and absorption of the particular nutrient can be increased by xylanase supplementation which partially hydrolyses the arabinoxylans leading to the release of bound nutrients, consequently enhancing the bird performance. In the present study citric acid and non starch polysaccharide degrading enzymes and their combination was used to observe the performance of broiler.

MATERIALS AND METHODS

One hundred and sixty birds were randomly allotted to five dietary treatment groups, with four replicates having eight chicks each in a completely randomized design. The standard broiler ration (SBR) formulated using corn and soyabean meal as per BIS (2007). specifications formed the control ration (T1). Standard broiler ration supplemented with oxytetracycline (0.5 g/kg) was fed to birds in T2, SBR supplemented with citric acid (10 g/kg) in T3, SBR supplemented with NSPDE (0.1 g/kg) in T4 and SBR supplemented with combination of citric acid (10 g/kg) and NSPDE (0.1 g/kg) for birds in T5. The body weight of individual birds were recorded at weekly intervals from day old to six weeks of age. Feed consumed by birds in each replicate was recorded at weekly intervals from zero to six weeks of age. Feed conversion ratio (kg of feed consumed per kg weight gain) was calculated in each replicate.

RESULTS AND DISCUSSION

BODY WEIGHT

The data on mean body weight at weekly intervals maintained under five different dietary treatments are presented in Table 1.Non-significant effect of dietary supplementation of antibiotic (oxytetracycline) on mean body weight of broilers from 0-6 weeks of age in this study agrees with the report of Gunal et al. (2006). Haque et al. (2010) observed no significant effect. The difference between mean body weight of broilers in citric acid supplemented group and control group was also non significant at the end of six weeks of age. Contrary to this finding, Abdel-Fattah et al. (2008) and Moghadam et al. (2006). reported significant improvement in body weight gain. Mean body weight of birds in enzyme supplemented group (T4) was numerically higher than the control group but not statistically significant. This finding agrees with Luo et al. (2009). On the other hand Silva and Smithard (2002). reported improvement in body weight gain.

FEED CONSUMPTION

The mean feed consumption of birds in the five treatment groups showed no significant difference between groups up to three weeks of age (Table 2). At fourth and sixth week of age the mean feed consumption of birds in antibiotic supplemented group (T2) was significantly ($p<0.05$) higher than control and other groups which resulted significantly highest cumulative feed consumption in T2 group. These findings are in agreement with Celik et al. (2001). No significant effect on mean feed consumption of birds in citric acid group compared to control group was observed from 0 to 6 weeks of age in broilers. Similarly, Khosravinia et al. (2015). could not find any significant effect of citric acid supplementation on feed intake. The mean feed consumption of birds fed diet supplemented with NSP degrading enzymes in this study was statistically similar to control group. This finding agrees with Kocher et al. (2000) who reported that on supplementation of had no significant effect on feed intake over a three week period.

FEED CONVERSION RATIO (FCR)

The difference in mean FCR of birds between different treatment groups was non-significant up to five weeks of age. However, at sixth week, FCR values were significantly ($p<0.05$) higher in antibiotic group (T2) than other

supplemented groups (T3 to T5) due to the significantly higher feed consumption of birds in this groups (Table 3).However, cumulative FCR of birds from zero to six weeks of age was found statistically comparable among all groups. The lowest mean cumulative FCR value was obtained in citric acid fed group compared to all other treatments but the difference between treatments was non-significant. This finding is in agreement with report of Boling et al. (2000) who could not observe any significant effect of citric acid supplementation on FCR in broilers. Contrary to the present finding, Dabiri et al. (2009). reported improved feed conversion ratio in broilers fed diets supplemented with antibiotic compared to control diet group. Similar to the present findings of enzyme supplementation, Kocher et al. (2000) reported no significant effect on feed conversion ratio by supplementation of enzyme to sunflower meal. Contrary report was made by Nadeem et al. (2005) who observed significantly improved FCR in broilers supplemented with dietary NSP degrading enzyme.

Table 1: Mean (±SE) body weight of broilers in different dietary treatment at weekly interval, g
ns-non significant

Age in weeks	Treatment groups					F-value	p-value
	T1 SBR (control)	T2 SBR+ Antibiotic	T3 SBR+ citric acid	T4 SBR+ enzyme	T5 SBR+ citric acid + enzyme		
0	47.50 ± 0.62	46.94 ± 0.71	47.83 ± 0.58	46.61 ± 0.71	47.67 ± 0.63	0.64^{ns}	0.63
1	116.28 ± 2.62	121.20 ± 2.68	119.61 ± 3.01	115.06 ± 2.60	114.97 ± 2.98	1.02^{ns}	0.40
2	335.47 ± 8.50	346.77 ± 9.36	341.86 ±12.52	344.83 ± 9.47	342.79 ± 9.55	0.18^{ns}	0.95
3	686.24 ± 16.52	710.69 ± 17.98	671.69 ± 21.70	678.28 ± 21.21	672.12 ± 16.76	0.77^{ns}	0.55
4	1156.62 ± 23.85	1205.66 ± 26.45	1137.89 ± 36.38	1158.81 ± 29.88	1169.26 ± 27.53	0.74^{ns}	0.57
5	1708.41 ± 33.10	1770.57 ± 39.58	1722.25 ± 53.23	1734.44 ± 40.78	1739.35 ± 40.23	0.27^{ns}	0.89
6	2265.35 ± 38.62	2325.66 ± 50.32	2331.06 ± 62.00	2323.28 ± 51.61	2324.97 ± 53.68	0.27^{ns}	0.90

Table 2: Mean (±SE) feed consumption of broilers in different dietary treatment at weekly interval, g

Age in weeks	Treatment groups					F-value	p-value
	T1 SBR (control)	T2 SBR+ antibiotic	T3 SBR+ citric acid	T4 SBR+ enzyme	T5 SBR+ citric acid + enzyme		
1	104.97 ± 1.77	108.71 ± 5.24	104.11 ± 2.67	101.33 ± 5.28	99.79 ± 5.19	0.65^{ns}	0.64
2	362.17 ± 8.86	374.24 ± 16.42	336.89 ± 15.79	368.67 ± 10.10	387.47 ± 11.04	2.13^{ns}	0.13
3	553.99 ± 24.96	648.98 ± 71.69	544.00 ± 32.53	564.61 ± 34.82	581.61 ± 20.01	1.03^{ns}	0.42
4	800.84^{c} ± 41.77	962.28^{a} ± 13.53	846.22^{bc} ± 47.41	831.78^{bc} ± 28.81	926.58^{ab} ± 15.62	4.40*	0.01
5	1072.44^{a} ± 13.02	1107.49^{a} ± 8.13	1055.86^{ab} ± 16.64	1053.81^{ab} ± 37.48	1000.58^{b} ± 10.51	3.69*	0.03
6	1296.46^{b} ± 24.63	1369.73^{a} ± 11.64	1234.25^{bc} ± 20.37	1250.97^{bc} ± 25.64	1212.44^{c} ± 25.94	7.82**	0.00
Cumulative feed consumption (0-6 weeks)	4190.87^{b} ±84.02	4571.43^{a} ±76.27	4121.33^{b} ±33.70	4171.17^{b} ±91.49	4208.48^{b} ±39.99	6.84*	0.02

Mean values within a row bearing same superscript do not differ significantly ($p<0.05$)
ns-non significant
* significant ($p<0.05$)
**highly significant ($p<0.01$)

Table 3: Mean (±SE) feed conversion ratio and net profit of broilers in different dietary treatments at weekly intervals

Age in weeks	Treatment groups						
	T1 SBR (control)	T_2 SBR+ antibiotic	T_3 SBR+ citric acid	T_4 SBR+ enzyme	T_5 SBR+ citric acid + enzyme	F-value	p-value
1	1.54 ± 0.08	1.49 ± 0.07	1.47 ± 0.08	1.49 ± 0.05	1.54 ± 0.14	0.14 ^{ns}	0.97
2	1.67 ± 0.10	1.68 ± 0.09	1.53 ± 0.12	1.61 ± 0.04	1.71 ± 0.08	0.60 ^{ns}	0.67
3	1.58 ± 0.07	1.79 ± 0.19	1.68 ± 0.13	1.70 ± 0.09	1.78 ± 0.09	0.46 ^{ns}	0.76
4	1.70 ± 0.05	1.95 ± 0.04	1.83 ± 0.08	1.73 ± 0.06	1.87 ± 0.08	2.57 ^{ns}	0.08
5	1.96 ± 0.13	1.98 ± 0.08	1.79 ± 0.11	1.83 ± 0.05	1.75 ± 0.04	1.33 ^{ns}	0.31
6	2.33^{ab} ± 0.05	2.49^{a} ± 0.09	2.07^{b} ± 0.06	2.13^{b} ± 0.09	2.08^{b} ± 0.11	4.91*	0.01
Cumulative FCR (0-6 weeks)	1.89 ± 0.02	2.02 ± 0.07	1.82 ± 0.08	1.83 ± 0.04	1.85 ± 0.01	2.26 ^{ns}	0.11
Net profit/kg body weight, Rs.	12.36	8.66	14.10	14.65	12.28		

Mean values bearing same superscript within a row do not differ significantly ($p<0.05$)
ns-non significant
*significant ($p<0.05$)

CONCLUSION

The present findings, indicated that supplementation of antibiotic, citric acid, NSP degrading enzyme and the combination of citric acid and NSP degrading enzymes did not significantly influence the growth performance of broilers. Based on the net profit calculated per kg body weight, enzyme supplemented group was found more economical than other treatment groups.

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