



Effect of different non-antibiotic feed additives either alone or in combination on the performance and cost economics of broiler chickens

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ABSTRACT

In the present study, effect of different non-antibiotic feed additives either alone or in combination on the performance and cost economics of broiler chickens was investigated. Day-old commercial male broiler chicks (270) were randomly divided into nine treatment groups with six replicates of five birds in each. The dietary groups consisted of control diet, antibiotic (Virginiamycin @ 500 g/ton), probiotic (Protexin @ 500 g/ton), acidifier (Biotronic SE @ 3 kg/ton), prebiotic (Mos @ 500 g/ton) and its combinations with different inclusion rates. The results indicated that mean average body weight gain and feed conversion ratio of broilers were significantly influenced by addition of probiotic, prebiotic and acidifier either alone or in combination during prestarter, starter and finisher phases without showing any significant effect on average feed intake. Supplementation of dietary feed additives (except probiotic + acidifier) fed group yielded higher returns over feed cost compared to control and antibiotic fed groups. The highest return per bird was recorded with acidifier followed by probiotic + Mos groups.

Key words: Acidifier, Antibiotic, Broiler chicken, Economics, FCR, Prebiotic, Probiotic

In post WTO regime, the exports of poultry products were affected and as such antibiotics are being taken out of poultry and pig diets around the world, beginning in Sweden in the year 1986. The increased awareness among consumers for the poultry products without antibiotic residue encouraged the utilization of suitable alternatives for antibacterial compounds. Several non-antibiotic feed additives like probiotics, prebiotics and acidifiers have been identified as promising sources in minimizing incidence of disease and achieving better performance in chicken (Manal and Abou El-Naga 2012). Therefore, the present experiment was conducted to study the effect of non-antibiotic feed additives as an alternative to antibiotics on the performance and cost of production in broiler chickens.

MATERIALS AND METHODS

Birds and management: Day-old commercial male broiler chicks (270) were procured from Venkateswara hatcheries, Hyderabad. At day one, chicks were wing banded and housed in stainless steel battery brooders. Standard management practices were followed during the entire experimental period.

Experimental design and analysis: The birds were fed with maize and soybean meal based basal diets according to BIS (2007) during pre-starter (1–14 d), starter (15–28 d)

and finisher (29–42 d) phases (Table 1). The average initial body weight of the chicks was 37 g. The chicks were randomly distributed into nine dietary treatments of six replicates with five chicks in each CRD. The birds were fed one of the experimental diet as follows; T1, basal diet (control); T2, antibiotic (500 g/ton); T3, probiotic (500 g/ton); T4, acidifier (3 kg/ton); T5, prebiotic (500 g/ton); and their combinations with respective level of inclusion in T6 (Probiotic + Acidifier), T7 (Probiotic + Mos), T8 (Acidifier + Mos) and T9 (Probiotic + Acidifier + Mos) groups. Individual body weight and feed consumption of each group was recorded at weekly interval. The economics of using different dietary treatments were calculated in terms of returns over feed cost.

Statistical analysis: The data were analyzed by using general linear model procedure of statistical package for social sciences (SPSS, version 15) and significance was considered at $P < 0.05$.

RESULTS AND DISCUSSION

Average gain in weight: The results indicated that mean average body weight gains of broilers were significantly ($P < 0.05$) influenced by addition of all non-antibiotic feed additives (Table 2). During pre-starter phase, the mean body weight gain was not significantly different ($P > 0.05$) between acidifier alone and control groups but higher ($P < 0.05$) effect was observed in probiotic, Mos and probiotic + acidifier groups. In starter phase, acidifier alone had showed significantly ($P < 0.05$) higher weight gain compared to other dietary groups. Diets supplemented with acidifier, Mos and

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Table 1. Ingredient composition of basal diet (g/kg)

Ingredient	Prestarter (0-14 d)	Starter (15-28 d)	Finisher (29-42 d)
Maize	524	572	579
Soybean meal	406	353	335
Common salt	3.8	3.8	3.8
Sodium bi-carbonate	1	1	1
Dicalcium phosphate	20.6	19.3	16.5
Shell grit	5.9	5.9	6.6
DL methionine	2.46	2.1	1.99
L lysine HCl	0.74	0.61	0.09
AB2D3K*	0.15	0.15	0.15
B complex vitamins*	0.15	0.15	0.15
Choline chloride	1	1	1
HSCAS (Toxin binder)	2	2	2
Trace mineral mixture**	1.2	1.2	1.2
Liver tonic	0.5	0.5	0.5
Vitamin E-Se	0.2	0.2	0.2
Coccidiostat	0.5	0.5	0.5
Vegetable oil	30.2	37.2	50.8
<i>Nutrient composition (calculated)</i>			
ME (kcal/kg)	2950	3050	3150
Crude protein (%)	23	21	20.2
Lysine (%)	1.35	1.2	1.1
Methionine (%)	0.58	0.52	0.5
Calcium (%)	0.9	0.85	0.8
Available phosphorus (%)	0.48	0.45	0.4

*Vitamin premix provided per kg diet: vitamin A, 12,375 IU; vitamin D₃, 1,800 IU; Vitamin E, 6 mg; vitamin K, 1.5 mg; riboflavin, 7.5 mg; vitamin B₁, 0.6 mg; B₆, 1.2 mg; B₁₂, 6 mcg; Niacin, 9 mg; Calcium pantothenate, 6 mg. **Trace mineral provided per kg diet: Manganese, 120 mg; Zinc, 80 mg; Iron, 25 mg; Copper, 10 mg; Iodine, 1 mg; selenium, 0.1 mg.

probiotic + Mos exhibited significantly (P<0.05) higher body weight gain compared to control during finisher phase. These findings were in accordance with results of Bozkurt

et al. (2009) who reported that addition of non-antibiotic feed additives significantly (P<0.05) increased body weight gain at 21 and 42 days of age compared to control. Our study was in agreement with many studies where supplementation of Mos (Nyamagonda et al. 2011), probiotics (Patel et al. 2015), Probiotic + acidifier (Agboola et al. 2015) and probiotic + Mos (El-Shenwayandand Mosaad 2015) showed significantly (P<0.05) improved body weight gain in broiler chickens compared to control. In contrast, Hofacre et al. (2003) reported that supplementation of prebiotic to a diet with or without a probiotic did not improve weight gain in broilers at 28 d of age. The beneficial effects of probiotics in broilers might be due to significantly increased intestinal amylase activity and increase of the *Lactobacilli* colonizing effect in the intestine. The beneficial effect of Mos in broilers might be due to pathogenic adsorption with resultant removal of pathogenic bacteria.

Feed intake: There were no significant (P>0.05) differences in cumulative feed intake among all dietary treatments during all phases (Table 2). Similar results were also obtained by Anjum et al. (2005) and Agboola et al. (2015). This may be due to the factors like environmental conditions, dietary energy levels and doses of the additives used in the experimental diets.

Feed conversion ratio: All dietary supplemented groups exhibited significantly (P<0.05) improved feed conversion ratio during all phases of the experiment (Table 2). The best FCR was observed in with antibiotic supplementation during pre-starter period. However, other supplemented groups showed an intermediate results except Mos fed group which had lowest (P<0.05) FCR. During starter phase, there was no significant (P>0.05) difference among probiotic, acidifier, acidifier + Mos and probiotic + acidifier + Mos supplemented groups but they had better (P<0.05) FCR compared to control and probiotic + acidifier groups.

Table 2. Effect of different feed additives on average body weight gain (g), feed intake and feed conversion ratio in broilers

Groups diets	Average body weight gain (g/bird)			Feed intake (g/bird)			Feed/gain		
	0-14 d	15-28 d	29-42 d	0-14 d	15-28 d	29-42 d	0-14 d	15-28 d	29-42 d
T ₁ Control	276±3.71 ^a	799±12.8 ^{ab}	890±29.5 ^c	359±6.20	1182±21.0	1816±9.77	1.30±0.01 ^{ab}	1.48±0.01 ^b	2.05±0.06 ^c
T ₂ Antibiotic	268±3.08 ^{ab}	783±12.8 ^b	943±14.7 ^{abc}	344±3.58	1137±18.2	1847±66.7	1.28±0.01 ^a	1.45±0.01 ^a	1.96±0.05 ^{bc}
T ₃ Probiotic	262±2.34 ^b	783±13.1 ^b	941±8.28 ^{bc}	353±3.54	1128±26.8	1760±26.5	1.35±0.01 ^{bc}	1.44±0.02 ^a	1.87±0.02 ^{ab}
T ₄ Acidifier	277±2.66 ^a	823±4.15 ^a	959±12.9 ^{ab}	364±2.53	1191±5.75	1805±42.4	1.31±0.01 ^{abc}	1.45±0.04 ^a	1.88±0.04 ^{ab}
T ₅ Mos	263±2.87 ^b	773±13.0 ^b	954±25.4 ^{ab}	356±2.53	1130±17.8	1769±41.2	1.35±0.01 ^c	1.46±0.01 ^{ab}	1.86±0.02 ^{ab}
T ₆ Probi + Acid	261±2.39 ^b	762±6.70 ^b	916±15.1 ^{bc}	349±4.24	1128±11.4	1756±23.8	1.34±0.01 ^{bc}	1.48±0.01 ^b	1.92±0.04 ^{ab}
T ₇ Probi + Mos	272±8.67 ^{ab}	771±18.0 ^b	996±6.40 ^a	353±7.23	1127±19.1	1828±20.7	1.30±0.03 ^{ab}	1.46±0.01 ^{ab}	1.84±0.02 ^a
T ₈ Acid + Mos	266±2.47 ^{ab}	795±10.4 ^{ab}	932±14.9 ^{bc}	353±1.73	1151±17.2	1741±21.0	1.33±0.01 ^{abc}	1.45±0.01 ^a	1.87±0.03 ^{ab}
T ₉ Probi + Acid + Mos	270±3.03 ^{ab}	793±5.85 ^{ab}	925±14.0 ^{bc}	359±6.79	1144±16.3	1790±21.7	1.33±0.02 ^{abc}	1.44±0.01 ^a	1.94±0.03 ^{ab}
SEM	1.43	4.25	6.53	1.62	6.35	11.6	0.01	0.00	0.01
P value	0.041	0.025	0.009	0.159	0.095	0.379	0.040	0.030	0.004

^{abc}Means the values bearing different superscripts in a column differ significantly (P<0.05).

Table 3. Returns over feed cost and gain/loss over antibiotic or control diet of broilers at market age (42 d)

Group	Diets	Cumulative feeding cost/ bird (₹)	Final body wt. (g)	Sale amount* (₹/bird)	Returns over feed cost (₹/bird)	Gain/loss over control (₹/bird)
T ₁	Control	64.75	2,002	128.13	63.37	—
T ₂	Antibiotic	64.78	2,031	129.99	65.21	1.83
T ₃	Probiotic	63.13	2,023	129.50	66.37	2.99
T ₄	Acidifier	65.81	2,096	134.14	68.34	4.96
T ₅	Mos	63.26	2,027	129.72	66.46	3.08
T ₆	Probi + Acid	63.95	1,976	126.48	62.53	-0.84
T ₇	Probi + Mos	64.95	2,076	132.86	67.92	4.54
T ₈	Acid + Mos	64.04	2,030	129.94	65.89	2.52
T ₉	Probi + Acid + Mos	65.62	2,025	129.60	63.98	0.61

Antibiotic, ₹ 0.17/kg feed; Probiotic, ₹ 0.19/kg feed; Acidifier, ₹ 0.30/kg feed; Mos, ₹ 0.15/kg feed.

Supplementation of all non-antibiotic feed additives either alone or in combination improved ($P < 0.05$) FCR during finisher phase compared to control and antibiotic fed group. The best FCR was recorded with supplementation of probiotic + Mos together. In the same line, Bozkurt *et al.* (2009) observed that supplementation of organic acid and prebiotic + probiotic combination significantly ($P < 0.05$) improved feed efficiency during 21 d of age but combination of prebiotic with probiotic improved at both 21 and 42 d of age compared to control. Contrary to these findings, researchers reported that supplementation of probiotic + prebiotic (Hofacre *et al.* 2003) and probiotic + organic acid (Gunal *et al.* 2006) did not show any significant ($P < 0.05$) effect on FCR in broilers. Improvement in feed efficiency might be obtained by several factors like alteration in gut microbial status and improvement of nutrient digestibility.

Mortality: In the present study, total mortality was 2% only during finisher phase. This might be due to the continuous feeding of non-antibiotic feed additives which suppressed the undesirable microorganisms leading to improved health status (build-up resistance). Similar results were observed by Anjum *et al.* (2005).

Cost of feeding and return over feed cost: The results of the study revealed that the returns over feed cost ranged between ₹ 62.53 to ₹ 68.34 for different dietary treatments (Table 3). However, supplemented groups showed higher ($P < 0.05$) returns compared to control and antibiotic fed group except probiotic + acidifier + Mos group (due to higher feed cost resulting from addition of 3 growth promoters, without a proportionate gain). The highest profit per bird was recorded with acidifier (₹ 4.96/bird) followed by probiotic + Mos (₹ 4.54/bird) groups. Similar results were also reported by Parasar *et al.* (2013), Saiyed *et al.* (2015) and Patel *et al.* (2015) with probiotics.

From the present study, it can be concluded that supplementation of non-antibiotic feed additives either alone or in combination significantly ($P < 0.05$) improved the average body weight gain, feed efficiency and gave higher returns over feed cost compared to control and antibiotic supplemented groups.

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