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Effect of dietary supplementation of tannins, probiotics and antibiotic growth promoters on growth performance of broiler chicken

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Antibiotics are used as growth promoters (AGPs) in agricultural animal production as a means to increase growth performance through maintained animal health and improving feed efficiency of chicken. Extensive research has been done over the last couple decades to search for natural alternatives to in-feed antibiotics, and plant compounds (or phytogenic compounds) have been identified to have great potentials (Yang *et al.* 2015). Among the available alternatives to replace AGPs for poultry industry, phytogenic additives and probiotics appear as candidates due to their ability to emulate the bioactive properties of conventional AGPs. Probiotics improve feed conversion efficiency including alteration in intestinal flora, enhancement of growth of non-pathogenic facultative anaerobic and gram positive bacteria forming lactic acid and hydrogen peroxide, suppression of growth of intestinal pathogens, and enhancement of digestion and utilization of nutrients (Yeo and Kim 1997). Tannins are polyphenolic compounds widely distributed in the plant kingdom, where they play a protective role. Girard and Bee (2020) reported that ellagitannins isolated from *Rosa rugosa* petals have antibacterial activities against pathogenic bacteria such as *Salmonella* sp, *Bacillus cereus, S. aureus* and *E. coli* but they had no effect on beneficial bacteria. Tannins added to the diet are being used for farm animals to improve nutrition and control enteric diseases.

An experiment was carried out to study dietary supplementation of tannins, probiotics and antibiotic growth promoters on growth performance of broiler chicken. The experiment was conducted at Poultry Research and Training Centre, Bihar Animal Sciences University, Patna, Bihar. For the experimental feeding, 408 broiler chicks (Vencobb 400 Y strain) were procured locally. All the chicks were individually weighed and randomly allotted to four treatment groups each with five replicates of 20 chicks in such a way that average body weight was approximately similar for all the treatment groups. Feed ingredients, supplements and feed additives in required quantities for the formulation of experimental diets were procured from the local market nearby Patna in Bihar. Standard basal diets for pre-starter (0-7 days), starter (8-21 days) and finisher (21-35 days) phases of growth of broiler chickens were prepared by mixing the different ingredients as shown in Table 1, to meet the nutrient requirements of broiler chicken as per the recommendation of BIS (2007). Proximate composition, phosphorus (AOAC 2005) and calcium (Talapatra *et al.* 1940) contents of the feed ingredients used in the experiments were determined by following standard techniques. The calculated value of metabolisable energy, lysine, and methionine were used to balance the ration to meet the nutrients by the broiler chickens. All the standard management practices were followed during experimental period including vaccination schedule. All the broiler chicks were housed in deep litter system and provided *ad lib.* feed and water throughout the feeding trial of 35 days. In this experiment, Group 1 (T0) served as control group and was fed with basal ration, Group 2 (T1) were fed basal ration mixed with 1 g tannin per kg of feed; Group 3 (T2) basal ration with virginiamycin at the rate of 0.025 g per kg of feed; Group 4 (T3) were fed basal ration with probiotics at the rate of 0.5 g per kg of feed. In all groups 102 day old chick were divided into replicates of five. The body weight of individual birds was recorded at the start of the experiment and also at every week till the end of experiment. Feed conversion ratio (FCR) was calculated by dividing the feed consumed from the body weight gain. The performance index of broiler during different periods of growth was calculated by using the formula given by Bird (1995). The cost of different rations used in the present study was calculated based on the actual market price of feed ingredients which prevailed at the time of experiment.

Six broiler chicks representing the average body weight of the group were randomly selected and kept in metabolic cages and metabolism trial of five days was conducted to

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Table 1. Ingredient and chemical composition (% DM basis) of basal diets of broiler chickens used during experiment

Ingredient	Pre-starter	Starter	Finisher
Maize	57.90	56.00	59.20
Soybean meal	26.50	29.00	25.50
Groundnut cake	6.00	4.00	3.00
Meat cum bone meal	5.00	4.00	3.70
Vegetable oil	1.82	3.89	5.32
Limestone power	0.80	0.90	0.90
Dicalcium phosphate	0.70	0.85	1.00
Common salt	0.30	0.30	0.30
Trace mineral premix[1]	0.15	0.15	0.15
Vitamin Premix[2]	0.10	0.10	0.10
L-lysine	0.25	0.15	0.050
DL-Methionine	0.12	0.10	0.130
Choline chloride	0.06	0.06	0.150
Toxin binder	0.10	0.10	0.10
Coccidiostat	0.05	0.05	0.05
Sodium bicarbonate	0.150	0.150	0.150
Total	100	100	100
Chemical composition (% DM basis)			
Crude protein (%)	23.09	22.13	20.21
Ether extract (%)	8.11	8.23	8.23
Crude fibre (%)	3.81	3.90	3.90
Total ash (%)	6.26	6.34	6.34
Calcium (%)	1.00	1.00	1.00
Total phosphorus (%)	0.71	0.73	0.73
Available phosphorus (%)	0.41	0.44	0.44
ME (kcal/kg) *	3012.96	3125.36	3219.87
Lysine (%) *	1.01	1.00	1.00
Methionine (%) *	0.45	0.44	0.44

*Calculated values. [1]Trace mineral premix supplied (per kg diets): Magnesium-300 mg, Manganese-55 mg, Iodine-0.4 mg, Iron-56 mg; Zinc-30 mg and Copper-4 mg.[2]Vitamin premix supplied (per kg diet): vitamin A-8250 IU, vitamin D3-1200 ICU; vitamin K-1 mg; vitamin B1-2 mg, vitamin B2-4 mg; niacin-60 mg, pantothenic acid- 10 mg, cyanocobalamin-10 and choline-500 mg.

investigate the apparent total tract nutrient retention at the end of 5th week of feeding trial. The experimental feed and fresh drinking water were provided *ad lib*. initially, 2 days adaptation period was observed followed by 5 days excreta collection period. During the collection period, weighed amount of feed was offered to all broilers in the morning at 9 AM and residue left was weighed next morning at the same time. Simultaneously, faecal trays covered with polythene sheets were placed for the collection of excreta. Excreta was pooled and dried in hot air oven at 70°C for 48 hrs for dry matter estimation and thereafter stored for further analysis. The samples of the experimental diets and the dropping were analyzed for proximate principles, phosphorus (AOAC 2003), calcium (Talapatra *et al*. 1940) and gross energy (Adiabatic bomb calorimeter, Sanyo gallen kemp). All the data were analyzed statistically using statistical packages for social sciences (SPSS) software version 20.00 as per Snedecor and Cochran (1994).

A marginal fluctuation was observed in feed intake in among different group (Table 2). Abdul Rahim *et al.* (1999) conducted a study to know the effect of *Lactobacillus acidophilus* and zinc bacitracin alone, or in combination, on the growth performance of broiler. They observed feed intake was significantly (P<0.05) higher in bacitracin alone diet than probiotic and its combination. A good fluctuation was observed in the feed intake in every week among the different treatment groups. Average weight gain during the experiment varied from 1692.93 in T2 to 1725.07 g in T1 group, respectively. Parks *et al.* (2005) conducted an experiment to determine the effects of Virginiamycin and their combination on the growth performance of large white female turkeys and concluded that supplementation of virginiamycin significantly (P<0.05) improved body weight gain during the 0 to 3, 3 to 6, and 6 to 9 week periods compared with control birds and its combination with mannan oligosaccharide. Miles *et al*. (2006) reported that addition of Bacitracin methylene disalicylate or Virginiamycin in broiler diets significantly (P<0.05) improved weight gain at 7 weeks of age. A study was conducted (Swain *et al.* 2007) to know the effect of probiotic and antibiotic feeding either alone or in combination in the broiler ration up to six weeks of age. It was observed that body weight gain was significantly (P<0.05) higher in probiotic and/or antibiotic supplemented groups than the control. Schiavone *et al*. 2008 evaluated that inclusion up to 0.20% of chestnut tannin increased daily feed intake and average daily gain. The average FCR of fifth week of experiment varied from 1.65 in T1 to 1.78 in T0 group. Analysis of variance for the effect of treatment on FCR in broiler chicken showed significant (P<0.05) effect on change in FCR between the groups. The overall FCR for T1 group was found to be significantly (P<0.01) high than all other treatment group followed by T3, T2 group in comparison with control. Manoj Singh *et al.* (2008) stated that supplementation of Virginiamycin (500 g/MT) significantly (P<0.01) improved feed efficiency compared to control and Bacitracin methylene di

Table 2. Effect of dietary supplementation of tannin, antibiotics and probiotics on growth performance (0-35 days) of broiler chicken

Parameter	T0	T1	T2	T3	SEM	P-value
Average feed intake (g)	2963.52[b]	2845.38[a]	2822.85[a]	2831.90[a]	17.989	0.001
Average body weight(g)	1694.53	1725.07	1692.93	1710.53	31.822	0.723
Body weight gain(g)	1694.53	1725.07	1692.93	1710.53	31.82	0.723
FCR	1.75[b]	1.65[a]	1.67[a]	1.66[a]	0.032	0.047
Performance index	969.19±20.82	1046.35±34.26	1015.34±10.95	1033.95±35.83	14.66	0.282

[abc] Values with different superscripts in a row differ significantly (P<0.05; P<0.01).

Table 3. Effect of dietary supplementation of tannin, antibiotics and probiotics on nutrient retention (%)

Week	T0	T1	T2	T3	SEM	P-value
DM	74.29±2.41	70.62±1.16	72.73±1.61	73.60±1.33	2.396	0.489
Nitrogen	64.77±1.84	63.55±1	64.78±1.74	65.60±0.88	2.197	0.828
EE	76.33±1.20	73.55±1.98	75.11±1.76	76.67±0.93	2.163	0.505
Ca	17.07^{ab}±0.58	18.03^{b}±0.48	16.77^{ab}±0.18	15.40^{a}±0.67	0.722	0.039
P	14.40±0.80	14.30±0.61	13.03±1.24	13.53±1.31	1.460	0.759

^{abc}Values with different superscripts in a row differ significantly (P<0.05; P<0.01).

salicylate (150 g/MT and 200 g/MT) at 6 weeks of age. It was also observed that supplementation of antibiotics did not have significant effect (P>0.01) on feed consumption but highest feed consumption was noticed in antibiotic supplemented groups. The result of performance index (PI) at weekly intervals and at the end of fifth week in broiler birds is presented in Table 2. The average PI of 1-5th week of experiment varied from 969.19 in T0 to 1046.35 in T1 group.

The result of DM retention in broiler birds at 5th week of age is given in Table 3. DM retention percentage ranged from 70.62 in T1 to 74.29 in T0 group, followed by 73.60 in T3 and 72.73 in T0 group, respectively. Analysis of variance for the effect of treatment on DM retention in broiler chicken was non-significant (P<0.05) and found comparable among the groups. Nitrogen retention percentage ranged from 63.55 in T1 to 65.60 in T3 group, followed by 64.78 in T2 and 64.77 in T0 group respectively. Analysis of variance for the effect of treatment on Nitrogen retention in broiler chicken was non-significant (P<0.05) and found comparable among the groups. The result of EE retention in broiler birds at 5th week of age is given in Table 3. EE retention percentage ranged from 73.55 in T1 to 76.67 in T3 group, followed by 76.33 in T0 and 75.11 in T2 group respectively. The result of calcium retention percentage at 5th week of age is presented in Table 3. The calcium retention in birds ranged from 15.40 in T3 to 18.03 in T1 group. Analysis of variance for the effect of treatment on calcium retention percentage was significantly differed (P<0.05) and found higher, i.e. 18.03 in T1 group followed by T2 group 16.77 as compared with control (T0). Such changes might be due to presence of Tannic acid which leads to better absorption and availability of nutrient from offered feed at tissues level.

Phosphorus retention percentage in broiler birds at 5th week of age is given in Table 3. Phosphorus retention percentage ranged from 13.03 in T2 to 14.40 in T1 group, respectively. Analysis of variance for the effect of treatment on phosphorus retention in broiler chicken was non-significant (P>0.05) and found comparable among the groups. The results of parameters in balance of nutrition were in conformity with Panda *et al.* (2003).

SUMMARY

A total of 408, day-old Vencobb 400Y strain broiler chicks were locally procured, weighed individually and randomly divided into four treatment groups to study the effect of tannins, probiotics and antibiotics on feed intake, body weight, weekly body weight gain, feed conversion ratio, nutrient utilization, performance index and nutrient retention in broiler chickens during 35 days feeding trial. Growth performance of broilers in terms of feed intake, weekly body weight gain, feed conversion ratio and performance index was found significant and higher in T1 (Tannin group) and T3 (Probiotics group) in comparison to T2 (Antibiotics group) and control group. Supplementation of tannins and probiotics enhanced growth performance of broiler chicken compared to antibiotics and control group. There was no significant effect on dry matter, ether extract and phosphorus retention in broiler chickens fed tannin, probiotics and antibiotic except calcium. Thus, it may be concluded that supplementation of broiler diet with tannin, probiotics and antibiotics may prove a promising approach in enhancing the growth performance, body weight gain, feed conversion ratio and performance index.

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