Research Article

Appraisal of Suitability of Probiotics Over Antibiotic Growth Promoter Supplementation on Growth Performances and Hematology in Broilers

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Abstract | The experiment was carried out to evaluate the effects of probiotics over antibiotic growth promoter on growth performance and hematology of broiler chicken. To perform the study, a total number of sixty (60) day old 'Cobb 500' broiler chicks were randomly divided into three groups, naming group C that was supplied with normal broiler ration as control, group B was supplied with normal ration along with supplementation of probiotics, BACTOSAC @ 0.2 ml per liter drinking water and group A was reared with normal broiler ration along with growth promoter, antibiotics (Tetravet) @ 0.2 mg per liter drinking water. All the birds were reared in the same environmental conditions. As a part of growth performances evaluation, daily body weight gain and weight improvement, weekly average feed consumption, feed conversion ratio, final average body weight and carcass weight were recorded during the experimental period. As a part of hematological analysis at 5 weeks of age, blood parameters including total erythrocyte count (TEC), packed cell volume (PCV), haemoglobin (Hb), erythrocyte sedimentation rate (ESR) was determined. In case of growth performances group B showed significantly ($p< 0.05$) higher comparing to the group A and C. The lowest FCR found in group B comparing to the group A and C. In hematological analysis there was significant ($p< 0.05$) changes in TEC, HB, PCV in the group B compared to the group C and A. So, it can be concluded that probiotics has positive effects on the growth performances (daily and final body weight improvement, FCR and organs weight) and hematological values of broiler compared to the antibiotic growth promoters.

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Introduction

Probiotics are specific chemical agents produced by microorganism containing *Lactobacillus acidophillus, lactobacillus casi, Bifidobacterium bifidum, Aspergillus oryazae* and *Torulopsis* (Mohan *et al*., 1996). Probiotic preparations may consist of single strains or may contain any number up to eight strains. The

attraction of multiple strain preparations is that they are active against a wider range of conditions and in a wider range of animal species. Fuller (1989) redefined probiotics as "A live microbial feed supplement which beneficially affects the host birds by improving its intestinal microbial balance. Probiotics can be presented to the animal in various ways. The type of preparation will depend on the sort of use intended.

They can either be included in the pelleted feed or produced in the form of capsules, paste, powder or granules which can be used for dosing animals directly or through their food. Nearly all of the probiotics currently on the market contain lactobacilli and/or streptococci, few contain bifidobacteria. Pietras (2001), reported the efficacy of probiotics. They studied 1200 broilers in 3 groups which were given a starter diet for 3 weeks and then a grower diet comprising 19.2% protein and 12.7 MJME. Group 1 received no supplement, group 2 a supplement of 0.5 g/kg of flavomycin, and group 3 a supplement of 250 mg/kg of probiotic preparation of Lactobacillus acidophilus and Streptococcus faecium. For the 3 groups respectively, body weight averaged 2121, 2158 and 2212g. Khatun *et al.* (2010) conducted an experiment on 300 healthy day-old broiler chicks to study the effect of 5 commercially available probiotics on growth performance. They found there was no significant difference in feed intake and live weight gain of the birds. Sabiha *et al.* (2005) reported that the effects of different levels of probiotic (*Lactobacillus acidophilus, Streptococcus faecium* and Yeasacc 1026) supplementation on the performance of broiler chicken were evaluated using 144, one-day old, commercial broiler chicks for a period of eight weeks. The 0.025 percent probiotic supplemented birds showed a significantly higher (P<0.05) body weight and weight gain up to six weeks of age. The feed intake, feed efficiency and protein efficiency were statistically non-significant at sixth and eighth weeks of age among the treatment groups. The mortality percentage was not affected by treatments. Cost of production of broilers was lower in the 0.025 and 0.05 per cent probiotic supplemented groups at six and eight weeks of age respectively. It was concluded that the probiotic supplementation in standard broiler ration at a lower level was beneficial in the early stages of growth Gunal *et al.* (2006) reported that the Effects of an antibiotic growth promoter (flavomycin), a probiotic mixture (protexin) or a mixture of organic acids including plant extract and mineral salts (genex) on performance, intestinal microbial flora and tissue morphology have been examined in 160 day-old Ross 308 broiler chicks. Commercial corn-soybean- based broiler starter and grower diets were formulated. As basal diets for control treatment. In total, five dietary treatments were employed in the trial. Live weight gain, feed intake, feed conversion ratio and mortality were not affected by dietary treatments throughout the experiment. However, relative weight of the small intestine of antibiotic treatment had significantly less than that of the basal diet. Intestinal microbial flora and tissue were determined at 21 and 42 days. In both periods, antibiotic and the organic acids mixture treatments significantly decreased total bacteria counts. In addition to that all treatments significantly decreased gram negative bacteria counts compared to the basal diet.

Probiotic treatment significantly increased ileum and jejunum villus height, whereas antibiotic treatment significantly decreased muscularis thickness compared to the basal diet. Bozkurt *et al.* (2008) reported that the effect of dietary supplementation with an antibiotic growth promoter (AGP) and two prebiotics; mannan oligosaccharide (MOS) and dextran oligosaccharide (DOS), respectively, on growth performance and some slaughter characteristics of broilers. They found that Chicks fed on basal diets were supplemented with an AGP and both of prebiotics were significantly heavier at 21 and 42 days of age than that of control chickens fed with basal diet as control. Besides, body weight of birds given MOS supplemented diet was significantly higher than those birds fed with AGP and DOS added diets ($P < 0.05$). Feed consumption, feed conversion ratio and liveability of birds was not affected by dietary treatments determined both at 0 to 21 d, 22-42 d and 0-42 d periods ($P > 0.05$). Percentage weight of carcass yield, liver, pancreas and abdominal fat pad was not affected by dietary treatments also ($P > 0.05$). The results obtained in the present experiment showed that birds fed with AGP, MOS and DOS supplemented diets exhibited higher body weight gain ($P < 0.05$) and numerically improved feed efficiency than that of the control birds fed on basal diet. In conclusion, either MOS or DOS could replace for AGP as non-antimicrobial performance enhancer feed additives without scarifying any performance goal and carcass yield of broilers.

Kabir *et al.* (2004) reported the occurrence of a significantly (P<0.01) higher carcass yield in broiler

chicks fed with the probiotics on the 2nd, 4th and 6th week of age both in vaccinated and nonvaccinated birds. Although Mahajan *et al.* (1999) recorded in their study that mean values of giblets, hot dress weight, cold dress weight and dressing percentage were significantly (P<0.05) higher for probiotic (Lacto-Sacc) fed broilers. On the other hand, Mutus *et al.* (2006) investigated the effects of a dietary supplemental probiotic on morphometric parameters and yield stress of the tibia and they found that tibiotarsi weight, length, and weight/length index, robusticity index, diaphysis diameter, modulus of elasticity, yield stress parameters, and percentage Ca content were not affected by the dietary supplementation of probiotic, whereas thickness of the medial and lateral wall of the tibia, tibiotarsal index, percentage ash, and P content were significantly improved by the probiotic.

Abdullah *et al.* (2009) reported that the effect of probiotic (Table 1) (BIOMIN) ® on lead acetate absorption and it is toxic action on certain physiological and biochemical parameters: Body weight gain, Hb concentration, PCV%, serum total protein and serum lead level in chicks. The results show that probiotic significantly (P ≤ 0.05) decreased serum lead level, enhanced body weight gain, while it has no direct significant effect on serum total protein, Hb concentration, and PCV%. On the other hand, lead acetate alone (in both doses) was caused sever anemia, depression in the level of both Hb concentration and PCV%, while half dose (160 mg) of lead acetate was caused no effect on both body weight gain and serum total protein, but death of some chicks, and decreased serum total protein were occurred with full dose of lead acetate. Although there are many works performed with probiotics on broiler but this study is aimed to gather knowledge in using of probiotics and antibiotic growth promoter in a same experimental set as well as the comparison of the study effects among the probiotics and antibiotic growth promoter for the better and safe selection of promoting agents relating to growth and hematological values in broiler industry.

The current study was designed to achieve the following objectives:

- To find out the effects of probiotics on overall growth performances (Body weight gain, individual organ weight, FCR, feed intake) and hematological values (TEC, PCV, ESR) of broilers.
- To find out the effects of antibiotic growth promoters on growth performances (Body weight gain, individual organ weight, FCR, feed intake) and hematological values (TEC, PCV, ESR) of broilers.
- A comparison of probiotic and antibiotic growth promoters on growth performances and hematology of broilers.

Materials and Methods

A total of 60, day old "Cobb 500" broiler chicks were purchased from a local commercial broiler farm and was divided randomly into three (3) equal groups (n=20) as group C, B, And A. Birds of group C was considered as control. Group B was treated with supplementation of 0.2 ml Probiotic (BACTOSAC)/ litre drinking water and Group A was treated with supplementation of 0.2 mg antibiotic growth promoter (Tetravet)/litre drinking water, separately for next 35 days. Initial body weight of each bird was recorded just prior to segregation and kept them into separated floor. Daily body weight, body weight improvement, carcass weight, weekly feed intake and final average body weight were recorded up to the end of the 35 days of experimental period and the birds were sacrificed to collect blood sample for hematological study (TEC, Hb, PCVand ESR). The chickens in all the experimental groups was reared under similar management conditions with *ad libitum* feed and water.The response of the chickens was assessed in terms of body weights, carcass weight, feed intake and feed convertion ratio (FCR). The birds were fed with commercially available broiler feed (Table 2). Vaccination schedule (Table 3) for newcastle and gumboro diseases was maintained properly according the recommended manual. Figure 1 show the details of the experimental design of the work.

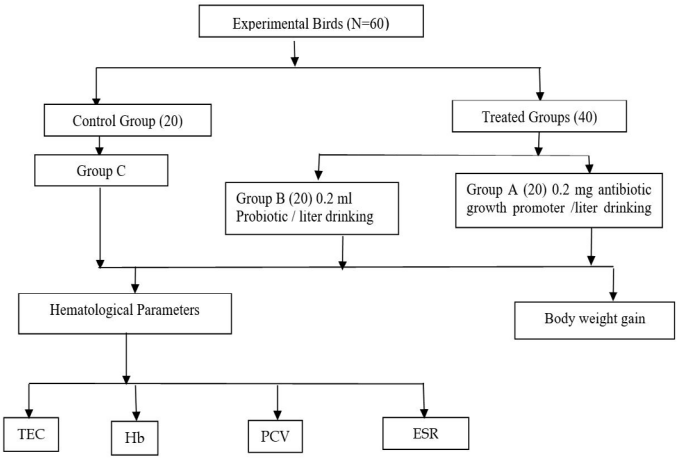

Figure 1: *The overall experimental design of the study.*

Table 1: *Composition of supplemented probiotics (BACTOSAC®) each 1 liter contains at least 1×10⁹ (cfu) of the followings.*

Lactobacillus acidophilus
Lactobacillus plantrum
Pediococcus pentosaceus
Saccharomyces cerevisiae
Bacillus subtilis
Bacillus licheniformis
Mollas, Deionize and Water

Table 2: *Composition of supplied broiler feed.*

Nutrients	Broiler starter (g /100 g)	Broiler grower (g /100 g)
Moisture (Max)	11	11
Protein (Min)	25	24
Fat (Min)	5	5
Fiber (Max)	4	4
Calcium (Min)	1.20	1.20
Phosphorus (Min)	0.75	0.75
Methionine (Min)	0.65	0.60
Lysine (Min)	1.40	1.40
ME (Min) Kcal/kg	3150	3175

Based on composition of the feed supplied by manufacturer (Agrovet Feeds Ltd. Gazipur, Bangladesh).

Table 3: *Vaccination schedule of birds.*

Age of birds (days)	Name of the vaccines	Name of the company	Dose	Route
07	BCRDV (Newcastle L-63)	Square Pharmaceuticals Ltd. , Agrovet Division, Dhaka, Bangladesh	One drop	Eye
12	Gumboro (Bangla GUMBORO VAC)	FnF Pharmaceuticals Ltd., Dhaka, Bangladesh	One drop	Eye
17	Gumboro booster (Bangla GUMBORO VAC)	FnF Pharmaceuticals Ltd., Dhaka, Bangladesh	One drop	Eye

Growth performance

Measurements of broiler performance including daily body weight, body weight improvement, daily food intake, average final weight, carcass weight and FCR were determined.

Hematological analyses

At the end of the experiment, fresh blood samples were collected from chickens of different groups to measure Total erythrocyte count (TEC), Hemoglobin (Hb) concentrations, packed cell volume (PCV) Erythrocyte Sedimentation Rate (ESR).

Collection of blood

On 5th week of age, blood sample was collected by sacrificing the bird. About three ml of blood was collected from each bird of which 1 ml of blood from the syringe was taken in the test tube containing anticoagulant (3.8% Na citrate solution) for hematological studies.

Hematological parameters

Blood sample was collected from the bird for the determination of various hematological parameters on 5th week of age. The following hematological parameters were measured:

1. Total erythrocyte count (TEC)
2. Haemoglobin (Hb) estimation
3. Packed cell volume (PCV)
4. Erythocyte sedimentation rate (ESR)

Total erythrocyte count (TEC)

A clean dry hemocytometer slide was placed under microscope and the finely rulled area was focused by low power objective (10X). Well mixed anticoagulated blood was drawn by the red blood cell pipette up to 0.5 mark. Hayem's solution was drawn by the blood containing pipette exactly up to 101 marks. Then the contents of the pipette were mixed thoroughly by 8 knot motion for 1-2 minutes. After proper mixing at least 2-3 drops of fluid were expelled from the pipette and asmall drop from the remaining portion of the mixture was placed on the counting chamber and covered by coverslip and waited for 2 minutes for settle down of RBC. The cells were counted from four corner square and one central square each containing 16 small squares.

The cellular distribution was observed using low power objective (10X) and cells were counted by high power objective (45X). The number of RBC was calculated as follows:

Number of RBC=No. of red cell counted X 200 X 50 and the result was expressed in million/mm^3 of blood. The counting and calculation of RBC were performed as per methods described by Ghai (1999).

Estimation of hemoglobin (Acid-Hematin method)

N/10 HCl was taken in the diluting tube up to its

2gm % mark. Well mixed anticoagulated blood was drawn by the Sahli pipette up to 20 cmm mark. Immediately, the blood of the pipette was transferred into the diluting tube containing N/10 HCl and the pipette was rinsed for 2-3 times. The content of tube was mixed thoroughly and left for five minutes in the comparator. After 5 minutes distilled water was added drop by drop and mixed with the help of stirrer. The mixing was continued until and unless the colour in the diluting tube matched with the colour of comparator. After matching, the tube was taken out of the comparator and the result was recorded from the graduated scale. The result was expressed in gm% or in %. The hemoglobin estimation was done as per method described by Ghai (1999).

PCV and Hb determination

PCV was estimated by the microhematocrit method using capillary glass tubes. Hb concentration was determined according to Coles (1986). The experimental analyses were conducted at the laboratory of the Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh.

Statistical analysis

All data were analyzed using R. Two statistical techniques were used, ANOVA for significance (5% level) test and LSD for mean separation. All the data were analyzed as post-hoc test.

Results and Discussion

Growth performance

Table 4 shows the effect of dietary probiotic (BACTOSAC) and antibiotic (Oxytetracycline) on growth performances of boiler chickens. According to comparisons of this table it has been proven that the higher amount of body weight gain and the lower level of FCR were observed in the probiotic groups. The improvement in the body weight, daily weight gain, feed consumption and feed conversion ratio in this study may be due to the increased efficiency of digestion and nutrient absorption processes due to presence of the probiotic bacteria. Edens (2003) reported that the inclusion of desirable microorganisms (probiotics) in the di*et al*lows the rapid development of beneficial bacteria in the digestive tract of the host, improving its performance. As a consequence, there is an improvement in the intestinal environment, increasing the efficiency of digestion and nutrient absorption processes. Edens *et al*. (1997) showed that in vivo and ex vivo administration of Lactobacillus reuteri resulted in an increased villus height, indicating that probiotics are potentially able to enhance nutrient absorption and thereby improve growth performance and feed efficiency. On the other hand, the beneficial effect of growth promoting feed additives on animals arises from stabilizing feed hygiene and beneficially modulating the gut ecosystem by controlling potential pathogens. Kabir *et al*. (2004), for example, conducted a 6-week growth performance study with broilers and found that live weight gain and carcass yields were significantly higher in broilers fed probiotic supplementation.

Table 4: *Effect of treatments on growth performance of broilers.*

Group	Average feed intake wt. (g/wk)	Weight improvement (Av. g/day)	Average FCR	Average of wt. (g)
C	239.72b	40.0b	1.83a	2141.0b
A	240.6b	39.7b	1.93a	2027.0b
B	241.8b	42.6a	1.57b	2303.4a
Level of significance	NS	*	*	*

Carcass characteristics

At the end of the experiment 35 days, five chickens were selected randomly from each group and slaughtered for carcass analysis (Table 5). The birds were dissected at the end of the 5th week feeding trial according to the procedure of Jones (1984). After removing the skin, head and viscera, final processing was performed and the dressed broilers were swept using absorbent paper (AP). The heads, feathers, feet and viscera were removed after slaughter. Then, abdominal fat pad was removed and weighed. Dressed carcass weight was calculated as the percentage of body weight (Petek *et al*., 2005). Thigh, breast, liver and gizzard were weighed individually. All of these traits were calculated in relation to live BW.

Table 5: *Effect of treatments on carcass on broilers.*

Parameter(g)	Group C	Group A	Group B	Significance
Dressed carcass wt.	1605b	1521b	1726a	*
Abdominal fat	3.73b	3.70b	3.55a	*
Breast	32.10b	32.16b	34.51a	*
Thigh	25.09b	26.1b	28.2a	*
Liver	3.51b	3.60b	3.01a	*

Hematological parameters

In case of hematological analysis (Table 6) total erythrocyte count (TEC), Hb and PCV showed highest in group B that was supplied with probiotics followed by group A and C. In the case of TEC, Hb and PCV there was a significant (at 5% level) result in group B comparing with group C and group A, but there is no significance in group A and C. But in case of erythrocyte sedimentation rate (ESR) there was no significant changes among the groups.

Table 6: *Effect of treatments on hematology on broilers.*

Treatment	TEC (million/cmm)	HB (g/L)	PCV%	ESR (mm in first hour)
C (Control)	281.00[b]	7.63[b]	26.42[b]	3.47[a]
A (antibiotic growth promoter)	282.24[b]	7.76[b]	28.24[b]	3.65[a]
B (Probiotics)	300.84[a]	8.27[a]	32.16[a]	3.53a
Significance	*	*	*	*

Conclusions and Recommendations

The study was performed in 60-day old broiler chicken for 5 weeks, dividing them randomly into three groups. The group C was control that was supplied with normal broiler ration and group B and A was supplied with probiotics (BACTOSAC) @ 0.2 ml/L drinking water and 0.2 mg antibiotic growth promoter (Tetravet) @ 0.2 ml/L drinking water, respectively. Daily body weight, weight improvement, average weekly feed intake, average final body weight, carcass weight, FCR were recorded. Hematological studies recorded at the end of the experiment. The present study showed that probiotics could be used to rear broiler production to get good growth performances.

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Novelty Statement

Now a days Its very much Important to produce safe and healthy food for the betterment of life. There are many approaches to Increase broiler production. This work Is the attempt to produce broiler production using probiotics Instead of using other growth promoters that may be found as residues which are harmful for consumption.

Author's Contribution

Planning, designing and overall work done by MS Islam and MM Rahman. Other authors were involved in data analysis, drafting and editing the manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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