Volume: 2, Issue: 2
Page: 128-152
2018

ISSN 2520-4750 (Online) & ISSN 2521-3040 (Print)

International Journal of Science and Business

Comparative Study of Feeding Probiotic (A-Max®) and Growth Promoter on Growth Performance of Commercial Broiler

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Abstract

An experiment was conducted with 120 Cobb-500 Broiler day old chicks to evaluate the effect of feeding probiotic (*Saccharomyces cerevisiae*) with or without growth promoter (GP). Birds were reared in open sided shed type house. Body weight and feed intake were measured and examined on day 0, 7, 14, 21, 28 and 32. Chicks were randomly divided into four groups having three replications. The number of birds in each replication was 10. Four diets were considered: control; probiotic (PB) @ 1 ml/liter; GP @ 100 g/50 kg and GP plus PB (@ 1 ml/liter+ 100 g/50 kg). The records were kept on body weight, feed intake and mortality while weight gain, feed efficiency (FE) and survivability were calculated. Temperature and humidity were recorded four times daily. At the end of the experiment, one broiler was sacrificed from each replication to determine carcass characteristics. Broiler chicks that received PB and a combination of PB+GP treatments showed significant improvement in performance ($p<0.01$) over control with respect to body weight gain, feed efficiency, carcass yield and cost effectiveness. Feeding GP alone had comparatively less weight gain, net profit and almost similar feed efficiency compared with PB and GP+PB groups but performance was significantly better than that of control group. This study indicated that the diet containing GP+PB offered slightly increased benefits to the growth performance of broilers, and these benefits were almost equal to the PB. It is revealed that probiotic (A-MAX) supplementation with growth promoter is beneficial for broiler production and no hazard on human health.

Key words: Probiotic, Growth promoter, body weight gain, feed efficiency, carcass yield and cost effectiveness.

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DOI: https://doi.org/10.5281/zenodo.1195861

Introduction

Poultry serves as one of the means of satisfying the increased demand for animal protein. The poultry industry during the past two decades has been one of the most dynamic and ever expanding sectors in the world (Alkhalf et al., 2010). The present population of poultry in Bangladesh is estimated to be 317.70 million including 266.07 million of chicken and 51.62 million of ducks (Bangladesh Economic Review, 2016). Presently, chicken meat is on demand as a cheap source of protein with low cholesterol value. Therefore, adaptation of broiler farming is increasing day by day by farmers. The biggest challenge of commercial poultry production is the availability of quality feed on sustainable basis at stable prices. In spite of this challenge, commercial poultry production ranks highest among the source of animal protein (Iyayi et al., 2008). The increase in the size of the poultry industry has been faster than the other food producing animal industries. The trade volume of poultry products has also increased parallel to the rapid growth of global poultry meat and egg production (Windhorst et al., 2006). Many factors may lead to alterations in meat quality. The most directly related to meat quality are pre and post-slaughter practices, bird age, strain, sex, environment, nutrition. Within the latter, antibiotics have been particularly considered by international health institutes, such as the Food and Drug Administration. As 70% of total cost of production is contributed by feed only, improvement of Feed Efficiency (FE) will significantly enhance the margin of profit. Antibiotics have long been used as growth promoters. In recent years, due to the residual effect of antibiotics on human health, the use of many antibiotics in food production is banned or going to be banned. The occurrence of cross resistance of antibiotic growth promoters with the human medicines has become an important issue at present. Moreover, the growing concern arising among the people about food safety, environment contamination, and general health issues due to the presence of residual antibiotics in poultry meat has driven a way to find out a solution to the use of antibiotic growth promoter. Considering these facts in mind the feeding of other non-antibiotic growth promoters such as probiotics, and synbiotics finds a potential substitute for antibiotics. The term probiotic derived from Greek word “pro bios” which means “in favor of life” (Coppola & Turnes, 2004). According to the definition by FAO/WHO, probiotics are live microorganisms which when administered in adequate amounts confer a health benefit on the host (Fuller et al., 1989). The use of probiotic has shown many beneficial effects in broiler. These advantages include the improvement of general health, feed efficiency, and

growth rate, as well as resistance to diseases (Ahmad, 2006) and positive response on mortality rate in broiler chickens (Anjum et al., 2005). Moreover, probiotics comprise a functional nutritional approach in which maintenance of a healthy gastrointestinal environment is achieved through the intake of adequate quantities of live beneficial microorganisms (Fuller, 1989; FAO, 2002). Probiotics have been regarded as good replacement of feed additives (Tomasik et al., 2003). Probiotics are responsible for the production of vitamin B complex and digestive enzymes, and for stimulation of intestinal immunity, increasing protection against toxins produced by pathogenic microorganisms (Kyriakis et al., 1999; Alexopoulos et al., 2004). Probiotics are specific chemical agents produced by microorganisms containing *Lactobacillus acidophilus, Lactobacillus casei, Lactobacillus plantarum, Lactobacillus rhymnosus, Enterococcus faecium, Bifidobacteriumbefidum, Aspergillusoryzae, Saccharomyces cerevisiae, Streptococcus thermophiles* and *Torulopsis* (Mohon et al., 1996). The mode of action of probiotics in poultry includes maintaining normal intestinal micro flora by competitive exclusion antagonism, lowering the pH through acid fermentation, competing for mucosal attachment and nutrients, producing bacteriocins, stimulating the immune system associated with the gut, increasing production of short-chain fatty acids. As a widely used probiotic strain, *Saccharomyces cerevisiae* is considered one of the most health boosting fungus because it have demonstrated a positive effect in aiding nutrient digestion and absorption in the host's body (Scgarrd and Demark, 1990). They have been broadly applied in livestock and poultry as a growth promoter and a competitive exclusion agent (Simon, 2010). The use of *Saccharomyces cerevisiae* spores as a probiotic or a direct fed microorganism could be an alternative to adding medicine to feed in the prevention and treatment of broiler chicken's necrotic enteritis under commercial like conditions (Knap et al., 2010). Therefore, when used as a poultry growth promoter, these spores added to feed could enhance broiler chicken's digestibility and performance parameters by creating the favorable conditions for beneficial bacteria (Steiner et al., 2006). In the recent research, it has been revealed that probiotics affect gene expression of carrier proteins responsible for cholesterol absorption (Matur & Eraslan, 2012).Since there have been a few investigations on effects of *Saccharomyces cerevisiae* in poultry, little information is available on its impact on nutrient metabolism and histological alterations to intestine in chickens. So, to further prove the potential of these fungal spore containing probiotic in improving broiler performance, this experiment

investigated the effect of probiotic (*Saccharomyces cerevisiae*) supplemented in feed with or without growth promoter. Antibiotics are extensively used as growth promoters in poultry production or to control infectious disease. Anti-microbial exercise and/or especially abuse is considered to be the most vital selecting force to antimicrobial resistance of bacteria (Moreno et al., 2000, Okeke et al., 1999).

Keeping this view in mind, the present research work was undertaken to fulfill the following objectives:

- To determine the carcass characteristics of the experimental broiler (meat composition, meat yield, internal organ and bone development)
- To investigate the effect of probiotics on caecal microbial count of broiler and
- To investigate cost-effectiveness of different diets in broiler performance.

Materials and Methods

Statement of the experiment

The experiment was conducted at Kader Poultry Farm, Cornai, Dinajpur. A total of 120 one-day-old straight run Cobb-500 commercial broiler chicks were used for this research work. The chicks were collected from a reputed hatchery (Kazi Farms Ltd., East Goalpara, Thakurgaon Town, Thakurgaon) of Bangladesh. The duration of the study was 32 days.

Preparation of the experimental house

A gable type open sided house was used for experimental purpose. A wire net was used on the floor. The room area was 147 sq. ft. that was partitioned into 12 pens of equal size by using wire net and bamboo materials. The experimental room was thoroughly brushed, swiped and properly washed by water after that bleaching powder @ 1kg/500 sq.ft. was spread over the floor and it was kept 24 hours without any further attention. The bleaching powder was cleaned by using forced tap water. After that the room was disinfected by GPC 8®solution (Manufactured by Animal Health Division, Renata Ltd, Bangladesh). Feeders, waterers, buckets and all other necessary equipments were also properly, washed and disinfected by GPC 8®solution (5 ml/L). Then fresh and dry rice husks were spread on the

floor of the pens as a litter material. Proper managemental procedures were followed during experimental period.

Design of the Experiment

The experimental broiler chicks were equally and randomly divided and distributed into 4 dietary groups and each group was replicated to 3 subgroups. Each dietary group consists of 30 chicks distributed into 3 replicated pens having 10 chicks. The layout of the experiment is shown in Table 1.

Collection of probiotic

The trade name of the probiotic product used in the experiment was "A-MAX®". It was manufactured by one of the USA Company named "Varied Industries Corporation (VI-COR)" and imported in Bangladesh. According to manufacturer's instruction the inclusion rate of the product for commercial broiler was 100 g/50 kg feed.

Collection of Growth Promoter

The trade name of the growth promoter used in this study was "Ami vet®" (multivitamin) and manufactured by a Bangladeshi Company named "Gentry Pharmaceuticals Ltd". This product was collected from a pharmacy named "Meysers Poshu Sastho." Dinajpur, Bangladesh, who is responsible for marketing this product in Dinajpur district.

Management during brooding period

The chicks were brooded up to 7 days. Temperature was maintained at 30℃ as brooding temperature which decreased gradually in subsequent weeks @ 2.5℃/week until the birds were adjusted to environmental temperature. To maintain lighting program and brooding, electric bulb (100 watt, 1 in each pen) were used up to 14 days of age of broilers. Broilers were exposed to 24 hours continuous light in first 14 days. Next 9 days, 1 hour dark then 5 days, 2 hours dark and last 4 days, 4 hour dark was provided.

Experimental diet

Completely pellet form diet was given to the broiler. All the feed ingredients were fresh and of good quality. Chemical analysis of the experimental ration was done in Degussa Lab, Germany (Courtesy of Evonik Degussa GmbH) by the Aftab feed Ltd., Bangladesh.

Formulation of broiler ration

The broiler diet was formulated for two phases (starter and grower). Starter diet was provided from 1stday to 12thdays and grower diet was provided from 13th days to 32nd days. Both types of diet were supplied in pellet form. The nutrient requirements (ME, CP, CF, EE, Ca, P, Lysine and Methionine) were satisfied as per requirement as recommended for Cobb-500 broiler strain diet and also same for all treatment except growth promoter (GP), probiotic (PB) and their combination. After weighing according to requirement, pellets were mixed with the proper amount of probiotics by hand mixing using protected separate hand gloves. Then required amount of probiotics were mixed with a small quantity (about 250gm) of pelleted feed. Eventually this amount was mixed with total feed using hand mixing of 1 kg capacity. Diets for each treatment were supply separately and distributed into three replicates with the help of plastic containers for each treatment. Four plastic containers were needed for 12 replicates. The nutrients requirement of broilers was satisfied according to BSTI standard. The composition of the diet is shown in Table 3; 4; 5.

Uses of experimental feeds

Starter diet was provided for the first 13th days and grower diet was provided to the broiler up to 32 days of age. In all cases, feeds were offered to the broiler chick *ad libitum*.

Routine management

Following routine management procedures are followed during experiment-

- Litter management
- Floor space management for birds
- Temperature management (Lighting for broiler)
- Feed and water management

Immunization of birds

Birds were vaccinated against common infectious diseases as a part of disease prevention program. All of the experimental broilers were vaccinated against New Castle disease (Ranikhet) and Infectious Bursal Disease (IBD) (Gumboro) at the age of day 5th, 10th, 17th and 21th respectively. All the vaccines were administered as per recommendation of the manufacturer (one drop in each eye) at the cooler part of the day (morning).Vaccines were used as per manufacturer's instruction and following schedule was followed.

Processing of broilers

At the end of the trial, to determine meat yield characteristics of the birds, 12 broilers; one broiler from each replicate group weighing average of pen weight were selected to facilitate processing. All broilers feed was withdrawn 12 hours prior to killing the birds. The birds were killed and allowed to bleed for 2 minutes and immersed in hot water (51-55°C) for 120 seconds in order to lose the feathers and this procedure was called semi-scalding. The feathers were removed by hand pinning. This was done manually. Then head, shank, viscera, giblet (heart, liver and gizzard) and abdominal fat were removed for determination of meat yield parameters. Dressed broilers were cut into different parts such as breast, thigh, drumstick, wing and back. Finally, every cut up parts were weighed and recorded for broiler of all replications.

The broiler processing data were calculated and recorded as follows-

- Blood weight
- Feather weight
- Cut-up parts weight
- Dressing yield
- Giblet weight of broiler
- Dressed weight of broiler

Data collection and record keeping

A standard record book was maintained throughout the experimental period.

Following parameters were recorded in the record book-

- Body weight of the broiler(in each week)
- Body weight gain
- Daily supplied amount of feed and feed residue
- Feed Efficiency (FE)
- Performance index (PI)
- No. of dead birds (mortality)
- Temperature and humidity (on regular basis)
- Record of vaccination
- Any disease or abnormal condition of the broiler
- Cost of production

Records of dressing yield

During processing following meat yield data were recorded for some parameters from each pen. Parameters are: blood loss, feather loss, head weight, neck weight, shank weight, viscera weight, dressed weight, breast weight, thigh meat, drumstick weight, wing meat, heart weight, abdominal fat weight, trimmed meat, total meat and dressing percentage.

Production cost

Cost of production per broiler was calculated by considering chick cost, feed cost, adding all vaccination cost, labor cost, litter cost and transportation cost.

Biosecurity

A strict biosecurity program was maintained inside and outside of the research shed as a most effective part of the disease prevention program.

Statistical analysis

The raw data were entered and sorted into MS Excel spread Sheet software. Data on body weight, body weight gain, feed intake, Feed Efficiency (FE), livability and edible meat

characteristics of broilers were subjected to analysis of variance (ANOVA) in a completely randomized design (CRD) employing Statistical Package for the Social Sciences (SPSS, version 20) for descriptive analysis.

Results

Live weight and live weight gain

The productive performance of broiler receiving feed supplemented with probiotic or growth promoter or their combination is shown in Figure 4.1. In respect to initial body weight, there was no significant difference among the dietary groups. At the end of 32 days of age, the highest live weight (1916.21 g/b) was found in broilers fed with both probiotic and growth promoter (GP+PB). This was followed by broiler belonging to probiotic (1890.43 g/b), growth promoter (1828.13 g/b) and control group (1788.27 g/b) respectively. However, broiler receiving either probiotic or growth promoter or both weighed were highly significant than that of control ($p<0.01$). The difference with regard to live weight and live weight gain was highly significant ($p<0.01$) in GP+PB. In figure 4.1, it is very clear that test ingredients had no effect on weight gain up to four weeks of age. At fifth week, body weight was significantly differed among different dietary groups. In figure 4.2, it is very clear that test ingredients had effect on weight gain from second week to fifth weeks of age. Both probiotic (PB) and combination of probiotic with growth promoter(PB+GP) enriched groups showed increased growth gain at 2^{nd}, 3^{rd} and 5^{th} week of age. At 4^{th} week of age, probiotic group was higher to weight gain than the other groups, but the differences were not significant.

Feed intake

Figure 4.3 shows the average feed consumption pattern of the broilers of different treatment groups. Both PB and GP containing groups consumed similar amounts of feed which were significantly lower than that of control and PB + GP ($p<0.01$). Weekly feed consumption data revealed that birds of all groups consumed more or less similar amounts of feed up to 28 days of age but GP and PB + GP groups had an increased feed intake during the last week of

the trial. For this reason, variation was observed in cumulative feed consumption and therefore it differed significantly from remaining dietary groups ($p<0.01$).

Feed efficiency (FE)

Difference in cumulative Feed Efficiency (FE) of the broiler of different dietary groups differed significantly ($p<0.05$). The lowest value was obtained for birds that received GP+PB. PB and GP supplemented groups showed almost similar but higher efficiency was found from control group ($p<0.05$). The results presented in Figure 4.4 clearly exhibits an impression that the broiler receiving GP+PB was the best converters of feed into live weight and the effect of probiotic was more prominent after 28 days and onwards.

Survivability

PB and GP+PB receiving groups had no mortality while the survivability of the control group and GP were 97.33% and 96.67%. However, it is clear that the control group suffered much as compared to remaining groups.

Edible meat yield characteristics

Edible meat yield characteristics of broiler receiving probiotic supplemented diet with or without growth promoter are shown in Table 7.The analyzed data in the table indicates that the treatments had no significant effect ($p>0.05$) on live weight, thigh, drumstick, wing, head and neck weight of the experimental birds. On the other hand, highly significant ($p<0.01$) differences were obtained in dressing percentage, breast meat, abdominal fat content, liver and gizzard weight among different treatments. Highest and lowest breast meat weight was recorded in PB and control group respectively. There was a tendency of increased breast meat content among PB, PB+GP and GP groups which had highly significant ($p<0.01$) effect compared to control group. Dressing percent, liver and gizzard weight was higher in GP+PB group than the control group. Abdominal fat was higher in control group than others. Also significant differences ($p<0.05$) were found on heart and dressed weight among the dietary groups.

Cost-effectiveness of production

The total cost of production in terms of per bird and per kg broiler was Tk. 203.33 and Tk. 113.72 for control diet, Tk. 207.09 and Tk. 110.80 for probiotic (PB) group, tk. 206.81 and Tk. 111.79 for growth promoter (GP) group, Tk. 211.17 and Tk. 110.21 for (GP+PB) group respectively. The profit in terms of per bird and per kg of broiler were highest in PB+GP group followed by probiotic (PB), growth promoter (GP) and control group respectively. It is therefore clear that additional supplementation of PB+GP and PB is profitable over GP and control group.

The additional costs incurred for growth promoter (GP) over control was Tk. 1.10/liter water, Tk. 0.68/kg for probiotic (PB) and Tk. 1.78/kg for PB+GP group. In contrast to the additional cost incurred for PB and GP supplementation, the profit over control was Tk. 2.92/kg, Tk. 1.93/kg and 3.51/kg broiler in PB, GP and GP+PB group respectively. Consequently, supplementation of GP+PB in broiler diet was more cost effective followed by PB and GP respectively.

Discussion

Live weight and live weight gain

The research results obtained in this study are consistence with the findings of Ahmad and Taghi (2006). They found that body weight gain of broiler, fed supplemented with probiotic (*Bacillus subtilis and B. licheniformis*) were significantly higher during the grower phase (21-42 days) than broiler fed the control diets. Other author Sabatkova et al., (2008) compared the efficacy of Avilamycin (GP) and probiotic BioPlus 2B (*Bacillus subtilis and B. licheniformis*) to investigate the performance and slaughter yields. They finally reported that the supplementation of Probiotic improved 4–5% weight gain ($p<0.01$).

Bai et al., (2013) compared the probiotic treated group with a control, an antibiotic and (probiotic + antibiotic) treated group and found that both antibiotic, probiotic and their combination improved average body weight in broilers during grower period (21-42 days) compared with control, but there was no difference ($p> 0.05$) in the weight gain of broilers in starter phase. Not only that, the finding of this trial is also agreed with Salim et al.,(2013);

Shim et al., (2012); HaoShen et al., (2004); Ashayerizadeh et al., (2009); O'Dea et al., (2006); Pelicano et al., (2003); Rahimi (2009). They also reported that supplementation of probiotic in broiler feed improved body weight and body weight gain significantly. In this study, both the live weight and live weight gain of the broiler of both PB and PB+GP groups are very close to the Cobb-500 commercial broiler's productive performance (Cobb 500 Management Guide, 2010).

Feed intake

Comparatively lower feed intake in probiotic supplemented group was an agreement with the results of Shim et al., (2012). They found that birds fed 10 mg/kg avilamycin consumed more ($p<0.05$) feed during the finisher and overall periods than birds fed diets containing probiotic without avilamycin while others have found non-significant variation in feed intake between control and probiotic group (Panda et al., 2008; Faria et al., 2009; Rada et al., 2013). But the result was consistence with Eseceli and Demir, 2010 and Erdogan, 2007. They also reported that supplementation of probiotic decreased feed intake significantly ($p<0.05$) compared to control group. In the present study feed intake of probiotic treated group was significantly lower ($p<0.01$) than control and PB+GP treated groups.

Feed efficiency (FE)

The significant effect of probiotic on feed efficiency (FE) of broiler was in close agreement with Shim et al., (2012); HaoShen (2004); Ashayerizadeh et al., (2009); O'Dea et al.,(2006); Pelicano et al., (2003); Rahimi (2009); Sabatkova et al., (2008); Zhou et al., (2010); Hassanein and Soliman (2010). They found that supplementing with *Bacillus subtilis* and *B. licheniformis* improved feed conversion efficiency in broiler. Panda et al., (2008) reported that dietary preparation of *Bacillus subtilis* and *B. licheniformis* (at the rate of 6 x 108 spore per kg of diet) significantly enhanced feed efficiency in White Leghorn Breeders. In another study Salim et al., (2013) also reported the lowest Feed Efficiency (FE) with probiotic (1.49) compared to antibiotic (1.50) and control (1.52) group respectively. This result was almost similar to the present study where the FE for probiotic, growth promoter and control group was 1.53, 1.56 and 1.59 respectively.

Livability

The research results obtained in this study are positively consistent with the observation of Knap et al., (2011); Zhang RenYi (2010) and Lee et al., (2007). They also found that feeding probiotics (*Bacillus spp.*) supplemented diet effectively enhance the resistance of broiler and protect them against the negative growth effects and mortality. However, HaoShen (2004) and Rahimi (2009) demostrated that *B. licheniformis* significantly ($p<0.05$) decreased diarrhea and mortality rates of experimental group in broiler. But Faria et al., (2009) and Eseceli and Demir (2010) revealed that there was no statistically significant difference ($p>0.01$) in the livability of birds reared with or without adding probiotic in diet.

Edible meat characteristics

In the present study, it was clearly indicate the effect of dietary probiotic towards some important meat yield characteristics of broiler. This result was particularly similar to the result of Molnar et al., (2013) who reported that *Bacillus spp.* supplemented group had significantly higher ($p<0.05$) breast yield (549 g) and lower thigh meat yield than the control group (474 g) where the breast weight of the broiler of this experiment for control and probiotic supplementation was 303.33 g and 386.67 g respectively. Novak et al., (2011) conducted a study and found that supplementation of *Bacillus subtilis* and *Bacillus licheniformis* had higher yield of wings and lower abdominal fat weight compared to control and *Bacillus cereus* supplemented group ($p<0.05$). The result of this study was also particularly consistent with the findings of Xiaolu et al., (2012), who reported that the supplementation of *Bacillus licheniformis* resulted in increased protein and free amino acid contents, and decreased fat content in chicken breast fillet ($p<0.05$). Luiz et al., (2012) compared the efficacy of antibiotic with probiotic in meat yield characteristics of broiler and finally reported that probiotic group have lower abdominal fat content (5.2 g) compared to antibiotic (9.6 g) and control (22.9 g) group respectively where the abdominal fat content of the experimental broiler of the present study was 7 g for probiotic group, 10.33 g for growth promoter and 29.6 g for control group respectively. Other authors (Moreira et al., 2001, Loddi et al., 2000, Vargar et al., 2000) found no significant difference in carcass yield between birds that were fed probiotic and control diet. However, the result of this study

agreed well with the findings of Pelicano et al., (2003), Mutus et al., (2006), Sabatkova et al., (2008), Zhou et al., (2010), Lei et al., (2013).

Cost effectiveness of production

The result of present study, it was clearly indicated that the feeding of PB, GP and their combination had beneficial effect on the profitability of broiler. The combination of GP+PB provided highest profit which is almost similar to PB group but higher than the control and GP group. This result was particularly similar to the results of Roy et al., (2013) who reported that the feeding of probiotic to broiler was either similar or more profitable than combination of PB+GP while better than GP alone. So it can be concluded that combined feeding may give more profit than others in case of commercial broiler farming.

Conclusions

The present research was undertaken to study the growth performance of broilers fed with probiotics (A-MAX®) and growth promoter (Ami vet®) through feed and drinking water respectively. The final body weight of broiler was highest in broilers supplemented with (GP+PB) followed by probiotic, growth promoter and control group respectively. Significant differences were observed in GP+PB from the control groups ($p<0.01$).The differences in feed consumption resulted a significant differences in feed efficiency ($p<0.05$). Lowest but best FE was in GP+PB group. Over all livability was good for probiotic and probiotic with growth promoter. Meat yield parameters of broiler showed highly significant differences ($p<0.01$) for the dressing percentage, breast meat, liver, gizzard and abdominal fat due to addition of either probiotic or growth promoter or their combination in diets. On the other hand, there were no appreciable differences in live weight, thigh, wing meat, head and neck of the broilers among the treatments. Dressing weight of GP and PB groups and heart meat yield of GP and GP+PB groups were more or less similar which differed significantly ($p<0.05$) from the control group. Again the control group had highest abdominal fat percentage which differed significantly ($p<0.01$) from the other treatment groups. The probiotic containing diet had the special activity to improve breast meat weight. The probiotic reduced abdominal fat. The highest profit per kg live weight was obtained in probiotic plus

growth promoter group followed by probiotic, growth promoter and lowest in control group respectively. The experiment revealed that performance and effectiveness of broiler was better with the supplementation of probiotic and growth promoter than the group of others. With regards to profit, combination effect of GP and PB had more profit. At present, world health leaders have described antibiotic-resistant microorganisms as “nightmare bacteria” that “pose a catastrophic threat” to people in every country in the world. In the context of this study, it may be concluded that combination of probiotic (A-MAX®) and growth promoter may be considered as an effective methods of increasing broiler productive performance.

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Table 1: Layout of the experiment

Treatments	No. of chicks per Replication			Total Number
	R1	R2	R3	
T_0 (Control)	10	10	10	30
T_1 (Control+ PB)	10	10	10	30
T_2 (Control+ GP)	10	10	10	30
T_3 (Control + GP + PB)	10	10	10	30
Total	40	40	40	120

GP= Growth promoter, PB= Probiotic, R= Replication

Table 2: Composition of the probiotic (A-MAX®)

Name of the ingredients	Amount
Saccharomyces Cerevisiae	$1.5x10^{12}$ CFU/kg
Amino Acids: Alanine, Argine, Aspertic Acid, Cystine, Glutamic Acid, Glycine, Histidine, Isoleucine, Leucine, Lysine, Methionine, Phnylalanine, Proline, Serine, Threonine, Valine	21.0% Minimum
Vitamin B_{12}	8.0% Minimum
Minerals & Other Vitamins	5.5% Minimum
Total Amino Acid, Vitamin & Minerals	34.5% Minimum

Table 3: Ingredient composition of broiler starter ration

Ingredients (%)	Treatments			
	T_0	T_1	T_2	T_3
Corn	51.16	51.16	51.16	51.16
Soybean meal 44%	41.71	41.71	41.71	41.71
Soya oil	3.38	3.38	3.38	3.38
DCP	1.63	1.63	1.63	1.63
Calcium Carbonate	0.953	0.953	0.953	0.953
NaCl	0.273	0.273	0.273	0.273
$NaHCO_3$	0.23	0.23	0.23	0.23
DL-Methionine	0.305	0.305	0.305	0.305
L-Threonine	0.03	0.03	0.03	0.03
Vit-Min-Premix	0.25	0.25	0.25	0.25
Probiotic(PB)	-	-	0.20	0.20

T_0= Control, T_1 = Control + Probiotic, T_2 = Control + Growth promoter, T_3= Control + Growth promoter + Probiotic

Table 4: Ingredient composition of broiler grower ration

Ingredients (%)	Treatments			
	T_0	T_1	T_2	T_3
Corn	61.45	61.45	61.45	61.45
Soybean meal 44%	31.63	31.63	31.63	31.63
Soya oil	3.10	3.10	3.10	3.10
DCP	1.725	1.725	1.725	1.725
Calcium Carbonate	0.94	0.94	0.94	0.94
NaCl	0.27	0.27	0.27	0.27
$NaHCO_3$	0.23	0.23	0.23	0.23
DL-Methionine	0.25	0.25	0.25	0.25

L-Threonine	0.04	0.04	0.04	0.04
Vit-Min-Premix	0.25	0.25	0.25	0.25
Probiotic(PB)	-	-	0.30	0.30

T_0= Control, T_1 = Control + Probiotic, T_2 = Control + Growth promoter, T_3= Control + Growth promoter + Probiotic

Table 5: Nutrient composition of broiler feed

Parameter	Starter diet (0-12days)	Grower diet (13-32days)
ME (kcal/kg)	3025	3100
Crude Protein (%)	22.00	21.00
Crude Fat (%)	5.00	5.50
Crude fiber (%)	2.50	2.50
Lysine (%)	1.20	1.10
Methionine (%)	0.50	0.48
Calcium (%)	0.90	0.88
Phosphorus (%)	0.45	0.42
Moisture (%)	11.00	11.0

Table 6: Vaccination schedule

Sl. No	Age of vaccination	Name of vaccines	Trade Name	Company	*Doses	Method of vaccination
1	5th day	IB+ND	Cevac IBD L	ACI	1000	Eye drop
2	10th day	Gumboro	Hipra GM97	Hipra	Do	Drinking water
3	17th day	ND	Cevac IBD L	ACI	Do	Do
4	21st day	Gumboro	Hipra GM97	Hipra	Do	Do

*As per manufacturer's instructions

Table 7: Some edible meat yield characteristics of broilers fed on Probiotic (A-MAX) with or without growth promoter (0-32 days)

Variable	Dietary treatments				Level of significance
	Control	PB	GP	GP+PB	
Live Weight (g/b)	1491.67±21.54	1533.67±23.14	1526.67±14.53	1580.67±20.08	NS
Dressing weight (g)	1117.67^{b}±15.72	1136.33^{ab}±18.12	1126.67^{ab}±12.98	1220.00^{a}±31.21	*
Dressing %	74.91^{ab}±0.04	74.09^{b}±0.10	73.80^{b}±0.17	77.15^{a}±0.99	**
Thigh (g)	111.33±5.81	112.67±1.76	113.00±1.53	107.00±4.36	NS
Drumstick (g)	56.67±4.98	56.33±1.20	65.67±0.88	54.00±2.89	NS
Breast meat (g)	303.33^{b}±4.41	386.67^{a}±6.07	365.00^{a}±2.89	376.67^{a}±7.26	**
Wing meat (g)	72.67±1.76	68.67±1.33	70.67±2.96	75.67±1.20	NS
Head (g)	34.67±1.45	35.67±0.88	37.00±0.58	35.33±0.67	NS
Neck (g)	36.00±3.05	43.33±4.81	42.33±4.26	46.33±0.33	NS
Liver (g)	37.67^{b}±0.33	37.33^{b}±1.45	38.33^{b}±0.67	45.67^{a}±1.10	**
Gizzard (g)	21.33^{b}±0.67	22.33^{b}±0.33	23.33^{b}±0.88	27.00^{a}±1.00	**
Abdominal fat (g)	16.33^{a}±0.88	7.00^{b}±0.58	10.33^{b}±1.45	7.33^{b}±0.67	**

abc Means bearing dissimilar superscript in a row differ significantly, **=($p<0.01$), *=($p<0.05$), GP= Growth promoter, PB=Probiotic.

Table 8: Cost of production and profit in different dietary treatment groups of broilers

Variables	Dietary treatments			
	T_0	T_1	T_2	T_3
Feed intake (g/broiler)	2770.83	2813.93	2780.64	2835.83
Final weight (kg/broiler)	1.788	1.869	1.850	1.916
Feed price TK. 43 per kg	43	43	43	43
GP@ Tk.110/-per Liter, 1 ml/1 L	---	---	1.10	1.10
A-MAX@340/-per kg, 200g/100kg	----	0.68	----	0.68
Feed cost (with or without test ingredients)/kg	43	43.68	44.1	44.78
Feed cost/bird	119.15	122.91	122.63	126.99
Others (Chicks, vaccines, disinfectants, transport, bedding materials, labor etc.)	84.18	84.18	84.18	84.18
Total cost of production /bird	203.33	207.09	206.81	11.17
Total cost of production Tk. /kg	113.72	110.80	111.79	110.21
Sale price Tk.155/ per kg	277.14	289.69	286.75	296.98
Profit Tk./broiler	73.81	82.6	79.94	85.81
Profit Tk./kg	41.28	44.2	43.21	44.79
Profit Tk. /kg (over control)	--	2.92	1.93	3.51

T_0= Control, T_1= Control +Probiotic, T_2= Control + Growth promoter, T_3= Control + growth promoter + Probiotic.

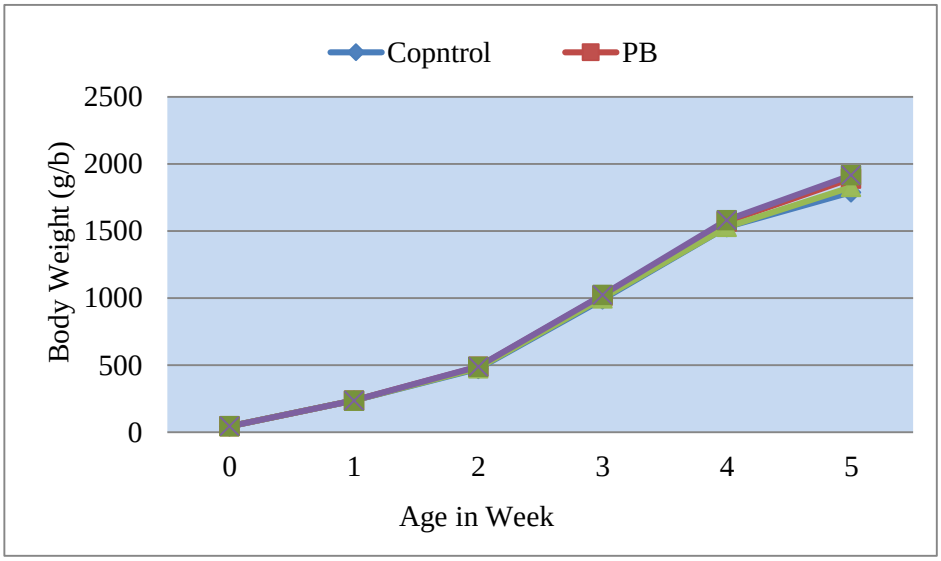

Figure 4.1: Effects of feeding probiotic on body weight of broiler chickens with or without growth promoter

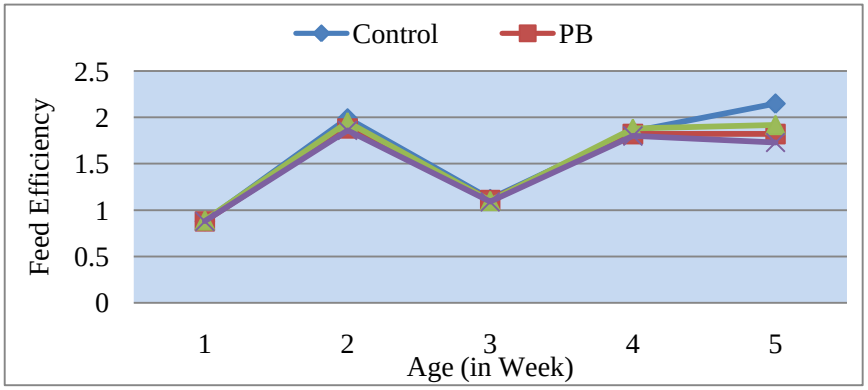

Figure 4.2: Effect of feeding probiotic on live weight gain broiler with or without growth promoter

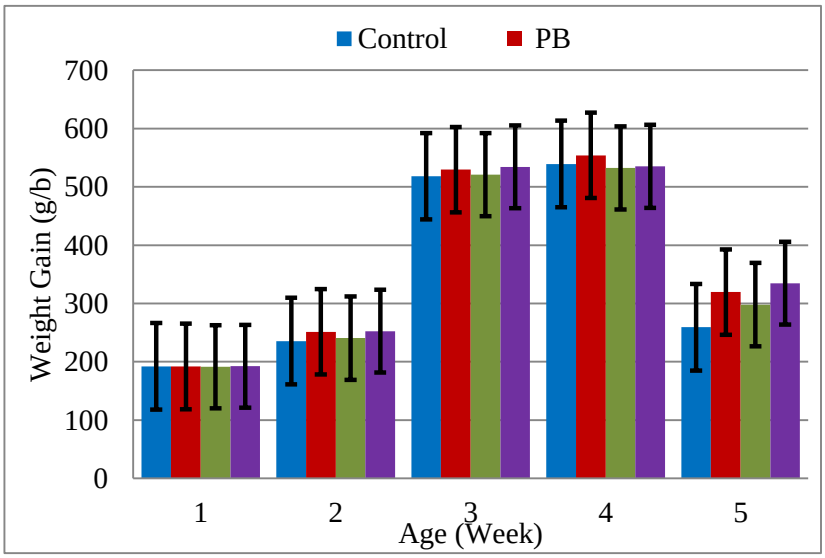

Figure 4.3: Weekly feed consumption patterns of different treatments

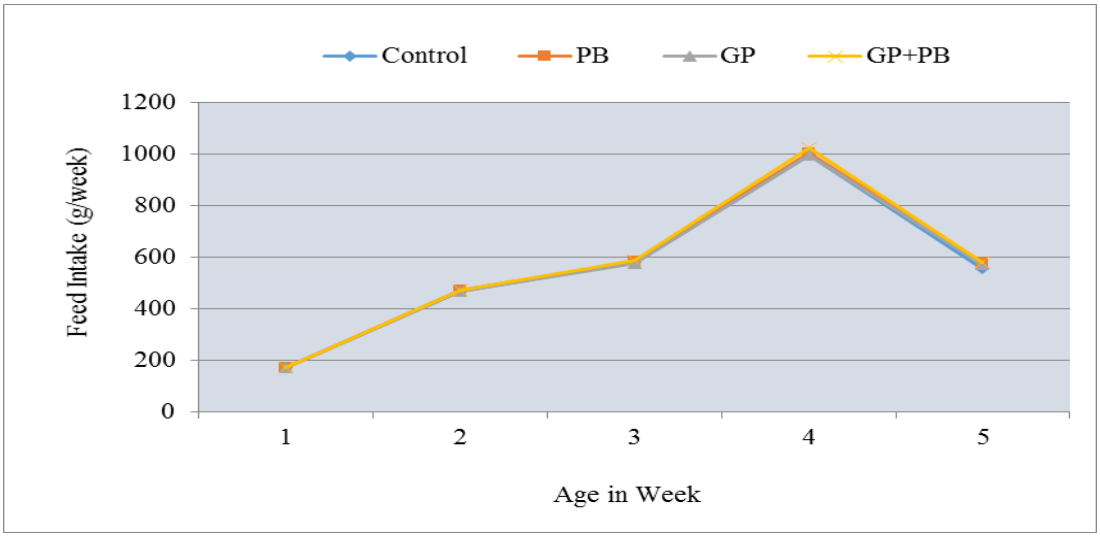

Figure 4.4: Weekly feed intake patterns of different treatments

Cite this article:

Rahman, M.S., **Sabuz,** S. H., U Salma, & Amin, M.N. (2018). **Comparative Study of Feeding Probiotic (A-Max®) and Growth Promoter on Growth Performance of Commercial Broiler.** *International Journal of Science and Business, 2*(2), 128-152. doi: https://doi.org/**10.5281/zenodo.1195861**

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