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Impacts of Dietary Supplementation of Probiotics and Synbiotics on Growth Performance, Carcass Characteristics and Meat Quality of Broiler Chickens

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ABSTRACT

This study investigated the effects of probiotics and synbiotics on the growth performance, carcass characteristics, and the performance of meat quality attributes in broilers. Total of 210 Ross-308 chicks of broilers were allocated randomly seven groups with 3 replicates and ten chicks per replicate. The dietary interventions included: basal diet (Control) T0, Basal diets including with three levels of probiotics and the probiotics dose rate were 1g, 1.5g and 2g/kg of feed respectively to T1, T2, T3 groups broiler starter and grower phase, basal diets with three levels of synbiotic and the synbiotic dose rate were 1g, 1.5g and 2g/kg of feed respectively to T4, T5, T6 groups in broiler starter and grower. In comparison between the control group and the broilers fed probiotics and synbiotic diet showed a substantial (P<0.05) increase in body weight, body weight growth, and carcass yield percentage. In comparison to the other treatment groups, dietary inclusion of probiotics and synbiotic dosage measure of 2g/kg in feed was responsible for higher feed intake, body growth and carcass yield. The treatment group that was given synbiotic supplements had a very low feed conversion ratio (FCR). The findings about the quality of meat showed that the treatment of probiotics and synbiotic changed significantly P^H readings from the collections of the control group. The results of the current study showed that type of synbiotic, which are used to optimize growth in broilers, optimize digestion and convert feed more efficiently to body mass.

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INTRODUCTION

In Bangladesh, the industry of poultry is among the most important terms of creating jobs & offering people a cheaper source of protein. Both low-income people and commercial farmers take considerable advantage of keeping hens. When compared to other meats, fowl is the most widely eaten and adaptable proteinaceous food (Sulaiman et al. 2025). Worldwide broiler meat consumption has been on a consistent increase throughout the year (OECD & FAO 2024). Therefore, production has increased greatly in the last 10 years by 20-30% (SR Publications 2024). The fact that broiler chicken is an inexpensive and good source of protein is justified by the explosion in chicken meat consumption. Another aspect is that most faiths and cultures do not realize chicken to be unclean; so, most people eat broiler meat without being held back by their own religions. Consumers of chicken meat are also concerned with the quality of the meat they eat. Since the 1940s, antibiotics have been used primarily for the protection of broiler chickens against a wide range of infectious diseases and for growth stimulation. Long-term use of antibiotics can result in the development of antimicrobial resistant (AMR) bacteria to the drugs and can cause infection in people (Sweeney et al. 2018; Tânia et al. 2018). Therefore, the use of antibiotics in food animals has been identified as a public health hazard by both the Economic and Social Committee of the European Union

(1998) and the World Health Organization (WHO 1997). In (EU 2006) the European Union banned the growth promotion use of antibiotics. The use of antibiotics for growth purposes has to come to an end as per declaration by FDA (Food and Drug Administration), which is a governmental organization in the United States, made this declaration in the year 2009 (FDA 2009). However, probiotics have not yet received FDA approval as growth promoters. Probiotics and synbiotic dietary supplements with little efficacy have replaced antibiotics. It is claimed that this whole replacement component will accelerate development and increase the defence against pathogenic pathogens (Al-Khalaifah 2018; Gulmez et al. 2019). With this in mind, knowing the effect of probiotics and synbiotics on chicken development and meat quality is extremely important. Probiotics are defined differently in different literary works. According to (Gulmez et al. 2019; Khomayezi & Adewole 2022), probiotics are "live microbial feed supplements that have a beneficial effect on the health of the host by improving the intestinal microbial balance"; to (Salminen et al. 2021) "a live microbial feed that is beneficial to health"; or they are "live microorganisms that, administered in adequate amounts, confer a health benefit on the host" (Mohammadigheisar et al. 2019). In addition, synbiotics have the power to increase the levels of healthy bacteria in the gut (Acharya et al. 2024). Probiotics increase intestinal bacteria, reduce pathogens, improve the immunological qualities of broiler meat (Peter et al. 2025) and improve the microbiological meat quality (Kabir et al. 2005; Khalil et al. 2021). Supplementing with probiotics significantly improvise impact on live body weight increase, immune response to the body visually appealing meat cut (Soomro Rn et al. 2019). The combination of prebiotics and probiotics is known as synbiotics, and it is effective as food additives or nutritional supplements. Some of the prebiotics ingredients are fructo-oligosaccharides (FOS) or inulin, galacto-oligosaccharides (GOS) or mannan-oligosaccharides (MOS). Prebiotics can enable probiotics to flourish in the intestines as they can better adapt to anaerobic conditions such as low oxygen, low pH and low temperatures. Prebiotics are the substrates which are used by probiotics to survive and flourish in a synbiotic area of the lower intestine (Khalil et al. 2021; Lipiński et al. 2021). Probiotics and synbiotic have significance on growth performance, carcass features and meat quality, according to the study.

The purpose of this work was to determine the effect of different commercial dietary probiotics and synbiotics supplements on the growth performance of broiler chickens, carcass traits, and meat quality.

MATERIALS AND METHODS

Study area, Birds and Experimental design

The study was conducted at post-graduate laboratory of the department of livestock Production and Management, Sylhet Agricultural University, Sylhet in Bangladesh. A total of 210 Ross-308 broiler chicks were purchased from Nahar Agro limited Bangladesh. The deformities and the constant size of every chick are verified. It was aimed at maintaining the average body weight of the chicks. A totally randomized method was used to divide the chicks into seven groups, with each group consisting of three replicates, and each replicate had ten chicks. The following parameters were considered and measured after 35 days of feeding: live weight, water fed on, feed fed on, increase in body weight, ratio of feed fed on and carcass features.

Dietary treatment groups

Two simple diets were created, namely starter and grower diets. During the initial three weeks of the experiment, the starter diet was given, and the remaining two weeks, the grower diet. The dietary interventions were as follows: The Control T0 basic diet. During the starter and growth stages of the broiler life cycle, the T1, T2, and T3 were fed simple diets with three dosages of probiotics at a dosage rate of 1g, 1.5g, and 2g/kg of food, respectively. T4, T5 and T6 were fed simple diets with three dosage rates of synbiotics of 1g, 1.5g and 2g/kg of food in the starter and grower broiler life cycle. Two commercial probiotics and synbiotics were given: Protexin and Poultry Star Sol as recommended by the manufacturers. A starter diet was fed from day 1 to day 21 of the experiment, and a grower diet was fed during day 22 through day 35 of the experiment.

Management of experiment

Before the start of the experiment, the house was well cleaned, and the floors were sprayed with bleaching powder, and the tap was switched to wash the floors with water after which a disinfection step with N-alkyl dimethyl benzyl ammonium (Timsen TM) was used. All the experimental birds had been raised in well-ventilated sheds lined with high absorbing sawdust bedding and rice husks litter and the chicks were exposed to an electric brooder together with a chick guard. To meet the nutritional needs of the test birds, the commercial meal blends and clean drinking water were also availed to the test birds during the research. On days 1-21, a starter diet was used as well as days 22-35 when a grower diet was given. It was served with three meals a day in the morning, noon, and night and three times a day in the morning, noon, and night on water. To ascertain how much feed was taken, the quantity of feed given and the quantity of feed left after 24 hours was weighed. These were keen medication administration and other biosecurity management practices.

Preparation of the birds and meat samples

Broiler chickens (n=21, live weight=1.5-2.0 kg) were taken and collected in experimental farms, Sylhet and weight of the chicken were measured. The birds were humanely killed by the conventional method of neck cut, and then their internal organs were extracted after 2 minutes of bleeding. The procedure was refrigerated in water immersion and then chopped and deboned the eviscerated carcass. The positions of the carcasses, breast, thigh, drumstick, and wing muscles were also separated on the left and on the right. Weight of wing, thigh, drumstick and breast muscle were then obtained. Drumstick, right thigh, breast and wing meat were vacuum-packed and stored at 4°C until they were analyzed in terms of cooking loss, moisture, drip loss, pH. The chicken meat was defrosted in 4°C overnight before my and any form of experiment. The different physicochemical characteristics were determined in samples immediately.

Growth Performance

Daily feed intake in each of the duplicates was taken to calculate the weekly feed consumption. Electronic weighing scale was used to measure the body weight of the broiler chicken on delivery and at the end of each week. Feed Conversion Ratio (FCR) was calculated by using values of feed consumption and weight.

Carcass characteristics

At the end of the experiment, three broiler chickens in each of the replications were randomly selected and slaughtered to test the body mass of the broiler chicken organs and the carcass characteristics. Weight of the hot carcass, heart, liver, breast and thighs were measured using a digital scale to the nearest 0.01g. Dressing percentage was measured by taking the carcass weight divided by the slaughter weight. The physicochemical properties of meat are determined.

pH measurement

Measurement of the pH of the meat samples was done according to the (Bendall 1973) procedure with pH meter duplicates that were portable (Orion model 301) and has probe-type electrode that has glass. Calibration Electrode was calibrated using calibration buffers at room temperature in 4.00 and 7.01pH.

Analysis of the moisture content

A Halogen moisture analyzer was used to analyze the moisture content of a fresh meat sample (HR73, Mettler Toledo, Switzerland) and evaluate the moisture contents of their meat samples. The meat samples were put into an aluminum dish and dried at 105°C until they produced the final outcome (2.8g of meat each). The final outcome comes out in the form of moisture content percentage of the meat sample.

Measurement of cooking loss

To determine the cooking losses of the meat specimens, 105g slabs of flesh which belonged to the breast were used. The blocks of samples were roasted until the internal temperature of the core was 70°C and they were put in plastic bags. The digital needle tipped thermometer was used to measure the temperature inside (H 1145, Hanna Instruments, Italy). The cooled samples engineered were then dried right after being removed from the water bath, and the water pumped out of the bag and then cooled in running water at a temperature of 18°C, with a duration of 30 minutes. Sample was later weighed by using paper towels to dry them Honikel (1998) says that the cooking loss was calculated using the percentage of weight dropped at the start of the cooking process.

Drip loss

The samples of breast muscles were weighed separately, packed and hung in plastic bags to rest over a period of 24 hours at 4°C and the percentage loss in weight was calculated as drip loss.

Statistical analysis

To determine things that were different among groups and were analyzed with ANOVA of SPSS version 25.0 (SPSS Inc., Chicago, IL, USA) followed by Tukey's HSD post-hoc test. Data were given as means ± standard error of mean and significance determined. Significance probability values below (P<0.05) were taken as significant.

RESULTS

Growth performance

Table 1 and Figure 1, 2, 3 are showing the impact of probiotics &the synbiotic and dietary supplements on feed consumption, increase in body weights and FCR. When compared to the controls group at d 21 and d 35 of age, the birds in the probiotic and synbiotic-supplemented diet group consumed 2g/kg feed and showed larger (P<0.05) meal consumption and body weight (BW) and reduction in feed conversion ratio (FCR) (Table 1 and Figure 2, 3). Treatment group receiving dietary supplements including all probiotics and synbiotics has a higher (P<0.05) BW growth as compared to the control group across all age groups. One of them at age 35, BW gains were highest in the synbiotic-supplemented broilers at a dosage of 2g/kg feed when compared to the probiotics and control groups. In comparison to the control group, the cumulative feed intake of the birds receiving probiotics (2g/kg probiotics and synbiotic diet) from days 1 to 35 had more feed intake (Figure 1). On day 35, treatment groups (2g/kg feed) with probiotics and synbiotic supplementation had lower feed conversion rate (1.55 vs. 1.53) compared to the control group FCR (1.65). Besides, when compared to other dietary treatment groups and the control group, the synbiotic supplemented T4 treatment group recorded the lowest FCR (1.53).

Table 1: Effects of probiotics and synbiotic on factors influencing the growth on broiler

Parameter	T0	T1	T2	T3	T4	T5	T6	SEM	P
Feed intake(g)									
0-21 day	940.32^{a}	992.15^{b}	994.41^{b}	1005.15^{c}	994.23^{b}	1001.46^{bc}	1009.21^{c}	3.70	0.001
22-35 d	1726.44^{ab}	1724.25^{a}	1731.36^{bc}	1736.25^{c}	1718.11^{a}	1730.92^{bc}	1743.52^{d}	3.29	0.003
0-35 d	2670.65^{a}	2715.13^{b}	2726.83^{c}	2741.13^{d}	2712.91^{b}	2735.71^{d}	2749.76^{e}	4.01	0.001
Body weight gain(g)									
0-21 day	705.13^{a}	745.23^{b}	762.37c	780.41^{d}	740.54^{b}	770.03^{c}	789.20^{d}	3.43	0.001
22-35 d	1010.43^{a}	1066.65^{b}	1088.32^{c}	1094.12^{cd}	1061.32^{b}	1076.19^{bc}	1094.23^{cd}	4.87	0.01
0-35 d	1620.62^{a}	1701.11^{b}	1710.54^{b}	1762.31^{c}	1702.11^{b}	1725.42^{b}	1789.19^{d}	3.34	0.001
Feed Conversion Ratio (FCR)									
0-21 day	1.36^{a}	1.33^{b}	1.31^{c}	1.28^{d}	1.33^{b}	1.32^{c}	1.27^{d}	0.003	0.001
22-35 d	1.68^{a}	1.60^{b}	1.57^{c}	1.56^{c}	1.61^{b}	1.58^{bc}	1.54^{d}	0.005	0.001
0-35 d	1.65^{a}	1.60^{b}	1.59^{a}	1.55^{bc}	1.59^{bc}	1.58^{cd}	1.53^{a}	0.006	0.001

a, b, c, d, e Means with various superscripts in a row significantly differ from one another (P<0.05) and P for the p-value, and SEM for standard error of the mean.

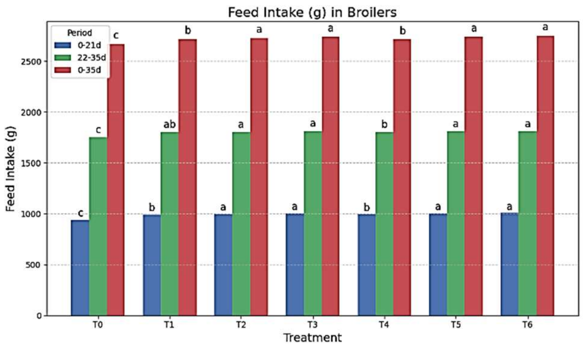

Fig. 1: Effects of probiotics and synbiotic on feed intake in broiler.

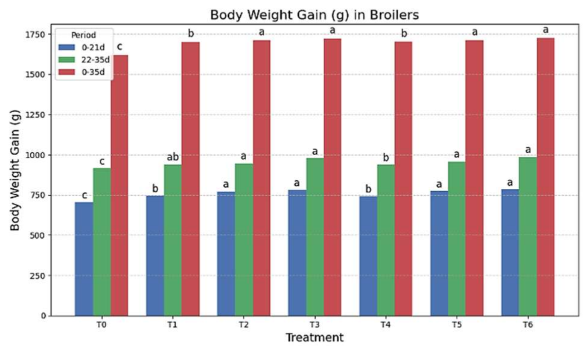

Fig. 2: Effects of probiotics and synbiotic on Body Weight Gain in broiler.

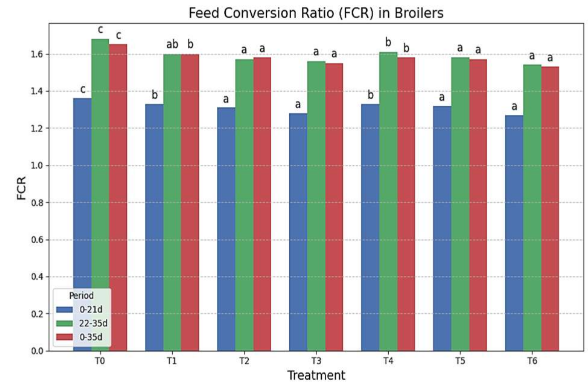

Fig. 3: Effects of probiotics and synbiotic on Feed Conversion Ratio (FCR) in broiler.

Carcass characteristics

The data in Table 2 and Figure 4 show that broiler dietary supplemented with probiotics and synbiotic fed group was given a greater ($P<0.05$) carcass weight, dressing percentage, Breast meat weight compared to the control group. Additionally, carcass weight (1106.9g) and dressing percentage (67.13%) of the synbiotic supplemented T6 group were significantly ($P<0.05$) higher than the probiotics supplemented T3 group and the control group Table 2. Compared with the control group, the weight of liver and breast muscle of broilers fed synbiotic supplements was also higher.

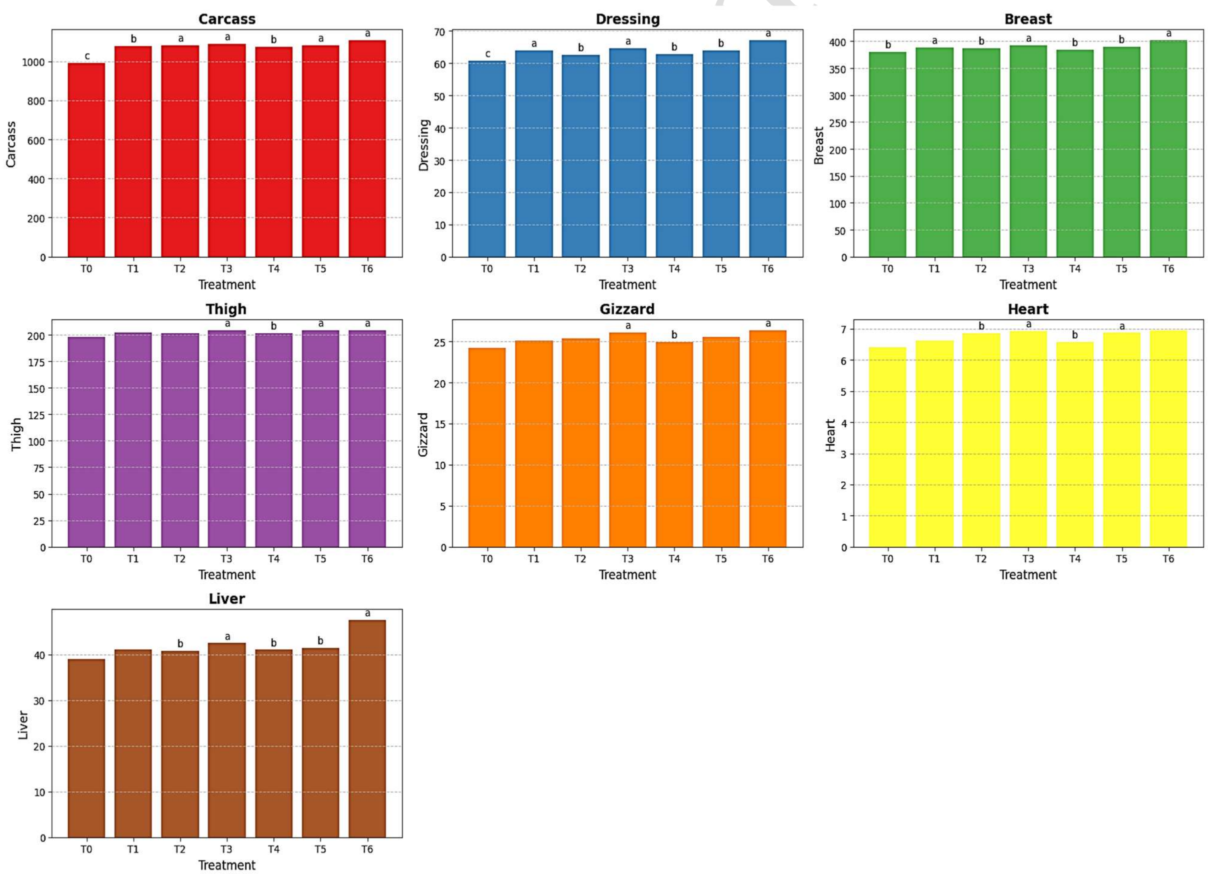

Fig. 4: Effects of probiotics and synbiotic on carcass characteristics in broiler.

Physicochemical characteristics of meat

Table 3 and Figure 5 present the physical and chemical features of poultry breast muscle meat. For drip loss, cooking loss and acidity of breast flesh and moisture value in control group T0 was in the range of 6.68, 27.25, 3.97 and 74.11% and for the treatment group T3 the value was 5.67, 23.89, 2.25, and 72.23% and for T6 the value was 5.57, 23.28, 2.15, and 72.15% respectively. Comparing probiotics and synbiotic treatments groups to the control group, feed supplementation at a dosage rate of 2g/kg results a difference in the values of pH, cooking loss, drip loss, and moisture results significant different ($P<0.05$). According to Table 3, the control group showed the highest value, whereas probiotics and synbiotic dietary intake of 2g/kg showed the lowest pH value, cooking loss, drip loss, and moisture values.

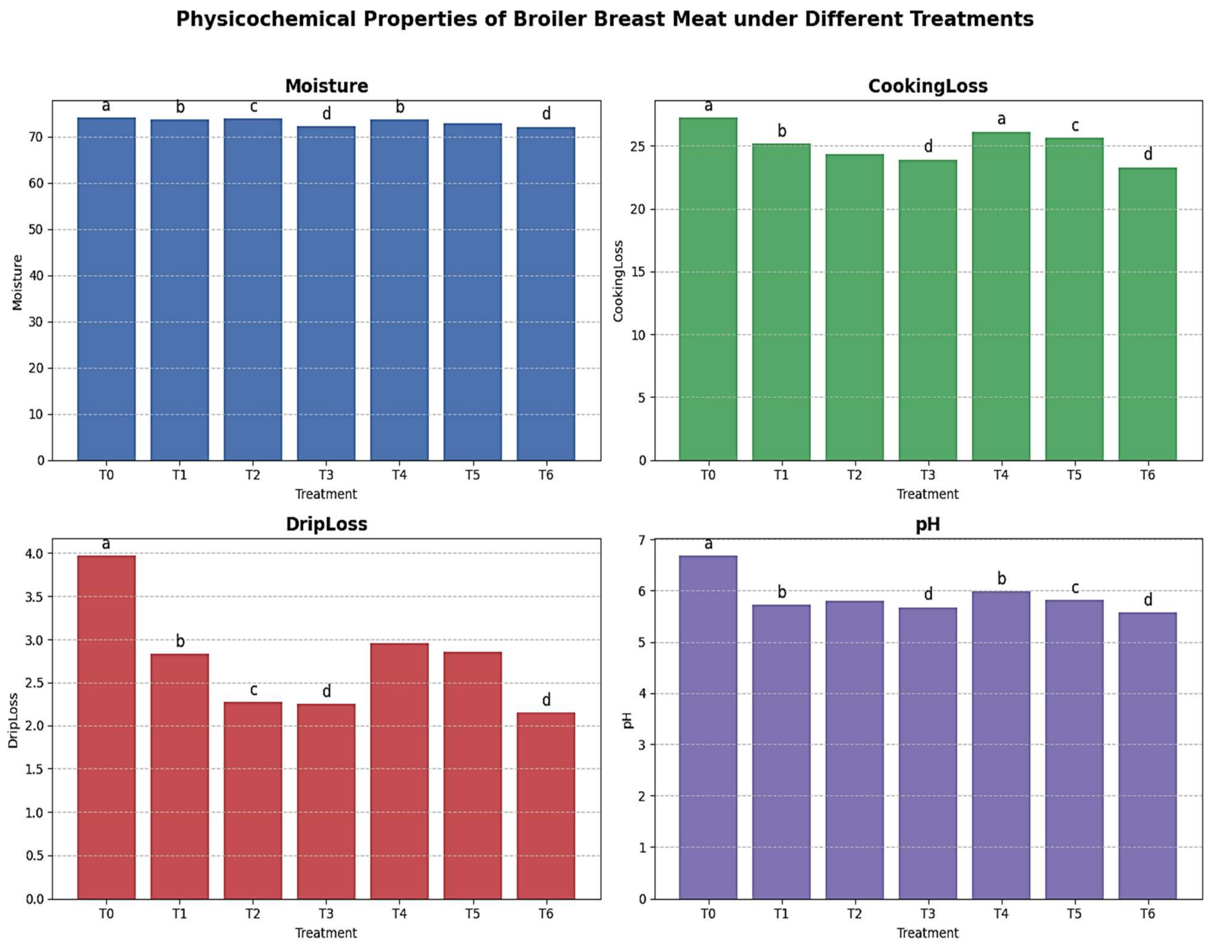

Fig. 5: Effects of probiotics and synbiotic on physiological properties broiler breast meat under different treatments

Table 2: Effect of synbiotic & probiotics on carcass characteristics of broiler

Parameter	T0	T1	T2	T3	T4	T5	T6	SEM	P
Carcass(g)	990.23^{a}	1075.90^{b}	1082.20^{bc}	1089.45^{c}	1073.17^{b}	1080.89^{bc}	1106.90^{d}	3.53	0.01
Dressing (%)	60.84^{a}	63.87^{b}	62.54^{c}	64.54^{d}	62.76^{c}	63.95^{b}	67.13^{e}	0.95	0.04
Breast(g)	380.23^{a}	388.58^{b}	387.19^{b}	391.75^{c}	384.43^{d}	389.68^{b}	401.76^{e}	1.6	0.03
Thigh(g)	197.78^{a}	202.42^{b}	201.28^{b}	203.87^{c}	201.12^{b}	203.87^{c}	204.12^{c}	0.78	0.16
Gizzard(g)	24.25^{a}	25.10^{b}	25.33^{bc}	26.12^{d}	24.95^{a}	25.56^{bc}	26.35^{d}	0.24	0.35
Heart(g)	6.41^{ab}	6.63^{ab}	6.85^{ab}	6.93^{bc}	6.58^{ab}	6.87^{c}	6.95^{c}	0.16	0.48
Liver(g)	39.02^{a}	41.11^{b}	40.67^{ab}	42.43^{b}	40.98^{ab}	41.39^{b}	47.49^{c}	0.29	0.08

$^{a, b, c, d, e}$ Means with various superscripts in a row significantly differ from one another ($p<0.05$), P for the p-value, and SEM for standard error of the mean

Table 3: Physicochemical properties of broiler breast meat

Parameter	T0	T1	T2	T3	T4	T5	T6	SEM	P
Moisture%	74.11^{a}	73.63^{b}	73.91^{ab}	72.23^{c}	73.68^{ab}	72.89^{c}	72.15^{c}	0.57	0.11
Cooking loss%	27.25^{a}	25.16^{b}	24.32^{c}	23.89^{d}	26.11^{d}	25.64^{b}	23.28^{d}	0.72	0.17
Drip loss%	3.97^{a}	2.83^{b}	2.27^{c}	2.25^{d}	2.96^{b}	2.86^{b}	2.15^{d}	0.23	0.21
pH	6.68^{a}	5.72^{b}	5.79^{b}	5.67^{b}	5.98^{c}	5.81^{b}	5.57^{b}	0.19	0.15

$^{a, b, c, d}$ Means with various superscripts in a row significantly differ from one another ($p<0.05$) and P for the p-value, and SEM for standard error of the mean.

DISCUSSION

Alternatives to antibiotics in feed can encourage the population of beneficial bacteria or decrease and eliminate potential infections, both of which may help birds improve in health and growth performance. Probiotics and synbiotics are the words used to describe the helpful microorganisms that enable the bacteria and these present an enormous promise for the health care industry, and they can be used by food manufacturers. Contrasted to that of the comparison group, all synbiotic and food probiotics treatments significantly improved broiler body weight gain, feed intake, and FCR on days 21 and 35 of the trial. Recent research supports that synbiotic and probiotic interventions have a great improvement on broiler performance indicators such as body weight gain (BWG), feed intake (FI), and feed conversion ratio (FCR) when compared to control groups especially at crucial trial endpoint around days 21 and 35 (Awad et al. 2009; Abdel-Hafeez et al. 2016; Leite et al. 2020; Rahman et al. 2021; Imari et al. 2023; Acharya et al. 2024; Rauf et al. 2024; Avberšek et al. 2026) in a study (360 Ross 308 broilers), the synbiotic supplementation at 0.25-1 g/kg significantly ($P<0.05$) improved the BWG, FI, and FCR compared to controls at days 10 and 35, and 0.75 g/kg optimum supplementation; FCR was lowest (Younis et al. 2024). Probiotic and synbiotic through water in Eimeria-stressed Cobb 500 broilers increased the BWG at 21, 28, and 35 days ($P<0.001$ main effect), improved FCR (1.56-1.58 vs. 1.76 in water controls) and enhanced the efficiency of FI (Chhetri et al. 2026). Synbiotics reduced FCR to 1.75 compared to 1.89 in controls and increased daily weight gain (Acharya et al. 2024). These results are consistent with a large body of research showing that probiotics are living microorganisms that improve microbial intestinal balance in the host and improves the growth performance and feed efficiency in broiler chickens following probiotics dietary treatment (Sherief M & MS Abd-A 2011; Al-Fataftah & Abdelqader 2014; Faseleh Jahromi et al. 2015; Khalil et al. 2021; Sulaiman et al. 2025). Prebiotics can also improve broiler performance (Yue Shang et al., 2015; Gulmez et al., 2019). The control of pathogenic or potentially pathogenic bacteria possessing type-1 fimbriae (mannose sensitive lectin), the immune modulation, the modulation of the intestinal morphology, and the enhancement of the mucin and brush border enzymes are the three main modes of action by which broiler performance is increased by MOS or FOS are proposed (Al-Khalaifah et al. 2025; Yan et al. 2025). FOS, MOS has the unusual ability to increase the barrier protection antibody response whilst also decreasing the initial stages (fever) response, resulting in increased immune function (Janardhana et al. 2009; Al-Khalaifah et al. 2025). Birds that were fed FOS-supplemented diets had altered mucosal architecture and longer villi (Xu et al. 2003). The study marked that the synbiotic group also showed greater BW increase, feed consume on the d 21, d 35 compared to the control group and this result is similar with the study of (Yue Shang et al. 2015; Mohammed et al. 2018; Khosravi et al. 2025). In comparison to the broiler control group, synbiotic dietary impact had significant ($P<0.05$) improvement in cumulative body weight growth at day 35 of age. The findings of (Awad et al. 2008; Abdel-Hafeez et al. 2016; Acharya et al. 2024) are all agreement with these findings. Other investigations of (Awad et al. 2009; Khosravi et al. 2025; Chhetri et al. 2026) confirm the results of our experiments on broiler growth performance. These studies showed that the probiotics and synbiotics could improve performances of broilers through increasing intestinal morphology and microbial balance, decreasing intestinal pathogens such as Campylobacter, Salmonella and E. coli by C.E. and antagonism, improving digestive enzymes activity and reducing bacterial enzymes activity (Li et al. 2014; Naeem & Bourassa 2025). Therefore, an increase in the general health and performance of the chickens may be brought about by the beneficial effects of these supplements on the GI tract.

One of the major aims for the industry is to increase the edible portions while getting a larger percentage carcass yield of items that can be sold. The broilers receiving synbiotic supplements increased the weight of carcasses and dressing percentage substantially which was in a complete match with that of (Awad et al. 2009; Younis et al. 2024) who mentioned that the proportion of carcass yield in the symbiotic-supplemented broilers was significantly higher than the control and probiotics-supplemented diet in broilers. The dressing percentage results were in consonance with the other researchers' results that the use of synbiotics increased the carcass weight and dressing percentage (Saiyed et al. 2015). Prebiotics were added to the broiler diet, and this resulted in the development of carcass features which may be linked to the prevention of intestinal pathogen colonization as well as the increased utilization of dietary resources (energy & protein) (Toghyani et al. 2011). The actual weight of the breast, thigh, and liver has drastically increased in the synbiotic supplemented group, supporting that theory. According to (S. L. Kabir et al. 2004) both vaccinated and non-vaccinated broiler chicks treated with probiotics on the second, fourth, and fifth week of age had a substantially ($P<0.05$) increased carcass production. It has been noted that by adding probiotic to diet increased the availability of protein. Synbiotics increased nutritional absorption and nitrogen stability, which can cause a big problem on carcass quality (Falaki et al. 2011).

Consumer taste and attractiveness of broiler meat depend on its physical & chemical properties. The pH is an important quality parameter for meat for its further processing and storage. The pH values in thigh and breast flesh were considerably lower in probiotics treatment than control (Ivanović et al. 2012). The finding supports our findings. The meat pH values in broiler chickens that were given a diet with probiotics and synbiotic additives were lower than those without additives. The probiotic additives in broiler diets can prevent muscle intramuscular fat degradation which affects meat pH and thereby declines pH level during the rigor mortis process in broilers can explain our findings. In this study, antimicrobial supplementation reduced both drip and cooking losses in broiler chickens. The addition of probiotics (Bacillus Coagulans) in feed minimizes both drip loss and cooking loss in Guanxi yellow chicken. As demonstrated in similar results (Zhou et al. 2010). With respect to meat, the less water it loses when cooked is better because it will also count when lost in weight. This processed meat products will create an issue. Probiotics and synbiotics as feed additives affect cooking and drip losses to a significant extent. Giving them feed may help increase the juiciness of the meat. When we refer to this, we mean juicy meat with less cooking and drip losses. Therefore, the meat's juiciness influences its required cooking time.

Conclusions

The results of this study provide information on the effect of probiotics and synbiotic feed supplementation on broiler growth performance, carcass characteristics, and meat quality. In comparison to the control group, when added to the diet of livestock, synbiotic and probiotics supplements dramatically increased body weight gain, feed conversion rate, percentage of carcass yield, and meat quality ($P<0.05$). When compared to the other treatment group, dietary supplementation with probiotics and synbiotics at a dose ratio of 2g per kg feed, resulted in increased feed consumption, BW gain and carcass yield. The synbiotic supplemented broiler with the dose of 2g/kg feed was also a favorable discovery since it had the maximum body weight growth when compared to the other dietary treatment groups. In conclusion, synbiotics as a growth promoter had a greater impact on increasing digestion to better convert feed to body mass.

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Conflict of Interest

The authors declare that there is no conflict of interest, confirming that the research and conclusions presented remain unbiased and untouched by any personal or financial considerations.

Author's Contribution

MDS Saleh conceived, designed the experiment, collected data; S Islam and ASM Mohiuddin curated and analyzed data and drafted manuscript; M Akter, D Mahmud, MDM Rahman and SP Soumo investigated and curated data; MDN Uddin- supervised and coordinated the experiment. All authors critically revised the manuscript and approved the final version.

Ethics Statement: This study has followed the institutional guidelines for the care and use of animals and was approved by the Animal Experimentation Ethics Committee, Sylhet Agricultural University, Sylhet, Bangladesh.

Generative AI statement: The authors used a generative AI tool for minor language editing only (like checking grammar); all ideas, data, analyses, and conclusions are entirely the authors' original work.

Data Availability: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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