Original Research Article
Effect of Tea extract and Probiotics on growth performance and carcass yield of Broiler Chicken.

ABSTRACT

Aims: This study was conducted to investigate the effects of tea extracts and probiotics on the growth rate, feed consumed, feed conversion ratio (FCR), and health performance of broilers.

Place and Duration of Study: Experiment was performed at Khulna agricultural university, between March 2024 and April 2024.

Methodology: A total of 200 cobb-500 broiler chicks, one day old chick was randomly allotted to 5 groups (40 chicks in each group). All were kept in cages for a period of 5 weeks. Dietary treatments used in this experiment were antibiotic free group (basal diet as a control), antibiotic added group, tea extract group, probiotic group and a combination of tea extract and probiotic group. Starter diet from day 1 to 21 and grower diet from day 22 to 35 were fed. Dailyobservationsweredocumented(up to 35th day)to analyse the gain inforlivebody weight.~~gainup to35th days~~

Results: The highest body weight gain was observed in Group E that was 2200gm in comparison to other group. Total feed consumed by birds was highest in group D (3360gm) whereas lowest feed consumed in group B treated by antibiotic (3198gm). However, the best Feed Conversion Ratio (FCR) was observed in group E (1.48) followed by group D (1.58), group C (1.60), group A (1.61) and lowest was in group B (1.64) in 35 days. Among the groups; group E obtained highest dressed weight followed by D, C, A and lowest dressed weight was in B group. There is no significant difference in liver and gizzard among the groups.

Conclusion: Hence, theresultssuggestedthatbetter growthperformance could beachievedinbroilerssupplementedwith probiotic and tea extract and those can be used as herbal growth promoter.

Keyword: Probiotic, Tea extract, broiler, Weight gain

1. INTRODUCTION

According to the OECD-FAO Agricultural Outlook 2020–2029 (OECD 2020), global chicken meat consumption is projected to hit 145 million tons by 2029, accounting for half of the overall increase in worldwide meat consumption.~~By 2029, the world's consumption of chicken meat is expected to reach 145 million tons, or 50% of the total growth in meat consumption worldwide, according to the OECD-FAO Agricultural Outlook 2020-2029 (OECD 2020).~~Globally, poultry farming constitutes a substantial portion of the agricultural sector. These days, there is increased interest in native animals in general and the poultry industry in particular because of their high meat quality and long-term viability (1).

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Commercial chicken farming is a lucrative industry, but it has several difficulties. Due to inadequate biosecurity and husbandry methods, one of the biggest challenges among them is the incidence of infectious and non-infectious illnesses. A number of antibiotics have been added to broiler feed throughout the years to improve performance, treat, and prevent illness (2, 3).It iscan be difficult to raise animals without antibiotics; in particular, producing broiler meat without using antibiotics hasis become ing more difficult in many poor nations, including Bangladesh, where antibiotics are used excessively (4).

Over the past 50 years, the widespread use of antibiotics as antimicrobial agents has led to the rise of drug residues in food and the emergence of resistant bacteria (5-7).
Poultry diets using herbal items can improve health and lower death rates (8).Recent research has revealed that a few herbs and plants have biological properties that include boosting immunity, enhancing antioxidation, and enhancing animal productivity(9, 10).
For thousands of years, China, Japan, and several other nations have utilized green tea (Camellia sinensis) as a beverage. Green tea is made up of more than 300 distinct components and more than 200 bioactive chemicals (11). The natural, non-toxic tea plant (Camellia sinensis) contains a variety of bioactive substances, including volatile oils, alkaloids, polyphenols, polysaccharides, vitamin C, and minerals (11, 12). About 92.2% dry matter, 82.4% organic matter, 19.3% crude fiber, 8.7% ether extract, 9.8% ash, 18.1% crude protein, 36.2% nitrogen free extract, and 3002 kcal/kg are present in the leaves (13).Green tea has a number of known chemical components, including polyphenols (catechins and flavonoids), caffeine, threobromine, theophylline, polysaccharides, amino acids, and minerals (14, 15).Research has demonstrated that green tea and its constituents, such as polyphenols, catechins, and L-theanine, has several physiological and biochemical properties, such as anti-inflammatory and antioxidant properties (12, 16-18)
Green tea is a naturally occurring substance that may enhance the nutritional value of chicken products and improve the health of poultry(16, 19).Due to these advantages, green tea may substitute antibiotic growth boosters in broiler andincrease productivity(11, 20, 21).

Probiotics, which are referred to as "live micro-organisms," have been a crucial feed ingredient in animal production for many years because, when given in sufficient amounts, they provide health advantages to the host(22-25).Probiotics have the potential to enhance feed intake and digestion efficiency in poultry by boosting the activity of digestive enzymes, maintaining the proper balance of bacteria in the gastrointestinal (GI) tract, promoting gut integrity, and ultimately improving the health and growth of the birds (26-28). Supplementing with probiotics has a major impact on immunological response, carcass production, live weight increase, and notable cut meat portions(27).
Some previous studies investigated impacts of probiotics and tea extract for poultry separately, but studies on the use of both are very rare. It is hypothesized that the combination between probiotic and tea extract exhibits the powerful influence of each addition that appeared in the alone form. Thus, the present study was planned to evaluate the effect of probiotics, tea extract and their combinations on growth performance, carcass characteristics in broiler chicks.

2. MATERIAL AND METHODS

2.1 Ethical Statement

All the birds used in this study were cared for and handled under the guidelines of the Bangladesh Veterinary Council Act 2019, Government of the People's Republic of Bangladesh. Birds care instructions and use regulations established by the institutions and countryies hasve been fulfilled accordingly. All precautionary measureswere taken into consideration to reduce pain during the experimental period.

2.2 Study Location and Experimental Design

The feeding trial was conducted in the experimental poultry house, Faculty of Veterinary, Animal and Biomedical Sciences, Khulna Agricultural University, Khulna-9100, Khulna, Bangladesh. A total of 200 Cobb-500 day-old-chicks were collected from commercial hatchery.After collection of chicks immediately they were allowed to brooding shad and were supplied drinking water mixture with vitamin-C and glucose to prevent the stress occurring during transport. For temperature maintain cheek guard, hover and source of heat (200w bulb) was prepared before the chick carried out. They were held in an environmentally controlled room (32 − 28 °C according to age). Using management guide recommendations, chickens were raised and fed until they were 35 days old. The experimental diets were designed to meet the nutritional needs of broiler chicken.

The chicks were split randomly into 5 equal groups, each with 40 birds. Group A (Negative/Control) has received basal water and diet with no treatment. Group B was treated with antibiotics, Ggroup C was supplemented with tea extract, Group D with probiotics and Ggroup E was given mixed probiotics with tea extract.

Table 1: Composition of antibiotic and probiotic used in the diet

Parameter	**Probiotic**	**Antibiotic**
Composition	*Lactobacillus plantarum* PXN® 47™ *Lactobacillus delbrueckii ssp. bulgaricus* PXN® 39™ *Lactobacillus acidophilus* PXN® 35™ *Lactobacillus rhamnosus* PXN® 54™ *Bifidobacteriumbifidum* PXN® 23™ *Streptococcus thermophilus* PXN® 66™ *Enterococcus faecium* PXN® 33™ 2 x 1012 CFU/kg **Ingredients:** Dextrose Monohydrate	Amoxicillin
Dose	**1gm/2L drinking water**	1 gm/L drinking water

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2.2.1. Experimental diet

Pre starter feed was provided from 1- 6 days. From 18 day, starter (Nourish feed) was given to 28th days of rearing. Then finisher (Nourish poultry feed) was given up to final day of experiment. Feed and water were provided ad libitum.

Nutrient	Pre starter(1-6)days	Starter (18-28) days	Finisher (29-up to sell)
ME (kcal/kg)	2950	3000	3050
CP%	21	20	19
Ca%	1	.95	.9
P%	.45	.45	.42
CF%	5	5	4
Lysine%	1.15	1.05	1

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Methionine%	.4	.45	.42
Vita and Mineral%	Adlibitum	Adlibitum	Adlibitum
Humidity%	12	12	12

ME= Metabolize energy, CP= Crude Protein, CF= Crude fiber

Table 2: Nutrient Compositions of Nourish feed

2.2.2. Green tea Extract preparation

Green tea extract was prepared by heating 50 g dry tea leaves with 200 ml distilled water at 80°C for 10 min (29). Green tea powder was obtained by grinding and passing through a 0.5 mm sieve. Then apply 2ml/kg feed.

2.3. Growth Performance

Daily feed intake per group was recorded to compute feed intake per week. Chick's body weight was recorded at the time of arrival and after every week of age by using an electrical weighing balance. Values of feed intake and weight gain were used to calculate feed conversion ratio (**FCR**).

2.4. Carcass Yield

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At the end of the experiment, 5 broiler chickens were randomly selected from each group. Broiler chickens were starved of feed overnight and then slaughtered by severing the jugular vein with a sharp knife and allowing blood to drain for five minutes. Slaughtered chickens were scalded in hot water (about 50°C) for one minute, then de-feathered and eviscerated manually. The live weights and dressed weights were recorded and the internal organ (liver, heart, gizzard, thigh, drumstick) were recorded and expressed as a percentage of live weight. The dressing percentage was calculated as the percent of live weight after bleeding and de-feathering. Eviscerated carcass weight was determined after removing blood, feather, shank, head, heart, liver, gizzard, kidney, lung, pancreas, crop, proventricles and the intestine.

1. Body weight gain = Final body weight – Initial body weight

$$2.\text{Dressing percentages (DP)} = \frac{\text{Dressed weight}}{\text{Live weight}} \times 100$$

$$3.\text{Relative weight} = \frac{\text{Weight of offal}}{\text{Dressed weight}} \times 100$$

3.5. Statistical analysis

The data were recorded in excel sheet and were analyzed statistically among the tTreatment and control groups of chicken by the analysis of variance (ANOVA) technique in completely randomized design by using IBM SPSS Statistics data editor; version 20. Significantly different means among treatments were separated as per the standard method of Duncan (1955) at 5 per cent% level of probability ($P < 0.05$).

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3. RESULTS AND DISCUSSION

The study was conducted to explore the effects of tea extracts and probiotic on body weight of broiler. A total of 200 chicks were taken, after 7 days of acquaintance chicks were divided into 5 groups in where A, B, C, D and E were used for Control, Antibiotic, Tea extracts, Probiotic, and Tea extracts and Probiotic respectively on broilers. In group A was considered as control group where no treatment was given; only common feed and water were given. Body weights were recorded at day14, day 21, day 28 and day 35.

3.1 Growth performance

Broiler treated with different treatment of tea extracts, probiotic and combination of tea extract and probiotic supplement showed that increased body weight gain than control group. Body weight was taken in every 7 day interval. As shown in table 3, during finisher phase, weight gain was lowest in group B which treated with antibiotics. But weight was increased in starter and finisher stage by probiotic and tea extract supplementation.

Table 3: Comparison of live body weight among the group

Week	**Live body weight gain(Mean±SEM)**					**P value**
	A	B	C	D	E	
1st	180± 1.93	190± 2.67	185± 2.67	200± 2.43	220± 1.44	0.021
2nd	480 ± 9.94	500 ± 2.88	510± 5.77	530± 3.93	540 ± 6.26	.001
3rd	900 ± 6.72	930± 5.23	930± 5.23	1030 ± 6.49	1050± 5.87	.015
4th	1395± 4.87	1400 ±7.86	1450± 6.45[b]	1520± 7.15	1650± 4.49	.011
5th	2020±16.18	1950±6.81	2095±2.54	2100±8.79	2200±5.34	.002

Results are expressed as mean±SEM

3.2.Feed Consumption:

We observed in our study group D consumed highest amount of feed that was total 3360 gm in comparison to other group. It may be probiotics help in metabolism of feed. Whereas lowest feed consumption was found in Group B(Basal diet +Antibiotics) which was 3198 gm total. Amount of total feed consumption was similar in group A and Group E which are shown in table 4.

Table 4:Feed consumption (gm) of broiler

Week	A	B	C	D	E
1	153	160	162	155	176
2	508	520	541	530	550
3	1134	1209	1277	1190	1260
4	2022	2100	2128	2059	2277
5	3252	3198	3318	3360	3256

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3.3 Feed Conversion Ratio (FCR)

The mean weekly feed conversion ratio in terms of feed intake per unit gain in weight for different dietary groups during 1st to 6th week were calculated from following the data. It was revealed from Table 5.

FCR was calculated in every week interval. In group E, best feed conversion was observed from day 7 to day 35 with a seven day interval. Group E was treated by Tea extract and Prebiotic. Worst feed conversion was seen in group A which was control group where no treatment was given, only feed and water supplement was performed.

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Table 5: Feed Conversion Ratio (FCR) of birds from Day 7 to Day 35

	Control	antibiotics	Tea	probiotics	Tea+ probiotics	P value
1st	.85	.84	.84	.81	.80	.220
2nd	1.06	1.04	1.04	1.02	1.02	
3rd	1.26	1.30	1.28	1.24	1.20	
4th	1.45	1.5	1.42	1.40	1.38	
5th	1.61	1.64	1.60	1.58	1.48	

4.4 Carcass characteristics

Weight of internal organs such as heart, liver, gizzard, Spleen, pancreas, is~~are~~ shown in Table 6. When the treatment of tea extracts with probiotic increased the percentage of weight of internal organ to body weight tend~~ed~~to increase. Offal's weight was recorded and calculated. Highest liver weight was observed in group C which is treated by Tea extract followed by group E, group D and lowest in group A. For gizzard, heart, spleen and liver highest weight shown in group E.

Table 6: Average Liver, Heart and Gizzard weight (g/bird) of broilers

Items(gm)	Treatments				
	Control	Antibiotic	Tea extract	Probiotic	Tea extract and probiotic
Heart wt.	12	11.5	13	14.5	15.5
Liver wt.	46.5	48	51.5	51	53
Gizzard wt.	28	30	31.5	32	34
Drumstick	72.05	68.64	77.4	78.1	81.95
Thigh	85.15	81.12	91.52	92.3	96.85

4.6 Dressed weight

After dressing of each bird at day 35, they were individually weighted. Among the groups, E obtained highest dressed weight followed by D, C, A and lowest dressed weight was in B group. Average dressing weight and dressing percentage was shown in Table 7.

Table 7: Average dressing percentage of birds

Group	Live body weight (kg/bird)	Dressed weight (kg/bird)	Dressing percentage
A (Control)	2020	1310±7.31	64%
B (Antibiotic)	1950	1248±4.05	64%
C (Tea extract)	2095	1408±3.78	67%
D (Probiotic)	2100	1420±3.69	68%
E (Tea andprobiotic)	2200	1490±4.04	68%

Discussion

This study was designed to investigate the influence of dietary tea extract, probiotic and/or tea extract-probiotic supplementation on growth performance, carcass traits, immune response and some blood biochemical alterations in broiler chickens. In this study, it was observed that green tea and probiotics in broiler diet had positive effect on growth performance, feed intake, and FCR.

Similar result was found by Biswas and Wakita(30)where four doses of green tea powder (0.50%, 0.75%, 1.00%, and 1.50%) were introduced to the starting and finisher diets of broiler chickens. At larger doses, supplemental tea powder tended to increase feed conversion ratio (FCR) while decreasing feed intake and body weight gain. According to Richards (2003)(31), an animal's body composition and development rate during its life are mostly determined by the amount of feed they consume. Birds fed diets containing green tea extract showed improvements in body weight and feed efficiency, suggesting that using these items as a viable substitute for antimicrobial feed additives as growth promoters. These findings were similar with previous studies using the green tea in broiler chickens diets ((32, 33) but not with study by Biswas and Wakita (30).However, another study found

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no effect of green tea supplementation on feed intake in broilers (34). According to Kaneko et al. (35)adding green tea to broiler meals at levels of 1.00%, 2.50%, and 5.00% linearly lowered the chicks' body weight rise.
Yang et al.(36) assessed the impact of the ideal concentration of tea extract by-product (0.50%, 1.00%, and 2.00%) on broiler performance when fed a diet free of antibiotics. They found that there were no discernible variations in feed efficiency or intake between treatments.Cao et al. (32)published similar results, showing that supplementation with tea products significantly decreased mortality but did not increase body weight gain, feed intake, or feed efficiency from 28 to 42 days of age.

Insignificant differences were also seen in body weight, feed consumption, and FCR. Another research found that broilers gained considerably more weight (1210.61 g/bird) at the 0.5% level during the finishing phase when compared to the 1.0% (1033.36 g/bird) level of green tea, which is in contradiction to the findings mentioned above(37).
In this study, positive effects of the probiotics supplementation on BW, feed consumption, and FCR were found in cobb500 broiler chicks. The BW gain and average daily gain were significantly higher in probiotics- fed chicks than that in control and antibiotic group chicks at the both starter and grower phase of the experiment. Probiotic supplements helped to balance the GIT microbiota, which is necessary for the early growth of the gut and raises the amount of feed that broilers consume during the starting phase (38)which is similar to our study.
Probiotic supplementation slowed down the stomach's emptying time, which increases feed intake(39, 40). But, several researchers found that probiotic administration had no effect on feed consumption (41).
On the other hand, several investigations claim that probiotics have little effect on broiler mortality or growth performance. It has been discovered that feeding broiler diets including probiotics or prebiotics decreased feed consumption (42, 43). Others have shown that adding probiotics to a broiler's diet has no effect on feed conversion rate (FCR)(44). Furthermore, it was shown that taking probiotic supplements had no effect on weight growth (45).
In our research, Tea extract and probiotics had positively influenced on carcass yield than the control and antibiotic group.

The amounts of lactic acid bacteria (Lactobacillus and Bifidobacteria species) and pathogenic bacteria (Bacteroides and Clostridium species) increased and decreased, respectively, when both types of green teas were included in the diet. These changes were not statistically significant. The capacity of polyphenols to function as antioxidants and antiradical agents may provide an explanation for the observed processes of green tea's promotion of lactic acid bacteria development (46-49). In vitro studies have demonstrated that physiological doses of green tea polyphenols and extracts can impede or delay the development of a variety of pathogenic strains of enteric bacteria, including pathogenic strains of *Escherichia coli*(50, 51).On the other hand, Cao et al. (52)discovered that feeding green tea polyphenols dramatically decreased the number of bacteria overall and decreased the counts of Bifidobacteria, Bacteroidaceae, Peptococcaceae, and Lactobacillus spp.The addition of tea polyphenols to broiler meals has an impact on the intestinal microbiota's bacterial diversity and richness (53). As tea extract helps the effects of probiotics, combination of tea extract with probiotics enhance the weight of different internal organs of broiler.
Yang et al. and Guray et al. observed that the percentage of abdominal fat in broilers dropped when the quantity of green tea by-product was raised (54, 55).

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4. CONCLUSION

In this study, we observed that feed supplemented with tea extract and probiotic can increase the body weight, average daily gain and reduced feed conversion ratio. Besides, dressing percentage with internal organ weight also increased by this supplementation. The findings of the study suggest that the combination of tea extract and probiotics in the diet could potentially replace antibiotics as a growth promoter, providing a more natural and possibly safer alternative for enhancing the bird's growth and health.~~However, supplementation of tea extract with probiotics in diet may be complete substitution of antibiotics.~~

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