*Asian Journal of Advanced Research and Reports*

***Volume 18, Issue 7, Page 103-113, 2024; Article no.AJARR.118333***
***ISSN: 2582-3248***

# Effect of Tea Extract and Probiotics on Growth Performance and Carcass Yield of Broiler Chickens

**Nazmin Sultana Runa [a*], Md. Tanvir Hasan [b], Md. Esteak Ahmed [c], Fowzia Bahar [d], Mahfuza Ferdous [e] and Md. Sahidul Islam [f]**

*[a] Department of Physiology, Faculty of Veterinary, Animal and Biomedical Sciences, Khulna Agricultural University, Khulna-9100, Bangladesh.*
*[b] Department of Medicine, Faculty of Veterinary, Animal and Biomedical Sciences, Sylhet Agricultural University, Sylhet-3100, Bangladesh.*
*[c] Department of Physiology and Pharmacology, Faculty of Animal Science and Veterinary Medicine, Patuakhali Science and Technology University, Patuakhali-8602, Bangladesh.*
*[d] Department of Animal Science, Faculty of Veterinary, Animal and Biomedical Sciences, Khulna Agricultural University, Khulna-9100, Bangladesh.*
*[e] Department of Animal Nutrition, Faculty of Veterinary, Animal and Biomedical Sciences, Khulna Agricultural University, Khulna-9100, Bangladesh.*
*[f] Department of Poultry Science, Faculty of Veterinary, Animal and Biomedical Sciences, Khulna Agricultural University, Khulna-9100, Bangladesh.*

***Authors' contributions***

*This work was carried out in collaboration among all authors. Author NSR designed the study of manuscript. Authors NSR, MTH and MEA performed the experiments, analyzed the data and wrote the initial draft of the manuscript. Authors FB, MF and MSI wrote the original draft of the manuscript and managed the literature searches. All authors read and approved the final manuscript.*

***Article Information***

DOI: https://doi.org/10.9734/ajarr/2024/v18i7689

**Open Peer Review History:**
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers,peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/118333

***Original Research Article***

***Received: 07/04/2024***
***Accepted: 10/06/2024***
***Published: 13/06/2024***

**Corresponding author: Email: nazmin.dr@gmail.com;*

***Cite as:*** *Runa, Nazmin Sultana, Md. Tanvir Hasan, Md. Esteak Ahmed, Fowzia Bahar, Mahfuza Ferdous, and Md. Sahidul Islam. 2024. "Effect of Tea Extract and Probiotics on Growth Performance and Carcass Yield of Broiler Chickens". Asian Journal of Advanced Research and Reports 18 (7):103-13. https://doi.org/10.9734/ajarr/2024/v18i7689.*

## ABSTRACT

Antibiotic-resistant bacteria have emerged as a result of the sharp rise in the usage of antibiotics as a necessary component of poultry and cattle production. Green tea, which has antioxidant properties, and probiotics, which are living microbial substances, are thought to be suitable alternatives to antibiotics in chicken diets since they have been linked to improved bird development and health.

**Aims:** This study was conducted to investigate the effects of tea extracts and probiotics on the growth performance and carcass yield of broiler chickens.

**Place and Duration of Study:** The experiment was performed at Department of Physiology, Faculty of Veterinary, Animal and Biomedical Sciences,Khulna Agricultural University, Khulna-9100, Bangladesh during the period from January 2023 and April 2023.

**Methodology:** A total of 200 one day old Cobb 500 broiler chicks were 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. A starter diet from day 1 to 21 and a grower diet from day 22 to 35 were fed. Weekly assessments of growth performance parameters were documented, and on the 35$^{th}$ day, carcass yield were measured.

**Results:** The highest body weight gain was observed significantly ($P<0.05$) in Group E which was 2200gm in comparison to other groups. Total feed consumed by birds was highest in group D (3360gm) whereas the lowest feed consumed in group B treated by antibiotics (3198gm). Significant differences ($P<0.05$) were observed among feed consumption of different groups. 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 the worst FCR was recorded in group B (1.64) at 35$^{th}$ days. Among the groups; group E obtained the highest dressed weight followed by D, C and A whereas the lowest dressed weight was reported in B group.

**Conclusion:** Hence, the results suggested that better growth performance could be achieved in broilers supplemented with probiotics and tea extract and these can be used as herbal growth promoter.


*Keywords: Probiotic; tea extract; broiler; growth performance; carcass yield.*

## 1. INTRODUCTION

According to the OECD-FAO Agricultural Outlook 2020–2029 (OECD 2020), global chickenmeat consumption is projected to hit 145 million tons by 2029, accounting for half of theoverall increase in worldwide meat consumption. 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].

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 noninfectious illnesses. Several antibiotics have been added to broiler feed throughout the years to improve performance, treat, and prevent illness [2,3]. Animal growth performance may be improved by adding growth boosters and antibiotics to the ratio. Several mechanisms have been proposed, including: (a) increased nutrient absorption and decreased gut utilization; (b) decreased intestinal microflora leading to increased nutrient availability for the host; (c) decreased harmful gut bacteria; (d) decreased production of growth-suppressive toxins or metabolites; and (e) decreased microbial de-conjugation of bile acids [4,62,63,64]. However, due to growing worries about antibiotic resistance and the prohibition on the use of sub-therapeutic antibiotics, there is a growing interest in finding antibiotic substitutes for the production of chickens. One strategy that may help minimize enteric disease in chickens and the subsequent contamination of poultry products is the use of probiotics [5]. As an alternative, probiotics and other similar substances can help broiler chickens develop and achieve improved health and performance [4,5]. It is difficult to raise animals without antibiotics; in particular, producing broiler meat without using antibiotics has become more

difficult in many poor nations, including Bangladesh, where antibiotics are used excessively [6]. 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 [7-9].

Poultry diets using herbal items can improve health and lower death rates [10]. Recent research has revealed that a few herbs and plants have biological properties that include boosting immunity, enhancing antioxidation, and enhancing animal productivity [11,12].

People from Korea, Japan, and China have been using green tea (*Camellia sinensis*), which contains the most potent antioxidant, catechin, as an anti-aging herb for generations. The addition of green tea to the diets of broiler chickens improved the chickens' ability to develop and produce lean meat [13]. Green tea is made up of more than 300 distinct components and more than 200 bioactive chemicals [14]. The natural, non-toxic tea plant (*Camellia sinensis*) contains a variety of bioactive substances, including volatile oils, alkaloids, polyphenols, polysaccharides, vitamin C, and minerals [14,15]. 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 [16]. Green tea has several known chemical components, including polyphenols (catechins and flavonoids), caffeine, theobromine, theophylline, polysaccharides, amino acids, and minerals [17,18]. Research has demonstrated that green tea and its constituents, such as polyphenols, catechins, and L-theanine, have several physiological and biochemical properties, such as anti-inflammatory and antioxidant properties [15,19-21].

Green tea is a naturally occurring substance that may enhance the nutritional value of chicken products and improve the health of poultry [19,22]. Due to these advantages, green tea may substitute antibiotic growth boosters in broilers and increase productivity [14,23,24].

Probiotics, which are referred to as "live microorganisms," 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 [25-28]. 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 [29-31]. Supplementing with probiotics has a major impact on immunological response, carcass production, live weight increase, and notable cut meat portions [30].

Some previous studies investigated the impacts of probiotics and tea extract on poultry separately, but studies on the use of both are very rare. It is hypothesized that the combination of 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. MATERIALS AND METHODS

### 2.1 Locale of the study 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 the collection of chicks immediately they were allowed to brood shad and were supplied with drinking water mixture with vitamin C and glucose to prevent the stress occurring during transport. For temperature maintenance cheek guard, hover and source of heat (200w bulb) were prepared before the chick carried out. They were held in an environmentally controlled room ($32-28\,^{\circ}C$ 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 chickens.

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 Amoxicillin (Renamox-Renata Animal Health), Group C was supplemented with tea extract (Tea leaves collected from Tea garden, Sylhet), Group D with probiotics (Protexin-ElancoBangladesh) and Group 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™<br>*Lactobacillus delbrueckiissp. bulgaricus*PXN® 39™<br>*Lactobacillus acidophilus*PXN® 35™<br>*Lactobacillus rhamnosus*PXN® 54™<br>*Bifidobacterium bifidum*PXN® 23™<br>*Streptococcus thermophilus*PXN® 66™<br>*Enterococcus faecium*PXN® 33™<br>2 x 1012CFU/kg<br>**Ingredients:**<br>Dextrose Monohydrate | Amoxicillin |
| **Dose** | **1gm/2L drinking water (according to** the manufacturers' prescription) | 1 gm/L drinking water(according to the manufacturer's prescription) |

**Table 2. Nutrient compositions of nourish feed**

| Nutrient | Pre starter01 to 06 days | Starter18-28 days | Finisher29 to 35 days |
|---|---|---|---|
| **ME (kcal/kg)** | 2950 | 3000 | 3050 |
| **CP%** | 21 | 20 | 19 |
| **Ca%** | 1 | 0.95 | 0.9 |
| **P%** | 0.45 | 0.45 | 0.42 |
| **CF%** | 5 | 5 | 4 |
| **Lysine%** | 1.15 | 1.05 | 1 |
| **Methionine%** | 0.4 | 0.45 | 0.42 |
| **Vitamin and Mineral%** | Adlibitum | Adlibitum | Adlibitum |
| **Humidity%** | 12 | 12 | 12 |

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

#### 2.1.1 Experimental diet

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

#### 2.1.2 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 [32]. Green tea powder was obtained by grinding and passing through a 0.5 mm sieve. Then apply 2ml/kg feed.

### 2.2 Growth Performance

Daily feed intake per group was recorded to compute feed intake per week. The chick'sbody weightwas recorded at the time of arrival and after every week of age by using an electrical weighing balance. Values of feed intake andweight gainwere used to calculatethe feed conversion ratio(FCR).

### 2.3 Carcass Yield

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 by weighing scale (RFL kitchen scale 5KG) and the internal organs (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, feathers, shank, head, heart, liver, gizzard, kidney, lung, pancreas, crop, proventriculus and the intestine.

1. $Body\ weight\ gain = Final\ body\ weight - Initial\ body\ weight$

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

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

## 2.4 Statistical Analysis

The data were recorded in Excel sheet and were analyzed statistically among the treatment and control groups of chicken by the analysis of variance (ANOVA) technique in a completely randomized design by using International Business Machines Corporation SPSS Statistics data editor; version 25, Chicago, IL, USA. Significantly different means among treatments were separated as per the standard method of Duncan [33] at 5 percent level of probability (P<0.05).

## 3. RESULTS AND DISCUSSION

The study was conducted to explore the effects of tea extracts and probiotics on the body weight of broilers. A total of 200 chicks were taken, after 7 days of acquaintance chicks were divided into 5 groups in which A, B, C, D and E were used for Control, Antibiotic, Tea extracts, Probiotic, and Tea extracts and Probiotic respectively on broilers. Group A was considered as a control group where no treatment was given; only common feed and water were given. Body weights were recorded at day 14, day 21, day 28 and day 35.

### 3.1 Growth Performance

Broiler treated with different treatments of tea extracts, probiotics and a combination of tea extracts and probiotic supplements showed that the increased body weight gain than the control group. Body weight was taken in every 7-day interval. As shown in Table 3, during the finisher phase, weight gain was lowest in group B which was treated with antibiotics. But the weight was increased in the starter and finisher stages by probiotic and tea extract supplementation.

### 3.2 Feed Consumption

We observed in our study group D consumed the highest amount of feed which was total 3360 gm in comparison to the 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. The amount of total feed consumption was similar in Group A and Group E which are shown in Table 4.

### 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 was calculated from following the data. It was revealed from Table 5.

**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$^{b}$ | 190±2.67$^{b}$ | 185±2.67$^{b}$ | 200±2.43$^{a}$ | 220±1.44$^{a}$ | 0.042 |
| 2nd | 480 ±9.94 | 500 ±2.88 | 510±5.77 | 530±3.93 | 540 ±6.26 | 0.076 |
| 3rd | 900 ±6.72 | 930± 5.23 | 930±5.23 | 1030±6.49 | 1050±5.87 | 0.059 |
| 4th | 1395±4.87 | 1400±7.86 | 1450±6.45 | 1520±7.15 | 1650±4.49 | 0.074 |
| 5th | 2020±16.18$^{b}$ | 1950±6.81$^{b}$ | 2095±2.54$^{a}$ | 2100±8.79$^{a}$ | 2200±5.34$^{a}$ | 0.041 |

$^{a,b}$ *Within a row, means sharing different superscripts differ significantly (P < 0.05). Results are expressed as mean±SEM*

**Table 4. Feed consumption (gm) of broiler**

| Week | A | B | C | D | E |
|---|---|---|---|---|---|
| 1st | 153 | 160 | 162$^{c}$ | 155$^{a}$ | 176$^{c}$ |
| 2nd | 508 | 520 | 541$^{b,c}$ | 530$^{a,b}$ | 550$^{b,c}$ |
| 3rd | 1134 | 1209 | 1277$^{b}$ | 1190$^{b}$ | 1260$^{b}$ |
| 4th | 2022 | 2100 | 2128$^{a,b}$ | 2059$^{b}$ | 2277$^{a,b}$ |
| 5th | 3252 | 3198 | 3318$^{a}$ | 3360$^{a}$ | 3256$^{a}$ |
| P value | 0.089 | 0.181 | 0.045 | 0.0145 | 0.008 |

$^{a,b,c}$ *Within a column, means sharing different superscripts differ significantly (P < 0.05)*

**Table 5. Feed conversion ratio (FCR) of birds from Day 7 to Day 35**

| Week | A | B | C | D | E |
|---|---|---|---|---|---|
| 1st | 0.85 | 0.84 | 0.84 | 0.81 | 0.8 |
| 2nd | 1.06 | 1.04 | 1.04 | 1.02 | 1.02 |
| 3rd | 1.26 | 1.3 | 1.28 | 1.24 | 1.2 |
| 4th | 1.45 | 1.5 | 1.42 | 1.4 | 1.38 |
| 5th | 1.61 | 1.64 | 1.6 | 1.58 | 1.48 |
| P value | 0.136 | 0.162 | 0.077 | 0.095 | 0.119 |

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

| Items(g) | Treatments | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | E |
| 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 |

**Table 7. Average dressing percentage of birds**

| Group | Live body weight (g/bird) | Dressed weight( g/bird) | Dressing percentage |
|---|---|---|---|
| A | 2020 | 1310±7.31 | 64% |
| B | 1950 | 1248±4.05 | 64% |
| C | 2095 | 1408±3.78 | 67% |
| D | 2100 | 1420±3.69 | 68% |
| E | 2200 | 1490±4.04 | 68% |

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 with Tea extract and Probiotic. The worst feed conversion was seen in group A which was the control group where no treatment was given, only feed and water supplement was performed.

## 3.4 Carcass Characteristics

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

## 3.5 Dressed Weight

After dressing each bird on day 35, they were individually weighed. Among the groups, E obtained the highest dressed weight followed by D, C, and A and the lowest dressed weight was in the B group. The average dressing weight and dressing percentage are shown in Table 7.

## 3.6 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 chicken. In this study, it was observed that green tea and probiotics in broiler diet had positive effects on growth performance, feed intake and FCR.

A similar result was found by Biswas and Wakita [34] 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 tends to increase feed conversion ratio (FCR) while decreasing feed intake and body weight gain. According to Richards [35], 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. Our findings were similar to previous studies using green tea in broiler chicken diets [36,37] but not with a study by Biswas and Wakita [34]. However, another study found no effect of green tea supplementation on feed intake in broilers [38]. According to Kaneko et al. [39] adding green tea to broiler meals at levels of 1.00%, 2.50%, and 5.00% linearly lowered the chicks' body weight rise.

Yang etal.[40] 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.[37] 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[41].

In this study, positive effects of the probiotics supplementation on BW, feed consumption, and FCR were found in Cobb 500 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. According to Peng et al, probiotics used in animal husbandry can significantly improve the growth performance of livestock and poultry. For instance, feeding broilers with L. plantarum B1 increased their weight gain and feed conversion ratio [42], while feeding them B. licheniformis increased their body weight and ADG significantly [43].

Probiotic supplements helped to balance the GIT microbiota, which is necessary for the early growth of the gut and raise the amount of feed that broilers consume during the starting phase [44] which is similar to our study.

Probiotic supplementation slows down the stomach's emptying time, which increases feed intake [45,46].However, several researchers found that probiotic administration did not effect on feed consumption [47].

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 [48,49]. Others have shown that adding probiotics to a broiler's diet does not effect on feed conversion rate (FCR) [50]. Furthermore, it was shown that taking probiotic supplements did not affect on weight growth [51].

In our research, Tea extract and probiotics had positive influence 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 explain observed processes of green tea's promotion of lactic acid bacteria development [52-55]. 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* [56,57].On the other hand, Cao et al. [58] 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 [59]. As tea extract helps the effects of probiotics, a combination of tea extract with probiotics enhances the weight of different internal organs of the 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 [60,61].

## 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.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

## ETHICAL APPROVAL

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 countries have been fulfilled accordingly. All precautionary measures were taken into consideration to reduce pain during the experimental period.

## ACKNOWLEDGEMENTS

The authors would like to express their gratitude to all of the members of the Department of Poultry Science and Department of Physiology, Khulna Agricultural University, Khulna-9100, Bangladesh for their friendly assistance in completing the research work.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Habimana R, Okeno TO, Ngeno K, Mboumba S, Assami P, Gbotto AA et al. Genetic diversity and population structure of indigenous chicken in Rwanda using microsatellite markers. PLoS One. 2020; 15(4):e0225084.
2. Tollefson L, Miller MA. Antibiotic use in food animals: Controlling the human health impact. J AOAC Int. 2000;83(2): 245-54.
3. Gaskins HR, Collier CT, Anderson DB. Antibiotics as growth promotants: mode of action. AnimBiotechnol. 2002;13(1):29-42.
4. Ohimain E, Ofongo R. The effect of probiotic and prebiotic feed supplementation on chicken health and gut microflora; A review. International Journal of Animal and Veterinary Advances. 2012;4(2):135-143.
5. Patterson JA, Burkholder KM. Application of prebiotics and probiotics in poultry production. Poult Sci. 2003;82(4):627-31.
6. Masud AA, Rousham EK, Islam MA, Alam MU, Rahman M, Mamun MA et al. Drivers of antibiotic use in poultry production in Bangladesh: Dependencies and dynamics of a patron-client relationship. Front Vet Sci.2020;7:78.
7. Sweeney MT, Lubbers BV, Schwarz S, Watts JL. Applying definitions for multidrug resistance, extensive drug resistance and pandrug resistance to clinically significant livestock and companion animal bacterial pathogens. J AntimicrobChemother. 2018;73(6):1460-1463.
8. Al-Khalaifa H, Al-Nasser A, Al-Surayee T, Al-Kandari S, Al-Enzi N, Al-Sharrah Tet al.Effect of dietary probiotics and prebiotics on the performance of broiler chickens. Poult Sci. 2019;98(10):4465-4479.
9. Selaledi LA, Hassan ZM, Manyelo TG, Mabelebele M. The Current Status of the Alternative Use to Antibiotics in Poultry Production: An African Perspective. Antibiotics (Basel). 2020;9(9).
10. TetehE, Tona K, Decuypere E, Gbeassor M. Moringa oleifera leave: Hydro-alcoholic extract and effects on growth performance of broilers. International Journal of Poultry Science. 2013;12:401-405.
11. BianchinM, PereiraD, Almeida JDF,Moura CD, Pinheiro RS, Heldt LFS et al. Antioxidant properties of lyophilized rosemary and sage extracts and its effect to prevent lipid oxidation in poultry pate. Molecules. 2020;25(21).
12. Mirzadeh M, Lelekami AK, Khedmat L. Plant/algal polysaccharides extracted by microwave: A review on hypoglycemic, hypolipidemic, prebiotic, and immune-stimulatory effect. CarbohydrPolym. 2021;266:118134.
13. Kaneko K, Yamasaki Y, Tagawa Y, Tokunaga M, Tobisa M, Furuse M.Effects of dietary Japanese green tea powder on growth, meat ingredient and lipid

accumulation in broilers. Japanese of Poultry Science. 2001;38(5):J77-J85.
14. Khan SH. The use of green tea (*Camellia sinensis*) as a phytogenic substance in poultry diets. Onderstepoort J Vet Res. 2014;81(1):e1-e8.
15. Karori SM, Wachira FN, Wanyoko JK, Ngure RM. Antioxidant capacity of different types of tea products. African Journal of Biotechnology. 2007;6(19).
16. Abdo Z,Hassan R, El-Salam A, Helmy S.Effect of adding green tea and its aqueous extract as natural antioxidants to laying hen diet on productive, reproductive performance and egg quality during storage and its content of cholesterol. Egyptian Poultry Science Journal. 2010;30:1121-1149
17. Cabrera C, Gimenez R, Lopez MC. Determination of tea components with antioxidant activity. J Agric Food Chem. 2003; 51(15):4427-35.
18. Karori SM, Wachira FN, Wanyoko JK, Ngure RM. Antioxidant capacity of different types of tea products. African Journal of Biotechnology. 2007;6(19).
19. Chen X, Wenjun Z, Liu X, Li T, Geng Z, Wan X.The growth performance, meat quality, and gut bacteria of broilers raised with or without antibiotics and green tea powder. J. Appl. Poult. Res.2019; p. 28:712–721.
20. Chen H, Zhang M, Qu Z, Xie B. Antioxidant activities of different fractions of polysaccharide conjugates from green tea (*Camellia sinensis*). Food Chem. 2008, 2008: p. 106:559–563.
21. SaeedM,Khan MS,Kamboh AA, Alagawany M,Khafaga AF,Noreldin AE et al. L-theanine: An astounding sui generis amino acid in poultry nutrition. Poult Sci. 2020;99(11):5625-5636.
22. Biswas MR, Miyazaki Y, Nomura K, Wakita M. Influences of long-term feeding of Japanese green tea powder on laying performance and egg quality in hens. Asian Austral. J. Anim. 2000;13:980–985.
23. Cao BH, Karasawa Y, Guo YM. Effects of Green Tea Polyphenols and Fructo-oligosaccharides in Semi-purified Diets on Broilers' Performance and CaecalMicroflora and Their Metabolites. Asian-Australasian Journal of Animal Sciences. 2005;18(1):85-89.
24. Kaneko K, Yamasaki Y, Tagawa Y, Tokunaga M, Tobisa M, FuruseM.Effects of dietary Japanese green tea powder on growth, meat ingredient and lipid accumulation in broilers. Japanese of Poultry Science. 2001;38(5):J77-J85.
25. FAO, FAO Guidelines for the evaluation of probiotics in food. Report of a joint FAO/WHO working group on drafting guidelines for the evaluation of probiotics in food. London, Ontario, Canada 2002; 2002.
26. Markowiak P, Slizewsk K. The role of probiotics, prebiotics and synbiotics in animal nutrition. Gut Pathog. 2018;10:21.
27. Iriti M,Scarafoni A, Pierce S, Castorina G, Vitalini S. Soil Application of Effective Microorganisms (EM) Maintains Leaf Photosynthetic Efficiency, Increases Seed Yield and Quality Traits of Bean (*Phaseolus vulgaris* L.) Plants Grown on Different Substrates. Int J Mol Sci. 2019;20(9).
28. Reszka P, Dunislawska A, SlawinskaA, Siwek M, Kapelański W, BoguckaJ.Influence of the effective microorganisms (EM) on performance, intestinal morphology and gene expression in the jejunal mucosa of pigs fed different diets. J AnimPhysiolAnimNutr (Berl). 2020;104(5):1444-1453.
29. Johnson TJ, Youmans BP, Noll S, Cardona C, Evans NP,Karnezos TP et al. A Consistent and Predictable Commercial Broiler Chicken Bacterial Microbiota in Antibiotic-Free Production Displays Strong Correlations with Performance. Appl Environ Microbiol. 2018;84(12).
30. Soomro RN, MEA El-Hack, Shah SA, Taha AE, Alagawany M, Swelum AA et al. Impact of restricting feed and probiotic supplementation on growth performance, mortality and carcass traits of meat-type quails. Anim Sci J. 2019;90(10): 1388-1395.
31. Abd El-Hack MA, El-Saadony MT, Shafi ME, Qattan SYA, Batiha GE, Khafaga AF et al., Probiotics in poultry feed: A comprehensive review. J Anim PhysiolAnim Nutr (Berl). 2020;104(6): 1835-1850.
32. Bombik T, Bombik E, Frankowska A, Trawińska B, Saba L. Effect of herbal extracts on some haematological parameters of calves during rearing.Bulletin of the Veterinary Institute of Pulawy. 2012;56:655–658.
33. Duncan DB. Multiple Range and Multiple F-Test.Biometrics. 1955;11:1-5.
34. Biswas AH, Wakita M. Effect of Dietary Japanese Green Tea Powder Supplementation on Feed Utilization and Carcass Profiles in Broilers. The Journal of Poultry Science.2001;38(1):50-57.

35. Richards MP.Genetic regulation of feed intake and energy balance in poultry. Poult Sci. 2003;82(6):907-16.
36. Sarker MSK, Ko SY, Kim GM, Yang CJ. Effects of *Camellia sinensis* and mixed probiotics on the growth performance and body composition in broiler. Journal of Medicinal Plants Research. 2010;4:546-550.
37. Cao BH, Karasawa Y, Guo YM. Effects of Green Tea Polyphenols and Fructo-oligosaccharides in Semi-purified Diets on Broilers' Performance and CaecalMicroflora and Their Metabolites. Asian-Australasian Journal of Animal Sciences. 2005;18(1):85-89.
38. Hrnčár C, Bujko J. Effect of different levels of green tea (*Camellia sinensis*) on productive performance, carcass characteristics and organs of broiler chickens. Potravinarstvo Slovak Journal of Food Sciences. 2017; 11, 623–628.
39. Kaneko K, Yamasaki Y, Tagawa Y, Tokunaga M, Tobisa M, FuruseM.Effects of dietary Japanese green tea powder on growth, meat ingredient and lipid accumulation in broilers. Japanese of Poultry Science. 2001;38(5):J77-J85.
40. Yang CJ, Yang IY, Oh DH, Bae IH, Cho SG, Kong IG et al. Effect of green tea by-product on performance and body composition in broiler chicks'. Asian-Australasian Journal of Animal Sciences. 2003;16, 867–872.
41. Sarker MSK, Ko SY, Kim GM, Yang CJ. Effects of *Camellia sinensis* and mixed probiotics on the growth performance and body composition in broiler. Journal of Medicinal Plants Research, 2010;4:546-550.
42. Peng Q, Zeng XF, Zhu JL, Wang S, Liu XT, Hou CLet al., Effects of dietary *Lactobacillus plantarum* B1 on growth performance, intestinal microbiota, and short chain fatty acid profiles in broiler chickens. Poult Sci. 2016;95(4): 893-900.
43. Chen YC, Yu YH. Bacillus licheniformis-fermented products improve growth performance and the fecal microbiota community in broilers. Poult Sci. 2020;99(3):1432-1443.
44. Hamasalim HJ. Synbiotic as feed additives relating to animal health and performance. Advances in Microbiology. 2016;6(4):288-302.
45. Rahman AU, Khan S, Khan D, Hussain M, Ahmed S, Sohail SM et al. Use of probiotics in broiler feed at starter phase. Sarhad J. Agric. 2009;2590.
46. Abdel-Raheem SM, Abd-Allah SMS. The effect of single or combined dietary supplementation of mannanoligosacharide and probiotics on performance and slaughter characteristics of broilers. International Journal of Poultry Science. 2011;10(11).
47. Sohail MU, Hume ME, Byrd JA, Nisbet DJ, Ijaz A, Sohail A et al. Effect of supplementation of prebiotic mannan-oligosaccharides and probiotic mixture on growth performance of broilers subjected to chronic heat stress. Poult Sci. 2012;91(9):2235-40.
48. Mokhtari R, Yazdani AR, Rezaei M, GhorbaniB.The effect of different growth promoters on performance and carcass characteristics of broiler chickens. . Journal of Animal and Veterinary Advances. 2010;9:2633–2639.
49. OlnoodCG, Beski SSM, Hoct M, Iji PA. Novel probiotics: Their effects on growth performance, gut development, microbial community and activity of broiler chickens. AnimNutr. 2015;1(3):184-191.
50. Sarangi NR, Babu LK, Kumar A, Pradhan CR, Pati PK, Mishra JP. Effect of dietary supplementation of prebiotic, probiotic, and synbiotic on growth performance and carcass characteristics of broiler chickens. Vet World. 2016;9(3)::313-9.
51. Yousefi M, Karkoodi K. Effect of probiotic Thepax and Saccharomyces cerevisiae supplementation on performance and egg quality of laying hens. International Journal of Poultry Science.2007;6:52–54.
52. Molan AL, Flanagan J, Wei W, Moughan PJ. Selenium-containing green tea has higher antioxidant and prebiotic activitiesthan regular green tea. Food Chemistry. 2009b;114: 829-835.
53. Molan AL, Liu Z,Tiwari R. The ability of green tea to positively modulate key markers of gastrointestinal function in rats. Phytother Res. 2010;24(11):1614-9.
54. Serafini M, Ghiselli A, Ferro-Luzzi A. In vivo antioxidant effect of green and black tea in man. Eur J ClinNutr. 1996;50(1):28-32.
55. Xu J, Yang F, Chen L, Hu Y, Hu Q. Effect of selenium on increasing the antioxidant activity of tea leaves harvested during the early spring tea producing season. J Agric Food Chem.2003;51(4):p. 1081-4.
56. Ciraj AM, Sulaim J, Mamatha B, Gopalkrishna BK, Shivananda PG.

Antibacterial activity of black tea (Camelia sinensis) extract against Salmonella serotypes causing enteric fever. Indian J Med Sci. 2001;55(7):376-81.

57. Yam TS, S. Shah, Hamilton-Miller JM. Microbiological activity of whole and fractionated crude extracts of tea (*Camellia sinensis*), and of tea components. FEMS MicrobiolLett. 1997;152(1):169-74.
58. Cao BH, Karasawa Y, Guo YM. Effects of Green Tea Polyphenols and Fructo-oligosaccharides in Semi-purified Diets on Broilers' Performance and CaecalMicroflora and Their Metabolites. Asian-Australasian Journal of Animal Sciences. 2005;18(1):85-89.
59. Zou X, Xiao R, Li H, Liu T, Liao Y, Wang Y et al. Effect of a novel strain of Lactobacillus brevis M8 andtea polyphenol diets on performance, meat quality and intestinal microbiota in broilers. Italian Journal of Animal Science. 2018;17:396-407.
60. Yang CJ, Yang IY, Oh DH, Bae IH, Cho SG, Kong IG et al. Effect of green tea by-product on performance and body composition in broiler chicks. Asian-Australasian Journal of Animal Sciences. 2003;16:867–872.
61. Guray E, Ocak N, Altop A, Cankaya S, Aksoy HM, Ozturk E. Growth performance, meat quality and caecal coliform bacteria count of broiler chicks fed diet with green tea extract. . Asian-Australasian Journal of Animal Sciences. 2011;24:1128.
62. 62 Daramola O.T, Jimoh, O.A. Supplementation Value of *Cinnamomumceylon* Powder on Growth Performance, Serum Metabolites, Antioxidant Activities and Meat Analysis of Broiler Chickens. Asian J. Res. Animal Vet. Sci. . 2024 May 4 [cited 2024 May 29];7(2):150-8.
Available from: https://journalajravs.com/index.php/AJRAVS/article/view/300
63. Mallika EN, Kumari KNR, Sudheer K, Sunidhi, Ravikanth K, Ganguly B. Evaluation of some phytogenic feed supplements for lean meat production in commercial broiler chicken. Curr. J. Appl. Sci. Technol. [Internet]. 2020 Oct. 27 [cited 2024 May 29];39(32): 148-55.
Available:https://journalcjast.com/index.php/CJAST/article/view/2944
64. Afsharmanesh M, Sadaghi B. Effects of dietary alternatives (probiotic, green tea powder, and Kombucha tea) as antimicrobial growth promoters on growth, ileal nutrient digestibility, blood parameters, and immune response of broiler chickens. Comparative Clinical Pathology. 2014 May;23:717-24.



*Peer-review history:*
*The peer review history for this paper can be accessed here:*
*https://www.sdiarticle5.com/review-history/118333*