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EFFECT OF GREEN TEA POWDER AS AN ALTERNATIVE OF ANTIBIOTIC ON GROWTH PERFORMANCE, MEAT QUALITY AND BLOOD LIPID PROFILE OF BROILER

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ABSTRACT

A study was conducted with green tea powder to evaluate the effect on broiler growth, meat quality and the development of internal organ. The broiler growth, meat quality and the blood profile have been improving day by day by using green tea powder with poultry feed. The experiment design should be well planned. Biosecurity of experimental design was maintained properly. Feed intake, feed conversion ratio is efficient in experiment birds. The live weight gain was significantly ($P<0.05$) higher in the group of Green Tea in the feed. The initial body weights of group T_o, T_1, T_2, T_3 and T_4 day of the experiment were 176.8 ±1, 184.2±1.3, 185.1±1, 190.2±084, 180.2±1.22 gm respectively and after 35th day of experiment final body weight were 1972±3.22, 1992±2.77, 1940±3.17, 1778±3.52, 1918±2.81 gm respectively. The net body weight gains were 1795.2±2.22, 1807.8±1.47, 1754.9±2.17, 1727.8±2.68, 1737.8±1.52 gm respectively and economics of production were analyzed and found the net profit per broiler. Green tea powder has significantly impact on feed intake T_o, T_1, T_2, T_3 and T_4 respectively 3058± 4.23, 2971±4.01, 2995±5.57, 3208±4.3 and 3226±5.25 and increase body weight. Here the total cholesterol is lower in the group of broiler supplied green tea 0.5% and compare to other group of GT and antibiotic group. Triglyceride level showed significant ($P<0.01$) differences among different groups where highest level was found in T_1 and lowest in T_3 groups due to green tea powder concentration of blood plasma of broiler chicken.

Keywords: Green tea powder, broiler, antibiotic

INTRODUCTION

The green tea is the most important medicinal plant. Green tea powder (GTP) is obtained from green tea leaves (*Camellia sinensis*), stems and fruits (Uuganbayar *et al*. 2005, 2006). Green tea leaves contain many polyphenolic compounds such as epicatechin (EC), epicatechin 3 gallate (ECG), epigallocatechin (EGC), and epigallocatechin 3 gallate (EGCG) (Biswas and Wakita, 2001). They contain certain anti-viral and anti- bacterial properties that inhibit growth. In this study, 1% green tea and modified lipophilic green tea polyphenols (GTP and LTP) were used in combination with the most commonly prescribed antibiotics to study their effects on gram-positive, gram-negative, and acid-fast bacteria. The results indicated that 1% GTP and 1% LTP provided different synergistic effects on several antibiotics in various bacteria. These results suggest that 1% GTP and 1% LTP provide beneficial effects on selected antibiotics against microbial growth and are able to reverse the antibiotic resistance to susceptible. Green tea polyphenols could serve as natural alternatives to combat against antibiotic resistance pathogens (Haghjoo *et al*. 2013).

Green tea which is also popular beverage is taken from a non-oxidized and unfermented leaves of the evergreen plant Camellia sinensis that produce mainly in tropical and subtropical climates (Cao *et al.* 2005; Kundo, 2005). The chemical composition of poultry meat has a crucial role for a health driven market or gourmet market due to this color changes, fat contents are an important factor influencing the quality and acceptability of meat and meat products (Carpenter *et al.* 2007). Therefore, a common approach to maintain host health is to increase the number of desirable bacteria in order to inhibit colonization of invading pathogens (Guo *et al*. 2004). It was reported that green tea and its chemical components show antibiotic-like effects of non-selectively decreasing total counts of all micro-flora (Cao *et al.* 2005). Considering above circumstances, the present research aimed to examine the effect of different levels of green tea powder as a substitute for an antibiotic in broilers diets on productivity, carcass and meat quality, to evaluate the effect of powder of green tea on lipid profile of blood plasma of broiler chicken and to find out appropriate green tea probiotics for chicken.

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MATERIALS AND METHODS

The birds were reared in a personal farm at Kornia, adjacent to the HSTU campus, Basherhat, Dinajpur. The required laboratory works were done with proper management at operation theater, Faculty of veterinary medicine HSTU, Dinajpur.

Experimental birds

Hundred day old broiler chicks of "Cobb 500" strain were purchased from the dealer of Nourish poultry Hatchery Ltd. The chicks were properly exposed to heat that means brooding and management was carefully maintained as the company manual for up to 7 days. The birds were assigned to treatments with 4 replications having 5 chicks in each using completely randomized designed (CRD).

Control	Head	Treatment	No of Chicks per replication			
			R_1	R_2	R_3	R_4
Control T_0	20	Basal feed without additive	5	5	5	5
Group T_1	20	Basal feed with Green tea 0.5%	5	5	5	5
Group T_2	20	Basal feed with Green tea 1%	5	5	5	5
Group T_3	20	Basal feed with Green tea 2%	5	5	5	5
Group T_4	20	Basal feed with Oxytetracyclin 0. 1gm/kg	5	5	5	5
Total	100		25	25	25	25

Experimental design

Total of 100 of seven (07) days old "Cobb 500" broilers were randomly divided into five (5) equal groups (5×20) and each group is divided into 4 replication i.e. 4×5, then the group was numbered as group T_0, T_1, T_2, T_3 and T_4. Group T_0 was considered as control and fed with only commercial ration. Group T_1 was treated with supplementation of 5 gm of Green Tea per kg of feed, Group T_2 was treated with supplementation of 10 gm of Green Tea per kg of feed Group T_3 was treated with supplementation of 20gm of Green Tea per kg of feed and Group T_4 was treated with supplementation of 0.1 gm of Oxytetracyclin per kg of feed. Initial body weight of each bird was recorded (at day 07) before separation of birds in bamboo made floor (Macha). In every week the Body weight gain and feed intake was recorded up to the end of the experiment (i.e. 35 days of bird age) and total 10 birds were sacrificed for taking visceral organ weight and collect blood sample for hematological test (Total cholesterol, Triglyceride, LDL and HDL).

Research diets

T_0 = Control Group (Basal diet with supplement) + Fresh Drinking water
T_1 = Basal diet + 0.5 % GT powder+ fresh Drinking water
T_2 = Basal diet + 1 % GT powder+ fresh Drinking water
T_3 = Basal diet + 2 % GT powder+ fresh Drinking water
T_4 = Basal diet + Oxytertracycline 0.1gm/kg+ fresh Drinking water

Formulation of broiler ration

Experimental diets were formulated to meet the nutrient requirement of broiler suggested national research centre Govt. (NRC 1998). The starter diet vied for this study was ME 3000 Kcal/kg and CP 21.50% and the finisher diet was ME 3070 kcal/kg and CP 19% and another nutrient requirements are CF, EE, Ca, P, Lysine and methionine.

General management practices

Bach Bamboo cage was 2.5 ft × 2ft was allotted for 5 birds in the shed. After 10 days the litter materials were removed regularly. *Ad libitum* drinking water was supplied, required temperature and humidity was maintained for the chicks. The chicks are properly vaccinated at schedule time. Biosecurity of the farm was maintained properly.

Measurement of live weight

The live weight of each bird was measured with digital balance of day old chicks and after 7 days. Subsequently every 7 days interval the birds were weighted and recorded up to 35 days of bird age total 10 birds were sacrificed, processed and then weights (live, Heart, spleen, Bursa).

Blood Collection

Blood was collected from wing vein from each group in sterile syringe for hematological measurement as soon as possible of blood collection.

Total cholesterol (TC) determination procedure

At first blood sample was collected from wing vein of the experimental birds. Then the sample was centrifuged in the centrifugal machine at 1000 rpm for 15 minutes. Then the blood serum was separated from test tube. Cholesterol reagent was added in the serum test tube. Incubate the test tube for 10 minutes in room temperature. Optical density was measured. Then the concentration was determined. Finally the result was wrote down and analyzed.

Determination of HDL

The High Density lipid (HDL) reagent was added in blood serum in test tube. Then the test tube was centrifuged in the centrifugal machine at 1000 rpm for 15 minutes. 10 micro liter of serum was taken and determined for cholesterol level.

RESULTS

Live weight and live weight gain

The effects of feeding green tea as an alternative to antibiotic growth promoter in broiler diet are presented below:

Table1. Live weight and live weight gain

Live weight (g/bird)						
Age (wk)	T_0	T_1	T_2	T_3	T_4	significance
1st week	176.8 ±1.00^{c}	184.2±1.3^{b}	185.1±1.00^{b}	190.2 ±0.84^{a}	180.2 ±1.22^{c}	NS
2nd week	434.8.0 ±1.41^{e}	465.0 ± 1.34^{b}	484.8± 1.0^{a}	424.2 ±1.00^{d}	427.0 ±1.14^{d}	NS
3rd week	794.2.4 ±1.51^{d}	815.0 ±1.92^{c}	897.0± 1.14^{a}	763.0±1.58^{e}	832.4± 1.64^{b}	NS
4th week	1296.0± 2.95^{a}	1266.0± 2.58^{c}	1266.0 ±2.17^{c}	1225.0± 1.58^{d}	1276.0± 2.95^{b}	NS
5th week	1972.0 ±3.22^{b}	1992.0 ±2.77^{a}	1940.0 ±3.17^{c}	1778.0 ±3.52^{e}	1918.0± 2.81^{d}	*
Body weight gain (g/bird)						
1st week	131.8 ±1.44^{c}	142.2±1.51^{ab}	142.1±3.22^{ab}	144.2 ±1.64^{a}	136.2 ±2.21^{bc}	NS
2nd week	258.0 ±1.87^{c}	280.8 ± 3.22^{b}	299.7 ± 2.28^{a}	234.2 ±1.31^{e}	246.8 ±1.87^{d}	*
3rd week	359.4 ±3.05^{b}	350.0 ± 3.72^{b}	412.2 ± 3.11^{a}	338.8 ±2.70^{c}	405.4 ± 1.92^{a}	*
4th week	501.8 ± 2.88^{a}	451.0± 1.92^{c}	369.0 ±2.62^{e}	462.0 ± 2.38^{b}	443.6 ± 1.37^{d}	NS
5th week	676.0 ±3.42^{b}	726.0 ±2.70^{a}	674.0 ±2.34^{b}	553.0 ±2.62^{d}	642.0 ± 1.87^{c}	*

** = Significant at 1% level of significance.

* = Significant at 5% level of significance.

NS = Non significant

a,b,c,d,e Values with different superscripts in the same row differ significantly (P<0.05).

Live weight and live weight gain

The live weight and live weight gain of broilers supplemented with different levels of green tea and antibiotic compared with the control group were presented in Table 1. Here T_0 was control group, T_1 was 0.5% of GT powder, T_2 was 1.0% of GT powder, T_3 was 2.0% of GT powder and T_4 was 0.1 gm of OTC per kg feed. The live weight was significantly higher in T_1 group in compared with other groups. The live weight were almost similar (P>0.05) in all group from 2nd to 4th weeks of age. At 5th weeks of age, the body weight among the groups were significantly varied. Live weight gain did not significantly differed at 1st and 4th weeks of experiment but differed at 2nd, 3rd and 5th weeks of age. The live weight gain was significantly(P<0.05) higher in the group of Green Tea @ 0.5% (T_1- 451 gm) compared to control, antibiotic as well as other tea groups. At the end of 5th weeks of age, the highest (P<0.05) body weight and total body weight gain were found in broilers supplemented with green tea compared to the antibiotic and control group. Highest body weight was observed in the GT@ 0.5% (1992 g/b) group followed by GT@ 1.0% (1940 g/b), GT@2% (1778 g/b) and control group (1972 g/b) and antibiotic(1874g/b) respectively.

Feed intake

Feed consumption of birds during the experimental period is shown in Table 2. Here the feed intake of broilers at 1st and 3nd weeks of age was similar (P>0.05). Significant differences of feed intake were found among the groups at 2nd, 4th and 5th weeks of age. At the end of the experiment, higher total feed intake was observed in the antibiotic group compared to the other groups (P<0.05). The feed intake of these groups were control (T_0-3058 g/b), Green Tea @0.5% (T-2971g/b), Green Tea @ 1.0% (2995g/b), Green Tea @ 2% (3208 g/b) and antibiotic (3226 g/b) respectively.

Table 2. Feed intake (g/bird)

Age (wk)	T_0	T_1	T_2	T_3	T_4	significance
1st week	144.0 ± 1.58^{b}	145.0± 2.30^{b}	160.0 ± 2.63^{a}	145.0^{b} ± 2.88	143.0^{b} ± 2.07	NS
2nd week	446.0 ± 2.91^{e}	468.0± 3.05^{c}	500.0 ± 2.77^{a}	490.0 ± 2.42^{b}	457.0 ± 2.75^{d}	*
3rd week	1010.0± 7.07^{b}	975.0 ± 5.01^{c}	1011.0 ± 5.57^{ab}	1019.0± 3.41^{ab}	1027.0± 3.86^{a}	NS
4th week	1876.0 ± 12-97^{ab}	1831.0 ± 7.67^{c}	1848.0 ± 6.06^{bc}	1892.6 ± 22.35^{a}	1894.2 ± 22.35^{a}	*
5th week	3058.0±6.15^{b}	2973.0 ±9.22^{c}	2997.0±10.15^{c}	3214.0 ±6.04^{a}	3230.0 ± 9.03^{a}	*

** = Significant at 1% level of significance.
* = Significant at 5% level of significance.
NS = Non significant
a,b,c,d,e Values with different superscripts in the same row differ significantly (P<0.05).

Feed conversion ratio (FCR)

Feed conversion ratio (FCR) of birds during the experimental period is presented in Table 3. Feed conversion ratio did not differ among the dietary groups at 2nd week. Significant differences of feed conversion ratio varied significantly among the treatment groups and control group at 1st, 3rd, 4th and 5th weeks of age. Lowest but best FCR was obtained in group supplemented with 1% green tea.

Table 3. Feed conversion ratio (FCR) (feed/gain)

Age (wk)	T_0	T_1	T_2	T_3	T_4	Level of significance
1st week	0.81 ± 0.003^{b}	0.79± 0.003^{bc}	0.86± 0.002^{a}	0.76 ± 0.001^{c}	0.79 ± 0.003^{bc}	NS
2nd week	1.02± 0.012^{bc}	1.01±0.003^{c}	1.03± 0.008^{bc}	1.16± 0.005^{a}	1.06 ± 0.029^{b}	NS
3rd week	1.271 ± 0.08^{a}	1.196±0 .04^{b}	1.27 ± 0.06^{b}	1.315± 0.08^{a}	1.23± 0.08^{as}	NS
4th week	1.286± 0.52^{a}	1.425 ± 0.037^{a}	1.296± 0.043^{a}	1.416 ± 0.59^{a}	1.38 ± 0.28^{a}	*
5th week	1.55± 0.065^{bc}	1.491 ± 0.058^{c}	1.54± 0.048^{bc}	1.8± 0.66^{a}	1.68± 0.059^{ab}	*

** = Significant at 1% level of significance.
* = Significant at 5% level of significance.
NS = Non significant
a,b,c,d,e Values with different superscripts in the same row differ significantly (P<0.05).

Carcass yield

Weight of different internal organs such as thigh, breast, liver and heart of the birds of T_0, T_1, T_2, T_3 and T_4 are shown in the Table-4. Statistical analysis of the data did not show any difference between breast weights of the birds of different feeding groups.

Dressing percentage, thigh, liver and heart weight differed significantly (p>0.05) among the experimental birds. These parameters are significantly higher in tea supplemented and antibiotic group compared to control group.

Table 4. Carcass characteristics of broilers fed with Green Tea and antibiotic

Age (wk)	Dietary treatments					Level of significance
	T_0	**T_1**	**T_2**	**T_3**	**T_4**	
Carcass wt. (g)	1950.00 ± 18.16^{a}	1970.00 ± 2.00^{b}	1910.00 ± 2.94^{b}	1750.00± 3.67^{b}	1900.00 ± 1.22^{c}	*
Dressing yield	1267± 0.45^{a}	1300± 0.58^{a}	1279 ± 0.59^{a}	1370 ± 0.46^{b}	1235± 0.56^{ab}	NS
Thigh wt. (g)	221.90± 1.87^{c}	276.00 ± 1.51^{a}	234.00 ± 3.16^{b}	225.00 ± 1.81^{c}	213.00± 3.14^{d}	*
Breast wt. (g)	345.00± 3.53^{c}	386.00± 3.84^{a}	388.00 ± 1.64^{a}	357.00± 4.78^{b}	385.00± 1.84^{a}	NS
Liver wt. (g)	60± 0.01^{c}	53 ± 0.01^{b}	56 ± 0.02^{b}	63 ± 0.02^{a}	57± 0.02^{b}	NS
Heart wt. (g)	14 ± 0.01^{ab}	16± 0.01^{ab}	15 ± 0.01^{ab}	18± 0.02^{a}	12± 0.01^{b}	NS

** = Significant at 1% level of significance. * = Significant at 5% level of significance. NS = Non significant
a,b,c,d,e Values with different superscripts in the same row differ significantly (P<0.05).

Blood parameters

Hematological parameters of the experimental birds were shown in Table-5. It was found Green Tea has an effect on the blood profile. The cholesterol level did not vary significantly (P>0.05) in different groups. However, total cholesterol is lower in the group of broiler supplied green tea @ 0.5% compare to other group of green tea and antibiotic groups. Green Tea to broiler has no effect on LDL of blood profile. All results are near to similar of normal level.

Triglyceride level showed significant (P<0.01) differences among different groups where highest level was found in T_1 and lowest in T_3 groups.

Muramatsu *et al.* (1986) observed that tea leaves have effect on the cholesterol level. Minimum cholesterol level was found in the liver muscle (51.553mg/100g).

Table 5. Blood parameters of broilers fed diet with Green Tea @ 0.5, 1 and 2%, OTC @ 0.1 gm/kg feed.

Parameters	**T_0**	**T_1**	**T_2**	**T_3**	**T_4**	**Level of significance**
Total Cholesterol (mg/dl)	157.0± 2.77^{c}	145.0^{d} ± 1.92	217.0^{a} ± 2.77	215.0 ± 2.16^{a}	198.0 ± 1.64^{b}	NS
HDL (mg/dl)	17.0± 1.22^{c}	25.0 ± 1.00^{b}	25.0 ± 1.41^{b}	30.0± 2.07^{a}	32.0 ± 1.51^{a}	NS
LDL (mg/dl)	110.0 ± 4.59^{c}	145.0 ± 1.76^{b}	167.0 ± 2.42^{a}	168.0 ± 2.62^{a}	145.0 ± 2.40^{b}	NS
Triglyceride (mg/dl)	120.0 ± 4.46^{b}	140.0± 4.34^{a}	125.0± 2.05^{b}	85.0 ± 1.64^{d}	100.0 ± 2.98^{c}	**

** = Significant at 1% level of significance. * = Significant at 5% level of significance.
NS = Non significant
a,b,c,d,e Values with different superscripts in the same row differ significantly (P<0.05).

DISCUSSION

It has been reported that tea catechins have antibacterial activity against various pathogenic bacteria. The results indicate that 1% GTP and LTP provide different synergistic effects on several antibiotics in various bacteria. It was found that 1% GTP works the best synergistically against enterobacter aerogenes, making the resistant strain susceptible to 8 out of 12 antibiotics used. 1% LTP appeared to inhibit *E coli*, *E. aerogenes*, *S marescens* and *M smegmatis* which are gram-negative micro-organisms (Bobak Haghjoo *et al.*, 2013).

Antibiotic growth promoters (AGP) are used for improving feed utilization, increasing general health of chickens and subsequently improving their productive performances through different dose of action (Nasir and Grashorn, 2008). Although high dose of antibiotic use negative effects on environment and human health (AL-Harthi, 2002; Nasir and Grashorn, 2008). Although minimal dose of OTC the effect of weight gain compared

with those feed of the control diet. Green tea phytogenics are of pharmacologically active ingredients such as catechins, flavanols, flavadiols, flavonoids and phenolic acids (Katiyar and Mukhtar, 1996; Ahmad *et al*., 1998; Lin *et al.*, 1998). Chicken received GTP supplemented diets had significantly ($p<0.05$) greater body weight T_1 at 35 days of age than those fed the un-supplemented control diet. This increase was (T_1 =451 gm. & 726 gm.) at 35 days of age. This result indicated that 0.05 gm. /Kg diet had a similar potential to those of OTC suggesting that GTP may be a useful non-AGP. This improvement could be attributed to phytogenics due to their high content of pharmacologically active ingredients (Muramatsu *et al*., 1986; Toda *et al*., 1989). Feed consumptions of broilers significantly decrease due to supplementation with either level of GTP or OTC compared to the control diets only during 1-35 days. For the whole period 0.05gm /Kg feed significantly increase feed consumption by compare to that of the control group. Different internal organs like thigh muscle, liver, heart, breast muscle, carcass and dressing percentage can be measured. No significant differences breast muscle supplementing diet compared to the control group. There was significant interaction between carcass percentage, dressing yield, thigh muscle, liver, heart (Biswas and Wakita, 2001; Kaneko *et al*., 2001).

Green tea has an effect on the blood plasma constituents. Triglyceride level showed significant ($p<0.01$) difference among different groups at the age of 35 days. Similarly (Muramatsu *et al*., 1986) indicated that high cp diets enhanced lipid utilization by increased plasma triglyceride concentration.

CONCLUSIONS

From the above experiment we can conclude that green tea is considered for the prevention and treatment of many poultry diseases. It improves poultry health and increases farm production. Experimental broiler has good FCR and higher body weight gain during rearing with green tea powder. Experimental design must be more accurate and scientific for future research. More research studies are needed to conduct for drawing a right condition especially on green tea powder because of limited works are done in this potential supplement. All poultry farmers should be aware of the great impact of green tea powder on poultry health and poultry production for economic development of Bangladesh.

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