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THE GROWTH PERFORMANCE AND LIPID PROFILE OF BROILERS FED DIET WITH OR WITHOUT ANTIBIOTIC AND GREEN TEA (*CAMELLIA SINENSIS*) EXTRACT

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ARTICLE INFO	ABSTRACT
Received 14 March, 2021	This experiment was conducted to determine the optimum level of green tea extract (GTE) in diets
Revised 20 April, 2021	without antibiotics and to evaluate its effect on broiler performances. A total of 100 Cob broiler chicks were kept for a period of 5 weeks. Dietary treatments used in this experiment were antibiotic free group (basal diet as a control), GTE 0.5% (basal + GTE 0.5%), GTE 1% (basal + GTE 1%) and
Accepted	GTE 2% (basal + GTE 2%) and antibiotic added group (basal + 0.05% oxytetracycline). GTE
28 April, 2021	(FCR) than other treatments ($P < 0.05$) where highest live weight (2034 g/bird) was recorded in
Online	broilers group provided with 0.5% GTE. The best FCR (1.58) was observed in the group
May, 2021	supplemented with 0.5% GTE. The obtained results also revealed significant ($P < 0.05$) difference among treatments in the linid profile parameters (total cholesterol HDL and trialyceride except
Key words: Green tea extract Antibiotics Broiler Performances Lipid profile	LDL). Broilers treated with 0.5% GTE showed lowest total cholesterol (115.0 mg/dl), triglyceride (116.3 mg/dl) and highest HDL (30.75 mg/dl). In conclusion, GTE can be added in the diet @ 0.5% for better growth performances of broiler as an alternative to antibiotic without any negative effect on lipid profile.

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INTRODUCTION

Antibiotic growth promoters (AGP) are used in poultry production for improving feed utilization, increasing general health of chickens and subsequently improving their productive performance through different modes of action (Attia *et al.*, 2011), although excessive use of antibiotic had negative effects on environment and human health (AI-Harithi, 2002). Usage of antibiotics as growth promoter in poultry diet has been banned due to concerns about their residues in animal tissues (Roe and Pillai, 2003) and the inclusion of antibiotics to animal diet has also been banned in some parts of the world (Simon, 2006). Various plants and plant extracts having antimicrobial properties as well as growth promoting effects have been discovered as an alternative to AGP (Cross *et al.*, 2007; Sarker *et al.*, 2010; Toghyani *et al.*, 2010). Green tea is a promising plants which are reported to have antioxidant (Molan *et al.*, 2009; Sahin *et al.*, 2010) and antimicrobial (Erener *et al.*, 2011; Khan, 2014) activities due to the presence of polyphenols (Gramza *et al.*, 2005; Khan, 2014). The beneficial effects of GT by-products (Yang *et al.*, 2014) on performance and health of poultry have been reported. Green tea extract is obtained from a nonoxidized and unfermented leaves of the evergreen plant *Camellia sinensis* that grows mainly in tropical and sub-tropical climates. The most abundant constituent of green tea extracts (GTE) is catechins which has antibacterial activities (Cao *et al.*, 2005; Hara-Kudo, 2005), as well as antitumorigenic, anti-inflammatory, antiproliferative, antiviral, anti-parasitic and antioxidative properties (Crespy and Williamson, 2004).

The GTE is a rich source of polyphenolic compounds and could possess strong antioxidant properties (Crespy and Williamson, 2004). However, studies comparing the effects of green tea extract (GTE) and antibiotics on broiler performance are limited. The present study tested the hypothesis that GTE and antibiotics may differently influence the growth and serum lipid profile of broiler chickens.

MATERIALS AND METHODS

Experimental products

The GTE used in this study was processed manually. Green tea leaves were cleaned and sun dried after collection. The leaves were grounded properly by a grinder machine. GTE was collected after mixing of dried green tea powder with distilled water that were sonicated for 3 hour, filtered and finally extracted following the methods developed by Samuel *et al.*, (2009).

Experimental birds and husbandry

A total of 100-day-old Cobb 500 broiler chicks were randomly assigned to 5 treatments containing 4 replicates of 5 chicks each maintained in gable type open sided house. The treatments consisted of a control, diets supplemented with three levels (0.5%, 1.0% and 2.0%) of GTE and antibiotic (0.05% Oxytetracycline) that was denoted as T_0 , T_1 , T_2 , T_3 and T_4 respectively. The extract was sprayed onto a small quantity of the feed and mixed thoroughly. The remaining feed was then added gradually and mixed to ensure a uniform distribution of the extract. All diets were formulated to meet the NRC (1994) requirements of broilers. The birds were reared on two growth phases namely, starter and finisher periods (Table 1). The temperature of the house was adapted to the stage of growth. Lighting regime was 23 h from day 1 to day 7 and 20 h from day 8 to the end of the experiment. Feed and water were provided ad-libitum throughout the experimental period.

Vaccination programme

The chicks were vaccinated against Newcastle disease (Ranikhet) and Infectious bursal disease (Gumboro) as per Table 2.

Table	1.	Formulation	of	commercial	ration	(kg/100	kg
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Ingredients	Broiler starter	Broiler finisher
Maize	43.00 kg	43.64 kg
Wheat	10.00 kg	10.00 kg
Rice polish	4.00 kg	10.00 kg
Soybean	26.00 kg	22.50 kg
Meat and Bone meal	9.00 kg	8.00 kg
Oyster shell	1.00 kg	1.00 kg
Salt	300 g	250 g
Methionine	200 g	180 g
Lysine	30 g	30 g
Vitamin Premix (broiler)	250 g	250 g
Feed zyme	-	50 g
Soybean oil	6.5 kg	4.00 kg
DCP	2.50 g	-
Choline chloride	100 g	100 g
Total	100.00 kg	100.00 kg

Source: Nourish Poultry and Hatchery Ltd.[®], Bangladesh

Table 2. The vaccination schedule of commercial broiler

Age of	Name and type of	Preparation of	Dose and route of
birds (day)	vaccine	dilution	administration
5	BCRDV freeze dried live vaccine	1 ampoule was diluted with 6 ml of distilled water	One drop in each eye
11	Nobilis Gumboro D 78 freeze dried live vaccine	1 ampoule was diluted with 36 ml of distilled water	One drop in each eye
18	BCRDV (Booster dose) freeze dried live vaccine	As used in day 5	One drop in each eye
21	Nobilis Gumboro D 78 (Booster dose) freeze dried live vaccine	As used in day 11	One drop in each eye

Source: BCRDV- Livestock Research Institute (LRI), Mohakhali, Dhaka, Nobilisgumboro D 78[®]- Intervet, International B.V.,Boxmeer, Holland.

Measurements

Growth performance parameters

Experimental birds were weighed initially and weekly basis for all birds from each replication for determination of initial live weight (ILW) and final live weight (FLW). Feed intake was calculated as the total feed consumed in each replication divided by the number of birds. Feed efficiency (FE) was calculated as the amount of feed consumed per unit of weight gain. Birds were checked for mortality once daily to estimate the livability percentage.

Serum lipid profile

From each treatment, birds were randomly selected for blood sampling at 35 d of age. Blood samples were collected from the wing vein into test tubes without anticoagulant, kept in the refrigerator overnight, then centrifuged to separate serum. The collected serum samples were stored at -20°C for further analysis. Triglycerides, total cholesterol and high-density lipoprotein cholesterol (HDL-C) were determined according to the methods of Bucolo and David (1973), Zak *et al.*, (1954) and Naito (1984) respectively. Very low-density lipoprotein cholesterol (VLDL-C) was calculated via dividing triglyceride levels by 5 and low-density lipoprotein cholesterol (LDL-C) was calculated as the difference between total cholesterol and the combined concentrations of HDL-C and VLDL-C.

Statistical analysis

The experimental design was complete randomized design (CRD). One-way analysis of variance (ANOVA) was conducted to determine the effect of the different treatments. Mean testing (least significant difference) was performed to determine whether significant differences exist among treatments at P < 0.05. All data were expressed as mean \pm SEM. SPSS (Version 20.00) was used for data analysis.

RESULTS AND DISCUSSION

Growth performance parameters

Inclusion of GTE and antibiotics in the experimental diets significantly affect the measured growth performance parameters (BW, FI and FCR) throughout the experimental periods (Table 3). The heaviest BW and the best FCRs were observed in broilers fed on diets supplemented with 0.5% and 1.0% of GTE, respectively. A linear trend (P < 0.05) was observed in the FCR in diets containing an increasing amount of GTE. No significant difference (P > 0.05) was observed among treatments in terms of mortality (data not presented).

GTEs are considered to provide health benefits as it contain high levels of polyphenolic catechins (epigallocatechin, epigallocatechin gallate and epicatechin gallate). For instance, green tea polyphenols are thought to interact with proteins and phospholipids in the plasma membrane, regulating signal transduction pathways, transcription factors, DNA methylation, mitochondrial function and autophagy (Kim *et al.*, 2014). Erener *et al.*, (2011) and Shahid *et al.*, (2013) showed a positive effect on the growth performance of broiler chickens when supplementing their diet with 200 mg/kg of GTE. Kaneko *et al.*, (2001) observed the beneficial effect of green tea on the productive performance and lean meat production of the broilers. Sarker *et al.*, (2010) reported that the diet containing 0.5% green tea was effective for the growth performance and meat composition of broilers.

Nevertheless, Khalaji *et al.*, (2011) did not observe a significant improvement in growth performance in a feed diet supplemented with GTE at a level of 300 mg/kg. The unextracted green tea powder has been reported to possess a favourable effect on broiler growth performance when supplemented at levels up to 10,000 mg/kg (Kaneko *et al.*, 2001; El-Deek *et al.*, 2012). The source of green tea raw material, as well as the processing and extraction conditions used in the preparation of extracts, has a direct impact on the phytochemical composition of the resulting extract (Labbé *et al.*, 2006). The growth promoting agents may have more impact when the diet used is less digestible and well-nourished, healthy chicks do not respond to antibiotic supplements provided that they are housed under the clean and disinfected conditions (Cross *et al.*, 2007; Toghyani *et al.*, 2010).

Increasing the level of dietary polyphenols due to increasing the inclusion rate of GTE could be responsible for the observed negative linear effect on the FCR of the current study. This effect could be attributed to the composition of the basal diet, origin and polyphenols of the green tea used and the time of harvest, the preparation method of phytogenic additive and/or the environmental conditions (Yang *et al.,* 2009). The bird liveability in this study was very high with no significant difference among treatments. This may be due to the use of easily digestible diets, lack of disease challenges and/or rearing chickens under clean environments.

Parameters		Dietary	treatment			Level of
Farameters	T₀	T ₁	T ₂	T ₃	T ₄	significance
ILW (g/bird)	42.17±0.07	42.28±0.07	42.06±0.09	42.12±0.05	42.30±0.15	NS
FLW at 35 days (g/bird)	1887.0±3.74ª	2034.0±2.16 ^e	1961.0± 1.47 ^d	1935.0±1.19 ^c	1903.0±4.29 ^b	*
Total FI (g/bird)	3194.0 ±1.87 ^d	3148.0 ±3.34 ^b	3152.0 ±1.08 ^b	3173.0±1.08 [°]	3097.0±3.34 ^ª	*
FE	1.63 ±0.02 ^b	1.58 ±0.01 ^a	1.60 ±0.02 ^b	1.61 ±.002 ^b	1.62 ±0.01 [♭]	*

Table 3. Effect of dietary green tea extract and antibiotic on broiler performances

 T_0 = Control, T_1 = basal + GTE 0.5%, T_2 = basal + GTE 1%, T_3 = basal + GTE 2%, T_4 = basal + 0.05% oxytetracycline, ILW = Initial live weight, FLW = Final live weight, FI = Feed intake, FE = Feed efficiency, NS = Non-significant at 5% level of probability, Values indicate Mean ± Standard error of mean (SEM). ^{a, b, c, d, e} means bearing different superscripts in a row differ significantly. * = (P < 0.05).

Table 4. Effect of dietary green tea extract and antibiotic on the serum lipid profile of 35-d-old broiler chickens (mg/dl)

Parameters		Level of				
	To	T ₁	T ₂	T ₃	T ₄	significance
Total	156.0±2.55 ^d	115.0±2.16ª	124.4±1.87 ^b	141.6±1.08 ^c	197.3±1.08 ^e	*
HDL	16.25±0.85 ^b	30.75±1.47 ^a	12.24±0.71 ^ª	20.50±1.08 ^c	25.40±1.08 ^d	*
LDL	119.3±1.40	118.7±1.19	116.3±2.27	115.8±2.24	117.2±1.42	NS
Triglyceride	124.7±1.47 ^b	116.3±1.47 ^ª	117.2±1.08 ^ª	118.8±1.04 ^ª	132.3±1.3 [°]	*

 T_0 = Control, T_1 = basal + GTE 0.5%, T_2 = basal + GTE 1%, T_3 = basal + GTE 2%, T_4 = basal + 0.05% oxytetracycline, NS = Non-significant at 5% level of probability, Values indicate Mean ± Standard error of mean (SEM). ^{a, b, c, d, e} means bearing different superscripts in a row differ significantly. * = (P < 0.05).

Serum lipid profile

There were significant differences (P < 0.05) in the measured serum lipid parameters (Total cholesterol, HDL and triglyceride except LDL) between broilers fed on the control diet or diets supplemented with GTE or antibiotics. Research conducted by Muramatsu *et al.*, (1986) and Yoshino *et al.*, (1994) confirmed the hypocholesterolimic and hypolipidemic properties of green tea polyphenols either via reduced absorption of dietary and biliary cholesterol and increased faecal excretion (Koo and Noh, 2007) and/or inhibition of cholesterol synthesis in the liver through inactivation of 3-hydroxy-3-methylglutaryl coenzyme A reductase and activation of adenosine monophosphate kinase (Singh *et al.*, 2009). Khalaji *et al.*, (2011) revealed a significant reduction in the total cholesterol at 500 mg/kg of GTE. 1.0 and 2.0% green tea extract with lard/cholesterol diets significantly reduced blood cholesterol level in rats (Muramatsu *et al.*, 1986). 0.5 to 1.5% green tea supplementation in broiler diets and 1.0% to 2.0% green tea powder on layers had effects on reducing the cholesterol content of broiler meat and egg yolk of layers (Uuganbayar *et al.*, 2006).

CONCLUSION

GTE supplementation may be suitable for growth performance as it improves feed efficiency of broilers compared to antibiotic added feed. Incorporation of GTE in the feed at 0.5% is favorable to the consumers because it assists to produce broilers with less fat and cholesterol deposition without antibiotic addition. Furthermore, growth performance parameters were not adversely affected. GTE may be an efficient alternative to AGP.

CONFLICT OF INTEREST

The author declares that there is no conflict of interests regarding the publication of this paper.

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