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Original Article

Effects of Grape Seed Powder on Productive Performance, Lipid Profile and Total Bacteria in Duodenum and Ceca of Broiler Chickens

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Abstract

Intensive broiler production exposed the birds to several stressors, such as environmental factors, crowding and vaccination. However, when free radical is higher than physiological tolerance cause oxidative stress. This study aimed to investigate the effect of supplementing different levels of grape seed powder to a broiler diet on productive performance, lipid profile and bacterial count of the duodenum and cecum. A total of 180 unsexed one-day-old broiler chicks (Ross 308). Birds were randomly distributed to four dietary treatments (three replicates/treatment, 15 chicks/pen). T1: (control) without addition, T2, T3, and T4, (1, 2, 3) % grape seed powder /kg diet, respectively. Results indicated that final body (42 days of age) and accumulative weight gain, and feed conversion ratio were significantly (P<0.05) better in T2 and T3 (2 and 3) % grape seed powder/kg diet. Blood glucose concentration, cholesterol, Triglyceride, LDL, and MDA were significantly (P<0.05) decreased in T3 and T4 compared with other groups. While there were significant (P<0.05) increases in HDL and Glutathione peroxidase in T3 and T4. There was a significant (P<0.05) decrease in total aerobic bacteria and clone bacteria and a significant increase (P<0.05) in lactobacillus of duodenum and ceca for T3 and T4, respectively. It could be concluded from this study that adding grape seed powder at levels of (2 and 3) % has beneficial effects on productive performance, lipid profile and microbial count of duodenum and ceca.

Keywords: Grape, Productive performance, Lipid profile, Broiler chickens

1. Introduction

Intensive broiler production exposed the birds to several stressors, such as environmental factors, crowding and vaccination. However, when free radical is higher than physiological tolerance cause oxidative stress (1). Oxidative stress is a factor that induces several diseases (inflammation, diabetes, skin lesions and neurological diseases) (2) and reduce growth, Immune suppression and increase lipid peroxidation (3), Synthetic antioxidant (BHA and BHT) is important phenolic compound to stabilize the feed, but natural antioxidant has become the focus for protecting the feeds (4). Grapes (Vitis vinifera) are rich sources of polyphenol compounds, which exert antioxidant, anti-inflammatory and antibacterial activity (5) immunostimulant (6). It has been shown that grape by-products improve the ecosystem of intestinal microflora of birds. Viveros, Chamorro (7) reported that dietary polyphenol products might be effective for beneficial bacteria growth, which resulted in growth performance. El-Damrawy (8) reported that supplementing the broiler diet with grape extracts lower plasma lipid concentration and enhances antioxidant and immunostimulant status (6). Therefore, the present study was designed to investigate the effect of supplementing different levels of grape seed

powder to a broiler diet on productive performance, lipid profile and bacterial count of the duodenum and cecum.

2. Materials and Methods

2.1. Study Design

This study was conducted to study the effect of adding different levels of grape seed powder to a broiler diet on productive performance, lipid profile and microbial bacteria in the duodenum and ceca. A total of 180 unsexed (Ross 308) broiler chicks were randomly distributed to four dietary treatments with three replicate pens/treatments (15 birds/pen): Treatments were as follows, T1: control; T2; T3; and T4 were feed 1, 2, 3% grape seed powder in their diets, from 1-42 days of age. Table 1 shows the chemical composition of the diet according to National Research Council (9). Average live weight, accumulative weight gain, feed consumption and feed conversion ratio were measured at 21 and 42 days. At 42 days of age, blood samples were randomly taken from 3 birds/treatment with equal average body weight. Glucose concentration and high-density lipoprotein (HDL) were measured according to a method previously described by Tietz, Finley (10), and low-density lipoprotein (LHL) was measured according to a method previously described by Grundy, Cleeman (11). The triglyceride was measured according to a method previously described by Fossati (12).

Table 1. Composition of the experimental diets

Ingredients, %	Starter diets	Finisher diets
	1-21 day	22-42 day
Yellow corn	51.0	54.0
Wheat	12.5	11.5
SBM (44%)	22.0	24.0
Protein con (40%)	10.0	10.0
Sunflower oil	1.5	1.5
Limestone	0.7	0.7
NaCl	0.3	0.3
Calculated composition of the experimental diet according to the National Research Council (9)		
CP (%)	21.49	20.0
ME/kg (Kcal)	2990.5	3150
Ca (%)	1.43	1.26
P,ava., (%)	0.67	0.57
Lysine (%)	1.22	1.14
Meth+Cys (%)	0.62	0.58

Protein conc. Provide per kg: 44% protein ; 2100 kcal ; fat 3.51%; lysine 3.90% ; 3.90% methionine+cystine ; 6% calcium; 3% available phosphorus and vitamins and mineral is which meet National Research Council (9)

Total protein and globulin were measured according to a method previously described by King and Wootton (13) and Marshall, Lapsley (14), respectively.

Glutathione peroxidase was measured according to a method previously described by Rotruck (15). Plasma AST and ALT were measured according to a method previously described by Reitman and Frankel (16). While microbial counts were measured according to the American Public Health Association protocol (17).

2.2. Statistical Analysis

Data were analyzed according to a Randomized complete design, and significant means were compared by Duncan multiple range tests (18) and statistical analysis (19).

3. Results and Discussion

The effect of supplementing different levels of grape seed powder in the diet on productive performance is presented in table 2. Results indicated that birds consuming a diet containing 3 and 4 % grape seed had significantly (P<0.05) higher final live body weight, accumulative average gain and feed consumption than those in the control group and the animals in T2. Feeding grape seed powder has not had any significant effects on the feed conversion ratio (g. feed / g. gain) (P>0.05). Supplementation of grape seed powder at 2 and 3 % improved final body weight by 2.19% and 2.79% for T3 and T4, respectively, over the control group (T1).

Table 3 summarises the effect of grape seed powder supplementation on cholesterol, triglyceride, High-density lipoprotein and low-density lipoprotein concentration. Grape seed powder treatments lead to a significant (P<0.05) decrease in plasma concentration of cholesterol, triglyceride and low-density lipoprotein for treatments T3 and T4 compared with the control group (T1) and did not differ significantly from treatment T2 in plasma concentration of (TG) and (LDL). High-density lipoprotein (HDL) was significantly higher in T4 than in treatment T1, While plasma concentration of (HDL) in T4 did not statically differ compared with T2 and T3.

Total aerobic bacteria and colon bacteria in the duodenum and ceca were significantly (P<0.05) decreased in T4 compared with the (T1), while total bacteria in (T4) was not (P<0.05) different compared with (T2) group. *Lactobacilli spp* bacteria in duodenum and ceca were significantly (P<0.05) higher in the T4 group over the control (T1), while *lactobacilli spp* bacteria in T4 was not significantly different compared with (T2) (Table 4).

Table 2. Effect of dietary treatment on productive performance of broiler chickens at 21 and 42 days of age

From0-21 days of age	Grape seed powder %				Levels of significance
	T1 (0 %)	T2 (1 %)	T3 (2 %)	T4 (3 %)	
Avg.body weiht (g)	854.70±7.92^{b}	895.24±5.29^{a}	874.65±13.10^{ab}	902.29±9.25^{a}	*
Avg. gain (g)	763.44±11.65	773.82±14.25	766.71±9.32	800.44±11.79	NS
Avg. feed intake (g)	1183.77±11.39	1194±8.75	1190.10±12.36	1201.00±15.37	NS
Feed conversion ratio	1.55±0.03	1.54±0.02	1.55±0.03	1.50±0.01	N.S
From 22-42 days of age					
Avg.body weiht (g)	2765.92±13.78^{b}	2776.25±17.30^{b}	2828.10±12.25^{a}	2845.41±15.4^{a}	*
Avg. gain (g)	2712.11±10.22^{b}	2736.81±11.98^{b}	2784.48±17.71^{a}	2802.25±16.71^{a}	*
Avg. feed intake (g)	4518±7.88^{b}	4525±12.17^{b}	4565.74±13.43^{a}	4585±11.02^{a}	*
Feed conversion ratio	1.67±0.007	1.65±0.009	1.64±0.014	1.64±0.011	NS

a,b means *(P<0.05) N.S : Not significant

Table 3. Plasma lipid at 42 days (mg/100ml) plasma

parameter	Grape seed powder %				Levels of significance
	T1 (0 %)	T2 (1 %)	T3 (2 %)	T4 (3 %)	
Cholesterol	77.29±8.32^{a}	62.18±8.91^{ab}	41.71±5.79^{b}	43.90±7.06^{b}	*
Triglycerides	160.40±5.84^{a}	149.39±6.26^{a}	122.94±4.98^{b}	109.45±7.77^{b}	*
HDL	78.48±5.10^{b}	85.96±5.62^{ab}	86.43±6.07^{ab}	96.11±4.45^{a}	*
LDL	55.24±6.63^{a}	42.91±3.62^{ab}	38.73±5.13^{b}	32.97±4.02^{b}	*

a,b means *(P<0.05)

Table 4. Effect of supplementing grape seed powder on the aerobic, Colom and *Lactobacilli* bacteria of duodenum and ceca (cfu/g) at 42 days of age

TREATMENTS	Duodenum			Ceca		
	Aerobic bacteria	Colon bacteria	*Lactobacilli* bacteria	Aerobic bacteria	Colon bacteria	*Lactobacilli* bacteria
T1	5.21±0.05^{a}	11.28±0.06^{a}	3.72±0.07^{b}	3.91±0.05^{a}	7.33±0.06^{a}	2.91±0.07^{b}
T2	5.01±0.06^{a}	11.19±0.10^{a}	3.88±0.6^{b}	3.77±0.06^{ab}	7.09±0.07^{ab}	2.99±0.04^{ab}
T3	4.52±0.09^{a}	10.81±0.09^{ab}	4.46±0.08^{a}	3.46±0.02^{b}	6.82±0.08^{a}	3.50±0.06^{a}
T4	4.37±0.10^{b}	10.47±0.7^{b}	4.69±0.09^{a}	3.23±0.06^{b}	6.99±0.10^{b}	3.81±0.09^{a}
Levels of significance	*	*	*	*	*	*

a,b means *(P<0.05)

Lichovnikova, Kalhotka (20) reported that the increase in *lactobacilli* bacteria (beneficial) and the decrease in pathogenic bacteria could be related to the antibacterial and antioxidant activity of phenolic compounds in grape seeds (21).

Table 5 showed that there was a significant (P<0.05) decrease in malondialdehyde in all experimental groups as compared with the control group (T1), while glutathioperoxidase was significantly (P<0.05) increased in T3 and T4 groups. Lipid peroxidation results from the imbalance between oxidation and antioxidant defence system (22) and impaired muscle membrane system. Malondialdehyde is a marker for lipid peroxidation (23). Flavonoids are potent antioxidants and can terminate oxidative reactions by scavenging free radicals.

There was a significant (P<0.05) decrease in plasma glucose concentration (T3 and T4) as compared with the control group (T1). This decrease in glucose concentration could be due to proanthocyanidins, which have been shown to have cholesterol-lowering activity (24) (Table 6).

Table 5. Effect of dietary grape seed powder on plasma glutathione peroxidase (GSH-PX), malondialdehyde (MDA) (µmol/mL) aspartate transaminase (AST) and alanine transaminase (ALT) (mg/100ml)

parameter	Grape seed powder %				Levels of significance
	T1 (0 %)	T2 (1 %)	T3 (2 %)	T4 (3 %)	
GSH-PX, umol/mol	4.71±0.61^{b}	4.98±0.13^{b}	6.32±0.16^{a}	6.92±0.12^{a}	*
MDA, umol/mol	205.24±5.87^{a}	176.14±3.15^{b}	182.89±6.04^{b}	167.00±5.86^{b}	*

a,b means *(P<0.05); GSH; glutathionperoxidase : MDA, malondialdehyde

Table 6. Effect of supplementing different levels of grape seed powder on glucose (mg/100ml), AST and ALT enzyme (Iu/ L plasma)

parameter	Grape seed powder %				Levels of significance
	T1 (0 %)	T2 (1 %)	T3 (2 %)	T4 (3 %)	
Glucose	241.72±12.00^{a}	219.81±6.11^{ab}	201.97±13.34^{b}	195.63±11.89^{b}	*
ALT	19.45±0.90	18.75±0.39	17.58±0.74	17.11±0.57	NS
AST	28.83±0.76	28.21±0.41	26.18±1.17	25.91±1.5	N.S

a,b means *(P<0.05); N.S: not significant; AST: Aspartate transaminatinase; ALT: Alnine transaminase

Authors' Contribution

Study concept and design: A. S. N.
Acquisition of data: H. E. A.
Analysis and interpretation of data: A. H. K.
Drafting of the manuscript: A. S. N.
Critical revision of the manuscript for important intellectual content: A. S. N.
Statistical analysis: H. E. A.
Administrative, technical, and material support: A. H. K.

Ethics

All the ethical standards were approved by the ethics committee of the Al-Qasim Green University, Al Qasim, Iraq.

Conflict of Interest

The authors declare that they have no conflict of interest.

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