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EVALUATION OF USING GINGER (*ZINGIBER OFFICINALE*) ON GROWTH PERFORMANCE, CARCASS CHARACTERISTICS, BLOOD BIOCHEMISTRY AND IMMUNE RESPONSES OF QUAIL BIRDS

El-kashef. M. M. A.

Dep.t of Anim. and Poult. Prod., Facu. of Enviro. Agric. Sci., Arish Uni, Egypt.

Corresponding author: El-kashef. M. M. A.Email: melkashef89@yahoo.com

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ABSTRACT: This study was conducted to evaluate the effect of different levels of Ginger **(***Zingiber officinale)* on growth performance, immunity response, some blood biochemical and hematological parameters of quail birds. A total of 180, one day-old quail birds were divided into four treatment groups, with three replicates per treatment and 15 birds per replicate. Birds in control group were fed basal diet. Birds in treatment groups were fed on diets supplemented with 0.25, 0.50 and 0.75% Ginger. Body weights and feed intake of birds were measured weekly. Feed conversion was calculated, accordingly. Blood samples of three birds per replicate were collected at 42 days of age for biochemical and hematological analysis. At the end of experiment, three birds were taken randomly from each replicate and slaughtered, and the spleen, thymus and bursa were separated and weighted. Results of this experiment showed that, supplementing of Ginger to quail diets improved body weight gain and feed conversion ratio of quail birds ($P<0.05$), and also increased total protein and albumin levels ($P \leq 0.05$). On the other hand, supplementing Ginger decreased serum triglyceride and plasma cholesterol levels in all treatments compared with control. In addition, high-density cholesterol fraction increased and low-density cholesterol fraction decreased in all treatments groups compared with control group. Birds fed Ginger significantly improved spleen, thymus and bursa percentage/body weight compared with control group. Plasma ALT and AST decreased in all levels of Ginger and could indicate good liver health.

In conclusion, results of this study showed that addition of Ginger showed a positive influence on growth performance, blood biochemical parameters, immune-responsiveness and it could be considered as a growth promoter agent for quail birds.

Key words: Ginger, growth performance, blood biochemistry and immune-responsiveness.

INTRODUCTION

The poultry industry aims to provide protein for human consumption at an affordable cost. Nowadays, poultry meat is one of the sources of animal protein and can contribute to filling the deficit resulting from the consumption of animal protein from red meat which led to increasing demand for poultry meat. Quails are a type of poultry of economic importance due to their quick growth, short maturity period, less space needed for breeding, resistance to most diseases and short incubation time (*Rahmani et al., 2014).* Generally, birds under intensive production systems are exposed to stress due to sudden changes in temperature, transportation, parasites, and vaccination (*Zhang et al., 2009).* All of these factors negatively affected poultry productive efficiency and carcass characteristics and lead to immune system imbalance (*Lan et al., 2004).* So, antibiotics have been used for several years all over the world as a growth promoter to control and prevent pathogenic bacteria to improve the production. However, there has become a great need for not using antibiotics in the poultry industry due to the miss-using of antibiotics in poultry production and the remnants of these substances in meat tissues in addition to the development of antibiotic-resistant bacteria (*Burgat, 1991 and Shahin et al., 2002).* So, the European Union decided in 2006 to ban the use of antibiotics as a growth promoter (*Eckert et al., 2010 and Khan et al., 2012).* Since that time, there has been an interest in improving poultry health by using Eco-friendly products such as herbs and medicinal plants that have attracted attention due to the safe effect of their active substances. Where medicinal plants are considered as a good and effective alternative for antibiotics due to its impact on the different physiological systems of animals, activities on the immune system, endocrine system, and digestive system. In addition, to the fact that these plants possess many active components such as active substances, antioxidants, anti-inflammatory and anti-microbial activities (*Nasir and Grashorn, 2010 & Khan et al., 2012).*

Medicinal plants are characterized as available, cheap source with no side effects on health and are digested easily. *Zingiber offcinale* is one of these plants and also known as Ginger, (*Han et al., 2013*). Ginger is used to treat many diseases as it possesses antibacterial, anticancer (*Citronberg et al., 2013*), anti-parasitic, antimicrobial (*Kumar et al., 2014*), antioxidants (*Nile and park 2015*), anti-inflammatory (*Zhang et al., 2016*) and antiseptic materials (*Ali et al., 2008*). In addition, Ginger contains many biologically active compounds such as phenolic and terpene compounds. The phenolic compounds are mainly gingerol, shogaols, paradols, gingerdiol and gingerdione (*Zhao et al., 2011; Stoner, 2013; Liu et al., 2019*). Also, Ginger contains significant amounts of iron, calcium, magnesium, selenium, zinc, vitamin E and vitamin C (*Shirin and Jamuna, 2010*). Therefore, this study was conducted to evaluate the effect of different levels of *Zingiber officinale* on growth, carcass traits, immunity and some blood biochemical and hematological parameters of quail birds.

MATERIALS AND METHODS

Study area:

This study was carried out at the Animal Production Farm of the Department of Animal and Poultry Production, Faculty of Environmental Agricultural Sciences,

Arish University, El Arish, North Sinai Governorate, Egypt.

Experimental birds and design:

One hundred and eighteen quail birds at one day-old were obtained from Atomic Energy Commission at Anshas, Sharkia Governorate, Egypt. Birds were used in the study after being left on the experimental site for a period of one week to acclimatize. The quail birds were randomly assigned to four dietary treatments, at nearly equal body weight and were randomly divided into 4 treatments groups. Each treatment was sub-divided into three replicates with 15 birds per replicate. Birds were brooded at 33^{o} C during the first week with the brooding temperature being reduced to 3^{o}C/week until it reached approximately 24^{o}C at week four of age. Light was provided continually using artificial light. The birds were subjected to similar conditions of management and sanitary conditions throughout the period of the experiment.

Experimental diets:

Ginger (*Zingiber officinale)* was obtained from a local herb store in North Sinai, Egypt, and supplemented diets at the rate of 0, 0.25, 0.50 and 0.75 % of the diet. During the growth period (1 – 42 days) birds received diets containing 24 % CP and 2900 Kcal ME/ Kg. Feed and clean water were provided *ad-libitum* daily. The diets were formulated to meet the nutrient requirements of quail as recommended by the National Research Council (1994) for this growing period. Table 1 showed the ingredients composition of the experimental diets.

Nutrient composition of *Zingiber officinale*:

Ginger is composed of 93.52% Dry matter, 8.42% crude protein (CP), 3.11% crude fiber (CF), 5.95% total ash, 5.54% Either Extract, 70.84% nitrogen-free extract.

Measurements:

Mortality was recorded daily during the experiment. Body weight was recorded weekly, and feed intake was daily recorded to determine body weight gain (BWG, g) as following equation:

BWG = final weight (g) – initial weight (g).

Feed conversion ratio (FCR) was calculated as the amount of feed required (g) for producing a unit of gain (g) according to the following equation:

FCR = feed intake (g)/weight gain (g)

Blood samples of three birds per replicate (selected randomly) were collected in the morning at 42 day of age. Blood samples were collected in EDTA containing tubes for determination of blood hematological parameters, while determination of serum proteins in serum of blood samples collected without anticoagulant. Serum was separated after centrifugation of clotted blood at 3,500 rpm for 20 min. Serum and EDTA blood were kept at 4°C. Blood serum samples were analyzed to determine the contents of cholesterol, triglyceride, total protein, albumin and globulin. At the end of experimental, three birds were taken randomly and slaughtered from each replicate, spleen, thymus and bursa were separated and weighted.

Statistical Analysis:

The obtained data were statistically analyzed using Analysis of Variance (ANOVA), applying the General Liner Model (GLM) Procedure, described in SAS User's Guide *(SAS., 2004).* Differences among means were tested using Duncan's multiple range test *(Duncan, 1955).*

The statistical model was:

$Y_{ij} = \mu + T_i + e_{ij}$

Where, Y_{ij} = an observation, μ = the overall mean, T_i = effect of treatment and e_{ij} = random error.

RESULTS AND DISCUSSION:

Productive performance:

Results in Tables 2 and 3 showed the effect of dietary Ginger on live body weight and body weight gain of growing quail birds. Results indicated that birds fed diet contained Ginger had significantly ($P \leq 0.05$) the highest final live body weight and body weight gain compared with the control groups.

Tables 4 and 5 illustrated the effect of different levels of Ginger on feed consumption and feed conversion ratio. The results showed that the feed intake had no significant ($P \leq 0.05$) effect on groups fed ginger compared with control group. However, feed conversion ratio showed significant ($P \leq 0.05$) differences between all groups fed on Ginger and control group.

These results are in agreement with *Abo Taleb et al., (2008); Ali et al., (2018) and Ahmed et al., (2019)* who showed a significant ($P \leq 0.05$) on body weight, body weight gain and feed conversion for birds fed diets containing of Ginger additives. The same trend was observed by *Meysam et al., (2017) and Swain et al., (2017),* who studied the effect of ginger on quail birds. Also, the same results were found by; *Rehman et al., (2017); Talukder et al., (2017) and Asghar et al., (2021)* when used ginger in broiler diets. These results are in agreement with the review article published by *Gaikwad et al., (2020)* who presented the effect of using Ginger in different levels and forms on several types of birds. On other side, other studies showed that addition of Ginger to birds' diet had no significant ($P \leq 0.05$) effect on growth performance such as final body weight and weight gain (*Mohammad et al., 2017; Herve et al., 2018; Habibi and Ghahtan, 2019).*

Several studies confirmed that Ginger promoted growth and productivity in poultry due to its phytochemicals, active compounds, nutrients, antimicrobial properties and anti-oxidant contents (*Nasir and Grashorn, 2010; Shirin and Jamuna, 2010; Khan et al., 2012; Kumar et al., 2014; Nile and park. 2015;* and *Liu et al., 2019*). These components led to stimulation of the secretion of digestive enzymes (lipase and amylase) and intestinal mucus in birds, to stimulate the digestion process efficiently and stabilize the microbial balance in the intestine (*Lee et al., 2003; Boyraz and Ozcan, 2006; Ghazalah and Ali, 2008*). In addition, Ginger contains many active substance such as (alkaloids, brunel, camphon, flavonoids, gingerol, gingerdiol, gingeron, humolin, limonene, saponins, shogaols, volatile oils and some phenolic ketone derivatives) (*Hashimoto et al., 2002*) these compounds could stimulate the digestive enzymes, and in turn increased feed conversion ratio (*Mohamed et al., 2012*). In addition, *Platel and Srinivasan (2000)* stated that Ginger enhanced secretion trypsin, amylase, bile acid and pancreatic lipase. These enzymes significantly affected the digestion and absorption of nutrients.

The difference between the present study with other studies results could be due to differences in Ginger source and processing methods or poultry species used (*Shirin and Prakash 2010; Wen et al., 2019*). This means that the useful effect of Ginger on performance depends on the bird species, Ginger dosage and its derivatives and interaction between other components. Despite this, the information

about the mechanism of action of Ginger is not clear (*Kiyama, 2020*).

Carcass characteristics:

Statistical analyses of carcass characteristics are shown in Table 6. The results showed that the diets containing different levels of Ginger significantly ($P \leq 0.05$) increased in dressed%, giblets% and total edible parts% compared with the control groups. There are some studies that showed that the use of Ginger in bird diets led to an improvement in the carcass characteristics *(Ahmed et al., 2019 and Asghar et al., 2021).*The Ginger did significantly affect the relative weights of heart and giblets. Some studies have reported similar results in poultry fed diets contain Ginger (*Salmanzadeh,2015; Talukder et al., 2017; Habibi and Ghahtan, 2019*). On the contrary, several studies reported that there was no significant ($P \leq 0.05$) affect for dressing and other organ compared with control group (*Zeweil et al., 2016; Muhammad et al., 2017; Kafi et al., 2017*)

On the other side, liver% was significantly decreased by increasing levels of Ginger. Also, gizzard% significantly ($P \leq 0.05$) increased by using Ginger levels compared with control group. Results in Table 6 showed that Ginger levels significantly ($P \leq 0.05$) changed thymus and bursa % compared with the control. The change in internal organs percentages could be due to Ginger which is used to treat many diseases as it possesses antibacterial, antioxidants (*Nile and park, 2015*), anti-parasitic, antimicrobial (*Kumar et al., 2014*), anti-inflammatory (*Zhang et al., 2016*) and antiseptic materials (*Ali et al., 2008*). In addition, Ginger contains many biologically active compounds such as phenolic and terpene compounds (*Zhao et al., 2011; Stoner, 2013 and Liu et al., 2019*). Also, Ginger contains amount of important minerals and vitamins (*Shirin and Jamuna, 2010*). This is important for the production of the immune cells due to the antioxidant activities of some components of Ginger (*Rocha et al.,2010)* and the ability of plant to modify the immune system *(Salem, 2005 and Dong et al., 2007).*

Blood constituents:

Results in Table 7 showed that the diets containing different levels of Ginger decreased ($P \leq 0.05$) serum total cholesterol. In addition, LDL fraction decreased, and HDL fraction increased in all groups compared with control group. In addition to, increased ($P \leq 0.05$) albumin levels. The results agree with those obtained by *(Salmanzadeh, 2015; Zeweil et al., 2016; Swain et al., 2017; Herve et al., 2018 and Asghar et al., 2021)* who recorded that Ginger significantly ($P \leq 0.05$) decreased total cholesterol, HDL fraction, LDL fraction and triglyceride. The decrease in plasma cholesterol levels may be attributed to the high content of Ginger from unsaturated fatty acids which may stimulate the cholesterol excretions into the intestine and the oxidation. On other side Ginger led to significant ($P \leq 0.05$) low level in the plasma glucose as compared to control group (*Salmanzadeh, 2015 and Swain et al., 2017*). This may be due to anti-diabetic activity in Ginger that works to reduce the level of sugar in the blood. It is thought that the anti-diabetic properties of Ginger are induced by activation of adenosine monophosphate kinase (AMPK), affecting cellular uptake of proteins with hypolipidemic and anti-diabetic properties *(Haddad et al., 2003 and Sanz, 2008).*

From the above, Ginger showed strong anti-lipidemic effect on triglyceride levels

and cholesterol (*Jang et al., 2007*); hence, its mode of action may be related to the inhibition of cholesterol synthesis such as (hydroxy--methylglutaryl coenzyme A (HMG—CoA) (*Saeid et al., 2010*). correspondingly, Ginger is a potent HMGR-inhibiting drug, known to cause liver-specific inhibition of cholesterol synthesis (*Manju et al., 2006*). In addition, other Research showed that diabetic therapy by insulin helps in decreasing triglycerides by affecting lipoprotein lipase levels (*Austin et al., 1984*). Ginger has insulin-stimulating effect which plays a role to decrease triglycerides in the blood (*Austin et al., 1984*).

Also, results showed that total protein and albumin level were significantly ($P \leq 0.05$) increased in group fed diets contain Ginger compared with control. The same results were recorded by *Swain et al., (2017)*. Plasma ALT and AST decreased with all levels of Ginger. The liver contains enzymes like ALT and AST and it releases these enzymes into the blood when injured infection (*Kaplan et al., 2003*). Hence, the significant ($P \leq 0.05$) differences among treatments in ALT and AST in this study may reflect the normal liver function of the bird groups fed diets containing Ginger and this suggests that ginger has properties that can promote liver health. On other side, the results showed different significant ($P \leq 0.05$) between all treatments compared to control group for WBCs and RBCs level.

According to the results of analyzing blood samples from different treatments, the birds fed on Ginger showed higher blood globulin and white blood cells count compared with the control group. This indicates that the Ginger raised the level of globulin in the blood, which serves as an indicator of the immune response and the source of antibodies (*Abdel Fattah et al., 2008*) and the production of immunoglobulin. Therefore, the observed effect may be due to increase immunoglobulin concentration and improved immunity (*Abu Taleb et al., 2008; Meysam et al., 2017; Rehman et al., 2017 and Habibi and Ghahtan 2019).*

CONCLUSION

In conclusion supplementation of Ginger up to 0.75% on quail diets improved growth performance, carcass traits, immune organs and blood constituents of quail birds. No side effects were observed on the bird, and it is considered a safe alternative to antibiotics and can be considered a growth stimulator.

Table (1): The composition and calculated analysis of diets.

Ingredients %	***Zingiber offcinale* %**			
	0	**0.25**	**0.50**	**0.75**
Yellow corn	54.42	54.27	54.17	54.09
Soybean meal (44%)	37.89	37.91	37.8	37.76
Corn gluten meal (60%)	4.00	3.96	4.02	4.03
Di-calcium phosphate	0.36	0.36	0.36	0.36
Salt	0.35	0.35	0.35	0.35
Limestone	1.82	1.74	1.64	1.5
L. Lysine	0.08	0.08	0.08	0.08
DL. Methionine	0.08	0.08	0.08	0.08
(V&M.) Premix*	0.3	0.3	0.3	0.3
Oil	0.7	0.7	0.7	0.7
Zingiber officinale	0	0.25	0.5	0.75
Total	100	100	100	100
Calculated analysis (%)				
Crude protein	24	24	24	24
ME Kcal/Kg.	2900	2900	2900	2900
Calcium	0.9	0.9	0.9	0.9
AV. Phosphorus	0.47	0.45	0.45	0.47
L. Lysine	1.35	1.36	1.36	1.36
DL. Methionine	0.51	0.51	0.5	0.51

* Each kg of vitamin mineral premix: contains: vitamin A, 1200000; vitamin D3, 300000IU; vitamin E, 700 mg; vitamin K3, 500 mg; vitamin B1, 500 mg; vitamin B2, 200 mg; vitamin B6, 600 mg; vitamin B12, 3 mg; folic acid, 300mg; choline chloride, 1000 mg; Niacin, 3000 mg; Biotin, 6 mg; panathonic acid, 670 mg; manganese sulphate, 3000 mg; iron sulphate, 10000 mg; zinc sulphate, 1800 mg; copper sulphate, 3000 mg; iodine, 1.868 mg; cobalt sulphate, 300 mg; selenium, 108 mg.

Table (2): Effect of dietary treatments on body weight (g).

Items	Control	*Zingiber offcinale* %		
		0.25	0.50	0.75
Initial weight at 7 day-old	31.00 ^{a} ± 0.00	31.00 ^{a} ± 0.00	31.00 ^{a} ± 0.00	31.00 ^{a} ± 0.00
14 day-old	58.45 ^{c} ± 1.40	63.01 ^{b} ± 1.29	67.01 ^{a} ± 1.45	67.90 ^{a} ± 1.02
21 day-old	89.67 ^{d} ± 1.39	96.45 ^{c} ± 1.45	100.01 ^{b} ± 1.29	102.34 ^{a} ± 1.40
28 day-old	138.59 ^{d} ± 1.36	147.01 ^{c} ± 1.45	151.01 ^{b} ± 1.22	154.01 ^{a} ± 1.29
35 day-old	196.66 ^{c} ± 1.57	206.13 ^{b} ± 1.88	211.30^{ab} ±1.13	216.39 ^{a} ± 1.36
Final weight at 42 day-old	254.88^{d} ± 2.09	266.20 ^{c} ± 1.55	276.65 ^{b} ± 1.42	286.10 ^{a} ± 1.15

a,b,c Means in the same row with different superscripts are significantly different ($P \leq 0.05$)

Table (3): Effect of dietary treatments on body weight gain (g).

Items	Control	*Zingiber offcinale* %		
		0.25	0.50	0.75
7 – 14 day-old	27.45 ^{c} ± 0.33	32.01 ^{b} ± 0.33	36.01 ^{a} ± 0.67	37.00 ^{a} ± 0.33
14 – 21 day-old	31.22 ^{b} ± 0.67	33.44^{ab} ± 0.33	33.00^{ab} ± 0.58	34.44 ^{a} ± 0.67
21 – 28 day-old	48.91 ^{a} ± 0.53	50.56 ^{a} ± 0.33	51.00 ^{a} ± 0.33	51.67 ^{a} ± 0.67
28 – 35 day-old	58.07 ^{b} ± 0.67	59.12^{ab} ± 0.67	60.29 ^{ab} ± 0.33	62.38 ^{a} ± 0.67
35 – 42 day-old	58.22 ^{d} ± 1.33	60.07 ^{c} ± 1.08	65.36 ^{b} ± 1.33	69.71 ^{a} ± 1.45
Total (WG) 7-42 day	223.88^{d} ±1.54	235.20^{c} ±2.33	245.65 ^{b}±1.33	255.10^{a} ±1.57

a,b,c Means in the same row with different superscripts are significantly different ($P \leq 0.05$).

Table (4): Effect of dietary treatments on feed intake (g).

Items	Control	*Zingiber offcinale* %		
		0.25	0.50	0.75
7 – 14 day-old	88.78 ^{a} ± 1.35	86.78 ^{a} ± 1.75	85.22 ^{a} ± 1.89	83.44 ^{a} ± 1.24
14 – 21 day-old	96.33 ^{a} ± 0.70	95.22 ^{ab} ± 0.62	94.11 ^{bc} ± 0.41	92.33 ^{c} ± 0.52
21 – 28 day-old	107.00^{a} ± 1.45	104.89^{bc} ±1.61	105.00^{ab} ±1.20	103.44^{c} ± 1.99
28 – 35 day-old	117.60^{a} ± 1.28	118.40^{a} ± 1.73	115.22 ^{a} ± 1.35	116.54^{a} ± 1.86
35 – 42 day-old	139.34^{a} ± 2.03	139.0 ^{a} ± 1=2.18	139.55 ^{a} ± 1.61	139.14^{a} ± 1.16
Total (FI) 7-42 day	549.06^{a} ± 3.86	544.29^{a} ± 4.45	539.10 ^{a} ± 2.64	534.90^{a} ± 1.91

a,b,c Means in the same row with different superscripts are significantly different ($P \leq 0.05$)

Table (5): Effect of dietary treatments on feed conversion ratio (g feed/ g gain).

Items	Control	*Zingiber offcinale* %		
		0.25	0.50	0.75
7 – 14 day-old	3.23 ^{a} ± 0.16	2.71 ^{b} ± 0.14	2.32 ^{c} ± 0.16	2.32 ^{c} ± 0.11
14 – 21 day-old	3.09 ^{a} ± 0.26	2.85 ^{b} ± 0.22	2.85 ^{b} ± 0.24	2.68 ^{c} ± 0.26
21 – 28 day-old	2.19 ^{a} ± 0.11	2.08 ^{a} ± 0.14	2.03 ^{a} ± 0.13	2.03 ^{a} ± 0.21
28 – 35 day-old	2.02 ^{a} ± 0.13	2.02 ^{a} ± 0.11	1.93 ^{ab} ± 0.23	1.85 ^{b} ± 0.12
35 – 42 day-old	2.39 ^{a} ± 0.16	2.32 ^{a} ± 0.14	2.13 ^{ab} ± 0.22	2.00 ^{b} ± 0.18
Total (FCR) 7-42 day	2.45 ^{a} ± 0.23	2.32 ^{b} ± 0.25	2.19 ^{c} ± 0.12	2.10 ^{c} ± 0.21

a,b,c Means in the same row with different superscripts are significantly different ($P \leq 0.05$)

Table (6): Effect of dietary treatments on carcass characteristics and lymphoid organs of quail birds at 42 days old**.**

Items	Control	*Zingiber offcinale* %		
		0.25	**0.50**	**0.75**
Live weight(g)	254	266	276	286
Carcass characteristics (%)				
Dressed	$73.36^{b}\pm1.36$	$74.65^{ab}\pm1.34$	$76.57^{a}\pm1.90$	$77.27^{a}\pm1.18$
Gizzard	$1.61^{b}\pm0.14$	$1.74^{ab}\pm0.18$	$1.75^{ab}\pm0.18$	$1.87^{a}\pm0.19$
Liver	$2.12^{b}\pm0.13$	$2.22^{ab}\pm0.18$	$2.24^{ab}\pm0.18$	$2.35^{a}\pm0.17$
Heart	$0.84^{b}\pm0.018$	$0.90^{ab}\pm0.044$	$0.95^{ab}\pm0.027$	$0.96^{a}\pm0.030$
Giblets*	$4.57^{b}\pm0.17$	$4.87^{ab}\pm0.20$	$4.93^{ab}\pm0.13$	$5.16^{a}\pm0.15$
Total edible parts**	$77.93^{b}\pm1.42$	$79.58^{ab}\pm1.54$	$81.73^{a}\pm1.03$	$82.14^{a}\pm1.28$
Lymphoid organs (%)				
Spleen	$0.067^{b}\pm0.003$	$0.070^{a}\pm0.003$	$0.071^{a}\pm0.003$	$0.074^{a}\pm0.003$
Bursa	$0.13^{b}\pm0.020$	$0.13^{b}\pm0.019$	$0.16^{a}\pm0.017$	$0.16^{a}\pm0.013$
Thymus	$0.26^{b}\pm0.019$	$0.31^{ab}\pm0.026$	$0.33^{a}\pm0.029$	$0.33^{a}\pm0.017$

a,b,c Means in the same row with different superscripts are significantly different ($P \leq 0.05$)
*Giblets = gizzard+ liver + heart.
** Total edible parts = dressing + giblets

Table (7): Effect of dietary treatments on some blood biochemical and hematological parameters of quail birds**.**

Items	Control	*Zingiber offcinale* %		
		0.25	**0.50**	**0.75**
T. protein(g/dl)	$4.16^{c}\pm1.04$	$4.22^{c}\pm1.01$	$4.37^{b}\pm1.03$	$4.61^{a}\pm1.02$
Albumin (A) (g/dl)	$1.47^{c}\pm0.31$	$1.64^{b}\pm0.67$	$1.70^{b}\pm0.12$	$1.83^{a}\pm0.29$
Globulin (G) (g/dl)	$2.40^{d}\pm0.16$	$2.81^{c}\pm0.23$	$3.00^{b}\pm0.29$	$3.24^{a}\pm0.4$
A/G ratio	$0.61^{b}\pm0.10$	$0.58^{b}\pm0.17$	$0.57^{ab}\pm0.19$	$0.56^{a}\pm0.13$
Glucose (mg/dl)	$175.1^{a}\pm2.67$	$155.85^{b}\pm2.53$	$145.16^{c}\pm2.43$	$131.15^{d}\pm1.34$
Cholesterol (mg/dl)	$182.84^{a}\pm3.55$	$168.93^{b}\pm2.44$	$155.82^{c}\pm3.63$	$142.81^{d}\pm3.71$
HDL- Cholesterol (mg/dl)	$61.01^{d}\pm1.42$	$69.18^{c}\pm1.80$	$75.32^{b}\pm1.29$	$82.20^{a}\pm1.03$
LDL- Cholesterol (mg/dl)	$121.83^{a}\pm3.97$	$99.74^{b}\pm2.91$	$80.50^{c}\pm2.74$	$60.61^{d}\pm2.88$
T. lipids (mg/dl)	$474.21^{a}\pm4.22$	$443.96^{b}\pm4.88$	$432.65^{c}\pm4.72$	$407.47^{d}\pm3.63$
ALT (U/L)	$48.39^{a}\pm0.51$	$45.49^{b}\pm0.30$	$43.86^{b}\pm0.56$	$40.83^{c}\pm0.86$
AST (U/L)	$12.42^{a}\pm0.53$	$11.66^{b}\pm0.88$	$11.12^{bc}\pm0.82$	$10.81^{c}\pm0.29$
RBCs (10^6)	$1.43^{d}\pm0.32$	$1.53^{c}\pm0.81$	$1.59^{b}\pm0.58$	$1.65^{a}\pm0.88$
WBCs (10^6)	$21.73^{d}\pm3.37$	$23.71^{c}\pm2.25$	$25.08^{b}\pm2.28$	$27.25^{a}\pm2.24$

a,b,c Means in the same row with different superscripts are significantly different ($P \leq 0.05$)
RBCs, Red blood cells
WBCs, white blood cells.

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الملخص العربي

تقييم استخدام الجنزبيل على الاداء الانتاجي وخصائص الذبيحة وبيوكيمياء الدم والاستجابة المناعية لطيور السمان

محمد مصطفى عبدالهادي الكاشف

قسم الانتاج الحيواني والداجني - كلية العلوم الزراعية البيئية - جامعة العريش - شمال سيناء - مصر

أجريت هذه التجربة لتقييم تأثير استخدام مستويات مختلفة من الجنزبيل على الأداء الإنتاجي والمناعة وبعض العوامل البيوكيميائية في السمان. تم استخدام ١٨٠ طائر عمر يوم واحد وتم تقسيمهم إلى أربع مجموعات، داخل كل مجموعه ثلاث مكررات (١٥ طائر فى كل مكررة). تم تغذية الكتاكيت خلال الأسبوع الأول على عليقة كنترول بدون أي إضافات. تم تغذية الطيور في المجموعات على علائق تحتوي على ٠، ٠.٢٥، ٠.٥٠ و٠.٧٥% من الجنزبيل. تم قياس أوزان الطيور عند عمر يوم وحتى عمر ٤٢ يوم بشكل دوري أسبوعيا، وتم قياس استهلاك العلف في نفس الفترات، وتم حساب معدل تحويل العلف وفقًا لذلك. تم أخذ عينات الدم عند عمر ٤٢ يوماً من ٣ طيورمن كل مكررة لتحليلها معملياً ، تم أخذ ثلاث طيور بشكل عشوائي من كل مكررة وذبحها وتم فصل الطحال والغدة الصنوبرية وغدة فابريشيوس ووزنها. وأظهرت نتائج هذه التجربة أن استخدام الجنزبيل في علائق السمان أدى إلى تحسن وزن الجسم الحي ومعدل التحويل الغذائي بشكل معنوي، وكذلك زيادة مستويات الألبيومين والجلوبيولين في الدم. وكذلك انخفاض تركيزات الجلوكوز الكلية. كما أدى استخدام الجنزبيل إلى انخفاض الدهون الثلاثية في الدم وكان مستوى الكوليسترول في البلازما أقل في جميع المعاملات مقارنة بالكنترول. بالإضافة إلى ذلك لوحظ زيادة نسبة الدهون عالية الكثافة وانخفضت نسبة الدهون منخفضة الكثافة في جميع المعاملات مقارنة بمجموعه الكنترول. كما لوحظ تحسن ملحوظ في نسبة الطحال وغدة فابريشيوس والغدة الزعترية فى الطيور التي غذيت على علائق تحتوي على الجنزبيل مقارنة بمجموعه الكنترول.

من خلال نتائج هذه الدراسة يمكن استنتاج أن إضافة الجنزبيل في علائق السمان له تأثيرًا إيجابيًا على أداء النمو، مكونات الدم، الاستجابة المناعية ويمكن اعتباره محفزًا للنمو.

الكلمات المرشدة:

الجنزبيل ، السمان ، الأداء الإنتاجي ، الاستجابة المناعية ، خصائص الذبحة.