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Impact of Dietary Supplementation with Ginseng or/and Garlic on Growth Performance, Blood Biochemical Parameters and Carcass Traits of Growing Male V-Line Rabbits

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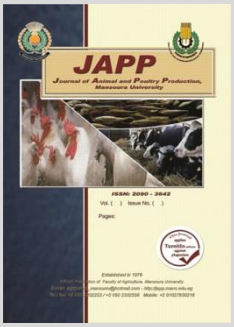

ABSTRACT

This study was conducted to investigate the effect of adding ginseng or/and garlic powder in the diet on growth performance, biochemical parameters and carcass traits of growing male rabbits. Weaned V-line male rabbits (n=48) were divided into four groups. They were assigned at random to receive a basal diet without supplementation (control group), supplemented with 50mg Ginseng or/and 5gm Garlic/kg diet. Growth performance parameters were recorded at age intervals from 5-14wk. Serum biochemical and carcass traits were determined at 14wk of age. Results show that dietary fortification with ginseng or/and garlic caused a significant increase (P≤0.05) in live body weight and body weight gain of male rabbits at 14wk old. Rabbits fed the diets supplemented with garlic alone or combined with ginseng displayed significantly better (P≤0.05) means of feed conversion ratio. Rabbits fed the ginseng or garlic plus ginseng-supplemented diets displayed significantly higher (P≤0.05) serum triglycerides and cholesterol levels. On the other hand, rabbits fed garlic or garlic plus ginseng supplemented diets showed significantly lower (P≤0.05) levels of serum low-density lipoprotein. Dietary supplementation with ginseng and garlic singly or in combination did not significantly affect dressing-out percentage, and weights of carcass yield, hind parts and edible organs of rabbits. However, rabbit fed the garlic-fortified diet displayed significantly heavier (P≤0.05) testes than did the control group and other experimental groups. The current study indicated that addition of ginseng or/and garlic powder in the diet increased growth performance without any adverse effect on immunity and carcass traits of growing V-line male rabbits.

Keywords: Rabbit, ginseng, garlic, growth performance, blood biochemicals, carcass traits.

INTRODUCTION

Nutrition in the past relied on livestock as a source of animal protein, which became insufficient due to the widening food gap between supply and protein intake, there was a need to provide an alternative and cheaper source of animal protein to fill this gap. According to Spore (2007) and Soyebo (2006), the production of rabbits works to improve both the food and living standards of poor families. This is due to the high growth and fertility rates of rabbits, as well as the low cost of setting up the project and low business wages. In addition, FAO recommended rabbit as a key ingredient to fight hunger.

Nutrition is the pillar of livestock projects, where total expenditure is 80% in terms of feed spending. Increasing income while reducing hypocrisy are the challenges to which scientific research strategies are applied to introduce untraditional feed additives (Pervez, 1992).

Rabbits and other animals are susceptible to many diseases due to organisms spread in the environment, through breathing or eating contaminated feed with pathogens or contact with other animals. The efficiency of the immune system can be distinguished between a healthy animal or sick by identifying the pathogens and develop a defense plan.

Antioxidants, antibiotics, flavoring agents, coccidiostat and anti-narcotic drugs come on from additives used to improve feed quality. In recent years, plant extracts and essential oils have been used as alternative therapies for some infectious diseases, improving animal productivity and food safety. Scientific research works hard to discover the natural herbs used in the field of rabbit breeding, which is a good way to improve health and productivity as well as improve the quality of meat in rabbits (Badr *et al.*, 2013).

Ginseng is a representative, traditional eastern Asian herb used as a tonic for slowing down the aging process (Pak *et al.*, 2005). The major active ingredient of ginseng is the ginseng saponin, which is composed of various ginsenosides. Currently, approximately 30 ginsenosides have been identified (Kim *et al.*, 2003; Bae *et al.*, 2004). There are at least 9 known species of ginseng, including the Asian (*Panax ginseng*), American (*Panax quinquefolium*), and Japanese (*Panax japonicus*) ginseng. These varieties have shown effects such as antioxidant effects, enhancement of diverse physiologic effects including immune stimulatory effects on the neuronal system (Lin *et al.*, 2008; Bak *et al.*, 2012) and control of the metabolic state (De Souza *et al.*, 2015; Lian *et al.*, 2015).

Garlic has a great importance in many areas, especially the medical and therapeutic field (Shetty *et al.*, 2013). The chemical effect of garlic depends on the presence of organic sulfur compound (Amagase *et al.*, 2001). It also has an effective effect in lowering cholesterol in blood, lowering blood pressure and reducing platelet aggregation (Sterling and Eagling, 2001). In research studies, it was found that garlic has antifungal, parasitic and antimicrobial effects as well as antioxidant properties (Ankri and Mirelman, 1999). A research by Ahmed *et al.* (2002) revealed that adding garlic

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powder to rabbit diets led to improved feed conversion and live body weight.

Therefore, this study was conducted to investigate the effect of adding ginseng or/and garlic powder in the diet on growth performance, blood biochemical parameters and carcass traits of growing V-line male rabbits.

MATERIALS AND METHODS

This study was conducted at the rabbit farm of El-Serw Animal Production Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. Laboratory work was conducted at Animal Production Department, Faculty of Agriculture, Mansoura University, during the period from April to June 2019.

Experimental design:

A total number of 48 growing V-line male rabbits aged 5 weeks (after weaning) were divided into four groups. The first group was fed on the basal diet without any supplementation (control); the second group was fed on basal diet containing 50 mg/kg diet ginseng, the third group was fed on basal diet containing 5 gm/kg diet garlic powder and the fourth group was fed on basal diet containing ginseng and garlic powder. Each group was distributed to four replicates with three rabbits each and used for a growing period of 63 days starting after weaning (at 35 days age) at the 5th week of age and lasted till the 14th week of age.

Management and feeding:

Rabbits were kept under similar management system. Cages were cleaned and disinfected regularly. Light in their houses was allowed 12-14 hours per day during the period of the study. Urine and faces dropped from the cages on the floor were cleaned every day in the morning.

The rabbits were housed in cages that provided them with fresh water and pelleted experimental diets which were offered *ad libitum* all over the experimental period. The diets were formulated in the farm from the available ingredients to cover the nutrient requirements of rabbits as recommended by NRC (1977) as shown in Table 1.

Table 1. Ingredients of the control diet used for feeding rabbits in the experimental groups.

Ingredient	(%)	Ingredient	(%)
Yellow corn	11	Sunflower meal	3.0
Barley	17	Di-calcium phosphate	1.4
Wheat bran	14	Limestone	1.0
Soybean meal (44%)	14	Sodium chloride	0.3
Alfalfa hay	32	Premix[1]	0.3
Hay Mint	6.0	Total	100

1 Each 1 kg of the premix contains: vitamin (A) 2 M IU, Vit. (D3) 150000 IU, Vit. (E) 8.33 g, Vit. (K) 0.33 g, Vit. (B_1) 1 g, vit. (B_2) 1.09 g, vit. (B_6) 0.33 g, vit. (B_5) 8.33 g, vit. (B_{12}) 1.7 mg, pantothenic acid 3.33 g, folic acid 0.83 g, biotin 33 mg, choline chloride 20 g, Mg 66.79 g, Zn 11.79 g, Fe 12.5 g, Cu 0.5 g, I 0.3 g, Se 16.6 mg, Co 1.33 mg and carrier $CaCO_3$ up to 1000 g.

Growth performance parameters:

During the experimental period, weekly live body weight (LBW) and daily feed intake (DFI) were recorded, then average daily weight gain (ADG) and feed conversion ratio (FCR, g feed/g gain) were calculated at age intervals of 5-8, 8-11, 11-14 and 5-14 wk.

Carcass traits:

At the end of growing period (5-14 weeks of age), three random growing rabbits from each experimental group were fasted for 12 hours, weighed and slaughtered. Slaughtered animals were de-skinned, dressed out and the hot carcass including head was weighed and recorded. Edible parts (head, liver, heart, kidneys, testes and fore parts) were separately weighed and recorded.

Dressing percentage was calculated as follows:

Dressing percentage = (carcass weight + head weight) / Live body weight x100

Blood sampling:

Blood samples were collected at the end of the experimental period (14 wk of age), from three rabbits in each treatment during slaughtering, in heparinized test tubes. Blood samples were centrifuged at 3500 rpm for 15 min and then plasma was carefully separated into labeled tubes and sorted at -20°c until analysis.

Concentration of total proteins, albumin, cholesterol, triglycerides, high density lipoproteins (HDL), low density lipoproteins (LDL) and immunoglobulins (IgA, IgG and IgM) as well as activity of aspartate (AST) and alanine (ALT) transaminases were determined in blood plasma using commercial kits (Bio Diagnostic, Egypt). Globulin concentration was obtained by difference between total proteins and albumin concentration.

Statistical analysis:

Data were statistically analyzed using computer program of SAS (2007) using the general linear models (GLM) as a one-way ANOVA. Significance among treatment means were tested at a level of $P<0.05$ using Duncan's New Multiple Rang Test (Duncan, 1955).

RESULTS AND DISCUSSION

Results

Growth performance:

Live body weight and body weight gain:

The effects of dietary supplementation with ginseng and/or garlic on live body weight (LBW) and body weight gain (BWG) during the entire length of the growing period (5-14 weeks of age) are given in Table 2. The results indicated that initial LBW of rabbits were insignificantly ($P>0.05$) different in all experimental groups of rabbits. It was observed that dietary fortification with ginseng and/or garlic caused a significant ($P\leq0.05$) increase in LBW of rabbits at 8 weeks old compared with the control group. Similar response was observed in LBW of rabbits fed the diets supplemented with ginseng and/or garlic at 11 and 14 weeks of age. For the intervals of 5-8 and 8-11 weeks of age, dietary garlic addition alone or in combination with ginseng led to a significant ($P\leq0.05$) increase in BWG of rabbits as compared to that of the control rabbits. Similarly, the single and combined addition of ginseng and garlic to rabbit diets positively affected ($P\leq0.05$) their BWG during the interval of 11-14 weeks of age and the whole experimental period compared with those fed the basal diet.

Feed intake (FI) and Feed conversion (FCR):

The effects of feeding diets supplemented with ginseng or/and garlic on FI and FCR of rabbits from 5 to 14 weeks old are shown in Table 3. The results indicated that means of FI of growing rabbits were not significantly affected ($P>0.05$) by dietary supplementation during the intervals of 5-8, 8-11, 11-14 weeks of age and the entire experimental period (5-14 weeks old). It was observed that concurrent administration of ginseng and garlic to rabbit diets led to a significant improvement

(P≤0.05) in FCR compared with the control group during the first three weeks of the feeding trial but means of FCR for the other experimental groups of rabbits were not significantly (P>0.05) different from that of the control rabbits. During the interval of 8-11 weeks of age, rabbits administered with ginseng, garlic or both exhibited superior (P≤0.05) means of FCR to that of the control group. But FCR of rabbits was not significantly (P>0.05) influenced by dietary supplementation during the age interval of 11-14 weeks. During the whole experimental period, rabbits fed the diets supplemented with garlic alone or combined with ginseng displayed significantly (P≤0.05) better means of FCR compared with the control group and those fortified with ginseng alone.

Table 2. Effect of adding ginseng and/or garlic to growing rabbit diets on live body weight (LBW) and body weight gain (BWG) during the growing period (5-14 weeks of age).

Measurement	Control	Ginseng	Garlic	Ginseng+ Garlic
		LBW (g):		
At 5 wk of age	727.5±10.90	723.8±9.40	716.7±5.27	715.0±6.78
At 8 wk of age	1314.6±16.55^{c}	1325.4±15.14^{cb}	1365.8±15.93^{ab}	1390.9±11.63^{a}
At 11 wk of age	1720.8±8.83^{d}	1803.8±22.32^{c}	1969.2±19.48^{b}	2030.9±8.03^{a}
At 14 wk of age	2091.3±24.56^{d}	2244.2±34.97^{c}	2345.0±27.56^{b}	2422.7±15.04^{a}
		BWG (g/h/d):		
5-8 wk of age	587.1±13.91^{b}	601.7±9.22^{b}	649.2±15.69^{a}	675.9±8.97^{a}
8-11 wk of age	406.3±14.50^{c}	478.3±15.43^{b}	603.3±18.23^{a}	640.0±9.53^{a}
11-14 wk of age	370.4±18.14^{b}	440.4±32.65^{a}	375.8±14.26^{b}	391.8±9.87^{ab}
5-14 wk of age	1363.8±23.24^{d}	1520.4±28.94^{c}	1628.3±26.79^{b}	1707.7±10.54^{a}

a-d: Means in the same row bearing different superscripts differ significantly (P≤0.05).
LBW: Live body weight and BWG: Body weight gain.

Table 3. Effect of adding ginseng or/and garlic to diets of growing rabbits on feed intake (FI) and feed conversion ratio (FCR) during the period of 5-14 weeks of age.

Measurements:	Control	Ginseng	Garlic	Ginseng+ Garlic
		Total feed intake (kg/h):		
5-8 weeks old	1.55±0.03	1.60±0.03	1.60±0.07	1.55±0.04
8-11 weeks old	2.42±0.07	2.61±0.06	2.51±0.04	2.48±0.19
11-14 weeks old	3.18±0.18	3.17±0.04	3.20±0.05	2.98±0.28
5-14 weeks old	7.15±0.16	7.38±0.05	7.32±0.06	7.00±0.43
		FCR (kg feed/kg BWG):		
5-8 weeks old	2.6±0.07^{a}	2.7±0.07^{a}	2.4±0.10^{ab}	2.3±0.05^{b}
8-11 weeks old	6.0±0.34^{a}	5.3±0.03^{b}	4.1±0.24^{c}	4.3±0.15^{c}
11-14 weeks old	8.6±0.47	8.0±0.43	8.5±0.40	8.4±0.43
5-14 weeks old	5.2±0.16^{a}	4.9±0.10^{ab}	4.5±0.13^{b}	4.5±0.23^{b}

a-c: Means in the same row bearing different superscripts differ significantly (P≤0.05).
FI: Feed intake and FCR: Feed conversion ratio

Carcass traits:

Data on the effect of single and combined dietary addition of ginseng and garlic on some carcass traits of growing rabbits are illustrated in Table 4. Interestingly, there were no significant differences in live body weight of different experimental groups of rabbits at slaughter. As presented in Table 4, the results indicated that dietary supplementation with ginseng and garlic singly or in combination did not significantly (P>0.05) affect dressing-out percentage, weights of carcass yield, hind parts, edible organs (liver, kidneys and heart) of rabbits. It was observed that rabbits fed the diet supplemented with ginseng and garlic simultaneously exhibited significantly (P≤0.05) higher absolute weight of head than did the control rabbits and other experimental groups, with no significant differences among them. Similarly, rabbits fed the garlic-fortified diet displayed significantly (P≤0.05) heavier testes than did the control group and other experimental groups, with no significant differences among them. Additionally, absolute full weight of intestine in rabbits fed the ginseng-fortified diet was significantly (P≤0.05) higher than those of the control group and the group fed garlic-supplemented diet. Means of the intestine weight for the other two experimental groups were not significantly different from those of the control group.

Table 4. Effect of adding ginseng and/or garlic to diets of growing rabbits on some carcass traits.

	Control	Ginseng	Garlic	Ginseng+ Garlic
Live weight (kg)	2.06±0.08	2.30±0.15	2.01±0.08	2.23±0.15
Carcass weight (kg)	1.31±0.05	1.44±0.11	1.29±0.04	1.43±0.10
Dressing-out %	63.7±0.91	62.7±0.67	64.1±0.83	64.3±1.63
Hind parts(g)	421.7±16.41	473.3±42.56	415.0±18.03	475.0±42.52
Head weight (g)	115.0±2.89^{b}	120.0±5.77^{ab}	111.7±6.01^{b}	138.3±7.26^{a}
Intestine weight (g)	328.3±17.64^{b}	443.3±48.42^{a}	330.0±12.58^{b}	373.3±21.67^{ab}
Liver weight (g)	54.7±3.69	62.9±4.98	58.7±1.25	62.2±7.56
Kidneys weight (g)	12.5±0.52	11.5±0.82	11.2±1.07	12.0±0.81
Heart weight (g)	5.7±0.07	5.8±0.15	5.6±0.41	6.1±0.29
Testes weight (g)	3.8±0.54^{b}	5.3±1.68^{ab}	9.0±1.55^{a}	5.3±1.20^{ab}

a-c: Means in the same row bearing different superscripts differ significantly (P≤0.05).

Blood biochemical Parameters:

The effects of adding ginseng and/or garlic to diets of growing rabbits on blood plasma biochemicals are presented in Table 5. The results showed that rabbits fed the diets supplemented with garlic and ginseng singly or in their combination had significantly lower (P≤0.05) concentrations of plasma total proteins and globulin than those of the control group. Dietary supplementation of ginseng alone caused a significant reduction (P≤0.05) in the level of plasma albumin compared with the control group, but plasma albumin concentrations in the other experimental groups did not significantly differ from that of the control group. However, there were no significant differences (P>0.05) in means of plasma albumin: globulin ratio and activities of transaminases (AST and ALT) among the different experimental groups of rabbits. Feeding diets supplemented with garlic and ginseng singly or in combination resulted in a significant (P≤ 0.05) increase in plasma cholesterol concentrations compared with the control group. In addition, rabbits fed the ginseng or garlic plus ginseng-supplemented diets displayed significantly higher (P≤0.05) plasma triglycerides levels than did their control counterparts or those fed the diet supplemented with garlic alone. On the other hand, rabbits fed garlic or garlic plus ginseng supplemented diets showed significantly (P≤0.05) lower the level of plasma low-density lipoprotein (LDL) than the control group or the group fed the diet supplemented with ginseng alone. However, dietary fortification of garlic and ginseng singly or in combination did not significantly (P>0.05) affect the high-density lipoprotein (HDL) concentration in growing rabbits. As shown in Table 5, rabbits fed garlic-supplemented diet displayed significantly lower plasma level (P≤0.05) of IgA level than other experimental groups of rabbits, with no significant differences among them, but plasma levels of IgM level significantly (P<0.05) decreased in response to feeding diets supplemented with ginseng alone or in combination with garlic compared with other dietary supplementation. However, no significant differences (P>0.05) were observed in plasma levels of IgG due to feeding the diets supplemented with garlic and ginseng singly or in combination.

Table 5. Effect of adding ginseng or/and garlic to diets of growing rabbits on liver function, lipid profile and immunological parameters in blood plasma.

Blood plasma parameters	Control	Ginseng	Garlic	Ginseng + Garlic
Liver function parameters:				
Total protein (g/dL)	6.5±0.28^{a}	4.2±0.16^{c}	5.0±0.20^{b}	5.1±0.20^{b}
Albumin (g/dL)	3.4±0.11^{a}	2.7±0.19^{b}	2.8±0.08^{ab}	2.9±0.26^{ab}
Globulin (g/dL)	3.2±0.34^{a}	1.4±0.17^{c}	2.2±0.21^{b}	2.3±0.26^{b}
Albumin / globulin ratio	1.1±0.16	2.1±0.30	1.4±0.21	1.4±0.31
AST (U/ml)	35.5±2.86	37.3±1.31	35.5±1.36	34.2±2.14
ALT (U/ml)	15.0±1.03	14.0±1.81	14.0±2.14	13.2±2.95
Lipid profile parameters:				
Triglycerides (mg/dL)	41.7±2.41^{b}	57.3±6.23^{a}	40.8±1.29^{b}	70.5±6.10^{a}
Cholesterol (mmol/L)	21.5±1.49^{c}	42.1±4.71^{ab}	38.0±2.13^{b}	48.6±1.85^{a}
HDL (mg/dL)	17.4±0.35	20.3±1.16	17.2±0.72	18.4±0.58
LDL (mg/dL)	0.7±0.07^{a}	0.5±0.04^{ab}	0.4±0.02^{b}	0.4±0.01^{b}
Immunological parameters (mg/dL):				
IgA (mg/dL)	83.8±1.22^{a}	80.0±1.81^{ab}	76.5±2.14^{b}	80.7±1.86^{ab}
IgG (mg/dL)	980.3±2.26^{ab}	981.2±1.90^{ab}	976.7±1.71^{b}	985.0±1.21^{a}
IgM (mg/dL)	234.2±1.19^{a}	230.3±1.26^{b}	234.0±1.26^{a}	228.5±1.12^{b}

a-c: Means in the same row bearing different superscripts differ significantly (P≤0.05).

AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, LDL: low-density lipoprotein, HDL: High-density lipoprotein, IgA: Immunoglobulin A, IgG: Immunoglobulin G and IgM: Immunoglobulin M.

Discussion:

The present results showed that dietary fortification with ginseng and /or garlic caused significant (P≤0.05) increases in LBW and BWG of rabbits at 14 weeks old. In agreement with our results, Alagawany *et al.* (2016) found that supplementation dietary garlic or turmeric up to 0.6% to rabbit diets led to improvement in LBW at 9 and 13 wk of age. This improvement in LBW with supplementation may be due to providing some compounds that enhance digestion and absorption of some nutrients in the diets. In addition, this may be attributed to the bioactive components (curcuminoids curcumin and allicin) found in turmeric and garlic that cause greater efficiency in the utilization of feed, resulting in enhanced growth (Alagawany *et al.*, 2016).

The present results showed that rabbits fed the diets supplemented with garlic alone or combined with ginseng displayed significantly (P≤0.05) better means of feed conversion ratio. The improvement in feed conversion ratio of the rabbits fed supplemented diets may be due to the antibacterial and antifungal properties of these herbs which might have improved the microflora and gut environment of the rabbits resulting in improved feed utilization. For instance, Reeds *et al.* (1993) attributed the positive effect of garlic on feed conversion ratio to the fact that susceptibility of pathogenic gram-positive bacteria to the antibacterial components of garlic is higher than the physiological desirable intestinal bacteria. According to the authors, the beneficial bacteria are believed to be unaffected by the presence of garlic as they are less sensitive to the inhibitory effect of garlic. Cullen *et al.* (2005) suggested that better feed conversion with depressed feed intake was observed in response to garlic supplementation in growing finishing pig diets.

Yan *et al.* (2011) demonstrated that the administration of fermented garlic powder (FGP) at a level of 2 or 4 g/kg diet improved growth performance, nutrient digestibility and meat quality in growing-finishing pigs. Kakimoto *et al.* (2000) reported that fermented garlic powder has an anti-oxidative activity several times more potent than that of intact garlic, as well as higher anti-diabetes, liver protective, anti-cancer, immunity enhancing, and cholesterol-reducing activities. Therefore, it is certainly conceivable that dietary FGP supplementation could enhance growth performance via mechanisms similar to those associated with garlic supplementation.

Rabbits fed ginseng with or without parsley supplemented diets showed significantly (P <0.05) the best values of final LBW, BWG, and FCR, the highest digestibility coefficients of CP, EE and NFE, as well as, the highest feeding values in term of TDN, DCP and DE, compared with Parsley supplemented diet and control one (Hassanien and Abd El-Karim, 2013). Also, dietary inclusion of ginseng at 4 and 6 g per 5 kg feed improved feed conversion ratio, increased broiler weight gain, and reduced mortality to 0% (Amaefule *et al.*, 2019).

In the present study, rabbits fed the ginseng or garlic plus ginseng-supplemented diets displayed significantly (P≤0.05) higher plasma triglycerides and cholesterol levels. On the other hand, rabbits fed garlic or garlic plus ginseng supplemented diets showed significantly (P≤0.05) lower levels of plasma low-density lipoprotein. Toghyani *et al.* (2011) noted that garlic supplementation did not induce any significant effect on the serum concentration of albumin. Also, supplementation diets with aged garlic extract had no significant effects on serum HDL cholesterol concentration (Rahman and Billington, 2000). Previous studies proved that garlic and their contents could activate the immune function such as lymphocyte proliferation, cytokine release, phagocytosis and killer cell activity (Wang *et al.*, 2011). Also, Alagawny *et al.* (2016) found that IgG concentration increased by adding garlic powder until 6 g/kg to rabbits diet.

The present results showed that dietary supplementation with ginseng and garlic singly or in combination did not significantly affect (P>0.05) dressing-out percentage, weights of carcass yield, hind parts and edible organs of rabbits. In agreement with our results Alagawny *et al.* (2016) revealed that, dietary garlic treatments did not affect carcass weight and yield as well as spleen weight and dressing percentages of rabbits. These results partially agree with Onibi *et al.* (2009), who showed that carcass and organ traits were not significantly influenced by dietary garlic supplementation. On the same context, Raeesi *et al.* (2010) elucidated that garlic at 1 or 3% had no significant effects on relative weights of carcass or digestive organs among treatments. The carcass weight, liver and kidney, were not significantly influenced by the garlic oil supplementation (El-Gogary *et al.*, 2018).

The results of the present study showed that the rabbits fed the garlic-fortified diet displayed significantly (P≤0.05) heavier testes than did the control group and other experimental groups. In agreement with our results, El-Gogary *et al.* (2018) reported that testes were significantly heavier in rabbits of garlic groups 0.5 and 0.75 g/kg garlic oil. On the other hand, Panax ginseng extracts increased testes weights of adult NZW rabbit bucks without distorting the tissue architecture (Iwuji *et al.*, 2017).

In conclusion, the current study indicated that addition of ginseng or/and garlic powder in the diet enhanced growth performance without any adverse effect on immunity and carcass traits of growing V-line male rabbits.

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تأثير إضافة الجينسينج أو/و الثوم إلى العليقة على أداء النمو، قياسات الدم البيوكيميائية وصفات الذبيحة لذكور أرانب الفي لاين النامية

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أجريت هذه الدراسة لبحث تأثير أضافه مسحوق الجينسينج أو/و مسحوق الثوم للعليقة علي أداء النمو، بعض قياسات الدم البيوكيميائية وصفات الذبيحة لذكور الأرنب النامية. تم تقسيم عدد 48 أرنب في لاين ذكر إلى أربع مجموعات، كانت المجموعة الأولى تغذى على العليقة الأساسية بدون أى إضافات (المجموعة القياسية)، وغذيت المجموعة الثانية على العليقة الأساسية مضاف إليها 50مجم مسحوق جينسينج/ كجم عليقة، والمجموعة الثالثة غذيت على العليقة الأساسية مضاف إليها 5 جم مسحوق الثوم /كجم عليقة والمجموعة الرابعة غذيت على العليقة الأساسية مضاف إليها كل من الجينسينج والثوم معاً. تم تسجيل قياسات معدل النمو خلال الفترة من 5-14 إسبوع من العمر. القياسات البيوكيميائية فى بلازما الدم وكذلك صفات الذبيحة تم قياسها فى نهاية التجربة. تبين النتائج ان إضافة الجينسينج أو/والثوم الى العلائق أدى إلى زيادة معنوية ($P \leq 0.05$) في وزن الجسم الحى ووزن الجسم المكتسب فى ذكور الأرنب عند الإسبوع 14 من العمر. الأرانب المغذاة على العليقة المضاف إليها الثوم أو الجينسينج مع الثوم أظهرت تحسن معنوى لمعدل التحويل الغذائى. أدت تغذيه الأرانب عل العليقة المضاف إليها الجينسينج أو الجينسينج مع الثوم إلى زيادة معنوية ($P \leq 0.05$) فى مستوى كل من الجليسريدات الثلاثية والكوليستيرول فى بلازما الدم. من ناحية أخرى, أظهرت تغذيه الأرانب على العليقة المضاف إليها الثوم أو الثوم مع الجينسينج انخفاضا معنوياً ($P \leq 0.05$) فى مستوي الليبوبروتينات منخفض الكثافة فى بلازما الدم. لم تؤثر بشكل ملحوظ ($P > 0.05$) إضافة الجينسينج أو/و الثوم إلى علائق ذكور الأرنب النامية على كل من نسبة التصافى، وزن الذبيحة، وزن الأجزاء الخلفية وكذلك الاجهزه الصالحة للأكل. أدت تغذية ذكور الأرانب النامية على العليقة المضاف إليها الثوم إلى أن تكون وزن الخصيتين أقل معنوياً ($P \leq 0.05$) بالمقارنة مع المجموعة القياسية وباقى المجموعات. تشير الدراسة الحالية إلى أن أضافه مسحوق الجينسينج أو/و الثوم في عليقة ذكور أرانب في لاين النامية أدى إلى تحسن أداء النمو دون أي تأثير سلبي علي المناعه وصفات الذبيحة.

الكلمات المفتاحية: أرانب، جينسينج، ثوم، أداء النمو، القياسات البيوكيميائية للدم، خصائص الذبيحه