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USING GINSENG AND BEE POLLEN AS NATURAL GROWTH PROMOTERS TO IMPROVE PRODUCTIVE PERFORMANCE AND CARCASS TRAITS OF GROWING RABBITS

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ABSTRACT

This study aimed to investigate the effects of using ginseng and bee pollen as natural growth promoters to improve productive performance and carcass traits of Californian growing rabbits. A total number of 60 growing Californian rabbits (Cal), 5 weeks old and with an average initial body weight 642.67±15.72g were used in the study. The rabbits were randomly allotted to four experimental groups. The 1st group fed basal diet and served as a control. *The 2nd group fed basal diet plus 250 mg ginseng/kg diet. The 3rd group was fed basal diet plus 250 mg Bee pollen (BP)/kg diet. The 4th group was fed basal diet plus 250 mg ginseng+ 250 mg BP /kg diet. Growth performance traits and carcass characteristics were used as indices for the study.*

Feed supplementation with either 250 mg ginseng (Gen) or 250 mg Bee pollen (BP)or mixture of 250 mg Gen + 250 mg BP/kg diet significantly (P < 0.05 or <0.01)improved rabbits final body weight, body weight gain and feed conversion ratio at 9-13 weeks of age, however the improvement in growth performance parameters was the best when mixture of ginseng and bee pollen were used .

Carcass traits of growing rabbits were not affected significantly by supplementation of ginseng or bee pollen in the diet.

***In conclusion**, based on the results of the present experiment and from an economic point of view, it is advisable to supply the commercial basal growing rabbit diet with mixture of 250 mg ginseng and 250 mg BP/ kg diet to improve their growth performance. More studies should be carried out by using more number of rabbits and higher doses of ginseng and bee pollen to insure its effectiveness as growth stimulants.*

Key word: Growth promoters**,** ginseng pee pollen, productive performance and carcass traits.

INTRODUCTION

Egypt is characterized by animal protein deficiency. This is not only due to the small number of existing farm animals as compared to rapid growth of human population, but also due to the low productive and reproductive capabilities of these animals (Seleem *et. al.,* 2011). The increase in animal protein production may come from short-life cycle of animals kept by the small holder farmers such as rabbits (Galal and Khalil, 1994). Rabbit farming is encouraged to minimize the gab between demand and supply of animal protein (F.A.O. 1987).

Several attempts have been carried out to promote and stimulate rabbits productivity and reproduction using some commercial growth promoters (Ashour *et al.,* 2004 and El-Kholy *et al.,* 2012). During the last years, interest in the study of phenolic compounds has increased greatly, mainly due to the antioxidant capacity of these substances in scavenging free radicals that are harmful to human and animal health (Prelipcean, 2012 and Capcarova *et al.*, 2013). Ginseng (Araliacease), also called Asian ginseng, is one of the most renowned herbal plants worldwide, but particularly in Asian countries and has been used for thousands of years to maintain homeostasis of the body and enhance vital energy (Choi, 2008 and Yildirim and Erener, 2010). It has previously been documented that bioactive components such as saponins (ginsenosides), antioxidants, peptides, polysaceharides, alkaloids, lignin and polyacetylenes are present in Panax ginseng (Palazon *et al*., 2003; Lü *et al*., 2009).

Bee pollen are used widely as natural biostimulants. Bee pollen (BP) contains many essential nutritional elements important for growth and development of animals and humans (Orzaez Villanueva *et al.*, 2002; Haščík *et al.*, 2011 and Pascoal *et al*. 2014). Bee pollen is a rich source of protein (25%); essential amino acids; fat (6%), containing more than 51% polyunsaturated fatty acids of which 39% linolenic (omega-3), 20% palmitic and 13% linoleic acids (omega-6); more than 12 vitamins; 21 minerals (calcium, chlorine, copper, iron, magnesium, iodine, molybdenum, selenium, strontium, stannum, boron, fluoride, vanadium, chromium, phosphorus, potassium, sulfur, aluminum, iron, manganese and zinc); 11 enzymes or co-enzymes; 11 carbohydrates (35–61%) which are mainly glucose, fructose and sucrose; flavonoids and carotenoids; phytosterols (Xu *et al.*, 2009; Hashem *et al.* (2021) and El-Sabrout *et al*. (2023 a and b).Also, Graikou *et al.* (2011) reported that the bee pollen are rich in flavonoids and phenolic acids which indicate the

observed free radical scavenging activity. Studies on the addition of BP to rabbits under Egyptian conditions during growing period are in somewhat limited (Attia *et al.*, 2014).

The present study was designed to investigate the effects of using ginseng and bee pollen as natural growth promoters on productive performance and carcass traits of Californian growing rabbits

MATERIALS AND METHODS

The experimental work of the present study was carried out at Rabbits Research Unit, Department of Animal and Poultry Production, Faculty of Technology and Development, Zagazig University, Zagazig, Egypt. The experimental work was initiated in April 2023 and terminated in August, 2023. The present experiment was conducted on growing Californian rabbits (5 weeks of age). The laboratory work was performed at Central Lab for Soil, Foods and Feedstuffs (International accredited Laboratory, has ISO 17025, since 2012) belongs to Faculty of Technology & Development, Zagazig University, Zagazig, Egypt.

A total number of 60 growing Californian rabbits (Cal), 5 weeks old and with an average initial body weight of 642.67±15.72g) were used in the study. The rabbits were randomly allotted to four experimental groups. The 1st group fed basal diet and served as a control. The 2nd group fed basal diet plus 250 mg ginseng/kg diet. The 3rd group was fed basal diet plus 250 mg bee pollen (BP)/kg diet. The 4th group was fed basal diet plus 250 mg ginseng + 250 mg BP /kg diet. All the experimental diets were iso nitrogenous and iso caloric. Rabbits in all experimental groups were fed *ad. libitum* and water was available all the time through water nipple in each cage. All rabbits were kept under the same managerial, hygienic and environmental conditions.

The samples of feed ingredients and the experimental diets were taken for chemically analyzed to determine crude protein, crude fiber, ether extract, nitrogen free extract, and moisture according to the methods international test The diets were formulated to meet the nutrient requirements of growing rabbits according to NRC (1977). Ingredients and chemical composition of the experimental pelleted diets are shown in Table 1.

Table 1: Ingredients and chemical composition of the experimental pelleted basal diet (Control diet).

Ingredients	**%**
Egyptian berseem hay	33.0
Barley grain	16.0
Yellow corn	12.0
Wheat bran	18.0
Soybean meal (44%)	16.5
Common salt	0.5
Molasses	2.0
Di-Calcium Phosphate	0.5
Limestone	1.0
Vitamin & mineral premix*	0.2
DL-Methionine	0.2
Anti-toxicants	0.1
Total	**100**
Chemical composition (%)	
Dry matter (DM)	90.64
On DM basis (%):	
Organic matter (OM)	82.19
Crude protein (CP)	18.00
Ether extract (EE)	3.60
Crude fiber (CF)	14.36
Nitrogen free extract (NFE)	46.23
Ash	8. 45
DE (Kcal/kg feed DM)**	2603.1

*Vitamins and mineral premix per kilogram contained: Vit. A 2,000,000 Iμ, Vit. D_3 150,000 Iμ, Vit. K 0.33 mg, Vit. B_1 0.33 g, Vit B_2 1.0 g, Vit B_6 0.33 g, Vit. B_{12} 1.7 mg, Pantathonic acid 3.33 g, Biotin 33 mg, Folic acid 0.83 g, Choline chloride 200 mg, Zn 11.7 g, Mn 5.0 g, Fe 12.5 g, Mg 66.7 mg, Se 16.6 mg, Co 1.33 mg, Cu 0.5 g, I 16.6 mg and Antioxidant 10.0 g.

**DE (Kcal/kg feed DM) was calculated according to Cheeke (1987).

Live body weights were weekly recorded, then body weight gain and relative growth rate (RGR) were calculated during the experimental period from 5 to 13 weeks of age.

$$RGR = \frac{w_2 - w_1}{1/2(w_1 + w_2)} \times 100$$

At the end of the experimental period (13 weeks of age), four rabbits from each groups were randomly taken and weighed before slaughtering. after slaughtering and complete bleeding, the head, pelt, viscera, feet and tail were removed. Weight of hot carcass (dressed weight) was recorded, and then dressing percentage was calculated. Weights of organs, including head, heart, liver and kidney were recorded.

Whereas: W_1 = Iinitial weight, and W_2 = Final body weight

Statistical analysis:

Data were statistically analyzed using analysis of Variance according to **Snedecor and Cochran (1982)** using the General Linear Model Program of **SPSS (2013)** using the following model for bucks:

$Yij = \mu + Si+ + eij$

Where, Yij = the observed value of a given dependent variable, μ = Overall adjusted mean, Si = Source of natural growth promoters effect (i = 1, 2 ,3 and 3)and eij = Random error. The differences between LSM (least square means) were analyzed by Duncan's New Multiple Range test (**Duncan, 1955**).

RESULTS AND DISCUSSION

Productive performance traits:

Results presented in Table (2) showed that feed supplementation with either 250 mg ginseng (Gen) or 250 mg bee pollen (BP) or mixture of 250 mg Gen + 250 mg BP/kg diet significantly ($P < 0.05$ or <0.01) improved rabbits final body weight, body weight gain and feed conversion ratio at 9-13 weeks of age, however the improvement in growth performance parameters was the best when mixture of ginseng and bee pollen were used. These results are in agreement with those obtained by El-Hanoun *et al.* (2007) and Attia *et al.* (2011) found that growing rabbits administrated bee pollen at 250 and 500 mg/kg BW significantly increased growth and survival rate during growing period. Abdel-hamid and El-Tarabany (2019), the inclusion of bee pollen as an oral supplement (250 or 350 mg/kg body weight) can improve feed conversion ratio of growing rabbits. Zeedan *et al*. (2017) noted that supplementing rabbit diets with 700 mg bee pollen/kg body weight increased body weight and body weight gain as well as improving the feed conversion rate of treated rabbits while decreasing daily feed intake. This decrease in feed intake could be due to the high content of carbohydrates and

Table 2. Productive performance traits of growing Californian rabbits fed diet supplemented with ginseng and bee pollen ($\bar{X}$±SE).

Items	Treatments				Sig.
	Control	Ginseng	Bee pollen	Ginseng + Bee pollen	
Live body weight (g) at:					
5 weeks	642.7±34.3	642.7±33.0	642.7±31.8	642.7±29.9	NS
9 weeks	1202.3±24.8^{b}	1291.4±15.2^{a}	1310.1±29.6^{a}	1326.4±27.1^{a}	**
13weeks	1873.9±39.5^{b}	2018.5±23.8^{a}	2031.2±41.6^{a}	2095.3±13.0^{a}	**
Live weight gain (g)from:					
5-9 weeks	568.6±29.6	629.2±33.6	637.0±34.3	674.3±29.3	NS
9-13 weeks	671.6±37.89	727.1±23.4	721.2±35.1	768.9±27.7	NS
5-13 weeks	1240.3±42.7^{b}	1356.4±36.5^{ab}	1358.2±56.9^{ab}	1443.1±31.7^{a}	**
Daily weight gain(g)from:					
5-9 weeks	20.31±1.06	22.47±1.20	22.75±1.22	24.08±1.047	NS
9-13 weeks	23.99±1.35	25.97±0.84	25.76±1.25	27.46±0.99	NS
5-13 weeks	22.15±0.76	24.22±0.65	24.25±1.017	25.77±0.57	**
Relative growth rate from:					
5-9 weeks	63.02±4.87	65.05±4.16	64.59±3.68	68.86±3.72	NS
9-13 weeks	43.60±1.32	43.9±1.27	4316±1.96	45.12±1.92	NS
5-13 weeks	99.49±4.32	101.55±3.33	100.41±3.94	105.53±3.39	NS
Feed intake (g) from:					
5-9 weeks	55.51±3.58	52.49±1.53	53.89±0.44	52.78±1. 20	NS
9-13 weeks	107.53±3.36	107.51±1.79	112.09±1.03	106.97±1. 50	NS
5-13 weeks	81.52±2.25	80.00±0.98	82.99±0.67	79.88±0.91	NS
***Feed conversion (g feed/g gain) from*:**					
5-9 weeks	2.97±0.49	2.44±0.11	2.44±0.11	2.18±0.06	NS
9-13 weeks	4.05±0.15	4.40±0.07	4.07±0.24	3.88±0.12	NS
5-13 weeks	3.50^{ab}±0.15	3.47^{a}±0.08	3.33^{ab}±0.14	3.08^{b}±0.07	*

Means in the same row with different letter, differ significantly (P<0.05).
NS = Not significant,* (P<0.05).and ** = P ≤ 0.01

sugars in bee pollen products, in addition to some bioactive substances that increase nutrient utilization efficiency, feed digestibility, and microbial biosynthesis (El-Sabrout *et al*. 2023a); thus, it does not make rabbits feel nutritionally deficient. Moreover, bee pollen and propolis combination positively increased rabbits' body weight (Attia *et al*. 2015).

The beneficial effects of ginseng on growth performance of rabbits are mainly attributed to the alteration of the intestinal microbial battery, increased enzyme secretion, improved immune response, reducing biological stress, increasing antioxidant activity and consequently improving health status (Brugalli, 2003, Fascina *et al*., 2012).

Additionally, the presence of ginsenoside in the panax ginseng complex contributed to improvement the parameters evaluated by its antimicrobial and antioxidant potential, as well as, assist the absorption of nutrients by increasing the permeability of the small intestinal mucosa as confirmed by Takahashi *et al*. (1992); Kim *et al*.,(2008), Zhang *et al*.(2008) and Lim *et al*.(2009).In agreement with the present results, Chrastinová *et al*.,(2009) found that, addition of gensing into growing rabbit diets (30g/ 100kg) improved average daily weight gain and daily feed intake ($P<0.05$). Similar results were reported with chickens (AO *et al*., 2011) and rats (Abdel-Wahhab *et al*., 2012).

Carcass traits:

Data in Table 3 showed that all carcass traits were not affected significantly by diet supplemented with 250 mg ginseng, 250 mg BP or 250 mg ginseng plus 250 mg BP /kg diet as compared with control group.

Similar results were found by Rabie *et al*., (1997) and Rabie and Silágyi (1998).They observed greater breast and high meat yield in broilers fed diets containing sapononin. Liver size significantly ($P<0.05$) reduced on diets with saponin alone or along with carnitine. Nemauluma *et al*. (2023) reported that bee pollen inclusion in the starter diets (12 g/kg) has positive effects on carcass yield without any adverse effect on the meat quality of broiler chickens.

In conclusion, based on the results of the present experiment and from an economic point of view, it is advisable to supply the commercial basal growing rabbit diet with mixture of 250 mg ginseng and 250 mg BP/ kg diet to improve their growth performance and maintain their health status during the hot summer conditions in Egypt.

More studies should be carried out by using more number of rabbits and higher doses of ginseng and bee pollen to insure its effectiveness as growth stimulants.

Table 3: Carcass traits (g) of growing Californian rabbits fed diet supplemented with ginseng and bee pollen ($\bar{X}$±SE).

Items	Treatments				Sig.
	Control	Ginseng	Bee pollen	Ginseng + Bee pollen	
Pre-slaughter wt.	2094.4±76.25	2050.2±36.37	2085.8±.224	2053.6±63.28	NS
Head wt.	121.80±4.79	121.20±4.98	126.80±2.08	119.40±2.71	NS
Giblets wt	82.6±5.52	84.40±3.00	84.00±2.43	76.40±3.70	NS
Liver wt.	58.60±5.15	60.00±2.92	59.40±2.21	54.60±3.17	NS
Kidney wt.	16.00±1.00	16.60±0.75	16.60±0.68	14.80±0.97	NS
Heart wt.	8.00±0.45	7.80±0.80	8.00±0.55	7.00±0.45	NS
Lungs	16.20±1.02	14.20±1.56	14.40±0.25	15.20±1.16	NS
Spleen	1.20±0.20	0.98±0.02	0.98±0.02	1.00±0.00	NS
Carcass*	1254.80±46.46	1248.00±26.55	1249.80±24.55	1264.80±54.70	NS
Dressing*	1339.4±49.65	1332.40±26.41	1333.80±26.26	1341.20±57.56	NS
Dressing (%)	63.96	64.98	93.94	65.25	NS

NS = Not significant.

*Carcass weight= Empty weight (fore limbs+ hind limbs+ trunk) + head weight.

*Dressing weight= Carcass weight+ Giblets weight (weights of heart+ kidneys+ liver).

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