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INFLUENCE OF BEE VENOM INJECTION ON GROWING RABBITS: 1- PERFORMANCE, CARCASS TRAITS, AND ECONOMIC EFFICIENCY

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ABSTRACT

In order to investigate the implications of bee venom (BV) injection on growth performance, carcass, relative organ weight, the performance index, and economic efficiency from 5 to 10 weeks, 45 grower male V-line rabbits were employed. Nine rabbits were randomly assigned to each of five the treatment groups that were of identical size. Rabiits were divided into three identical replicates for each treatment. The 1st group was untreated as a negative control. The 2nd group was injected dilution of normal saline (0.9%) as a positive control. The 3rd, 4th and 5th groups were injected 0.1, 0.2 and 0.3 mg of BV/ rabbit, respectively. The injection volume was 0.1 ml/ rabbit, the rabbits were injected at 5 and 7 weeks of age, and the experiment lasted for 10 weeks. The BV injected groups had higher significant body weight (BW), body weight gain (BWG) and feed consumption (FC) compared to the negative and positive control groups at 10 weeks of age. The 0.3 mg/ rabbit of BV injected group had a significantly better feed conversion ratio (FCR) compared to the negative and positive control groups during 5-10 week intervals. The results of all studied traits of carcass showed highly significant differences among the studied groups. The study clearly indicates that injecting growing V-line rabbits

with BV twice during the period from 5 to 10 weeks of age with the studied doses, especially 0.3 mg level, resulted in a significant improvement in performance traits, performance index and relative economic efficiency.

Keywords: body weight, performance index, relative organs weight, bee venom, rabbits

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INTRODUCTION

Compared to other sources of protein, rabbit meat is a more nutrient-dense and healthful form of animal protein (**Dalle Zotte and Szendro, 2011**). Additionally, with consistent development over the past several years, the production of rabbits has been identified as one of the animal industries in Egypt with the most potential and capacity for growth (FAO, 2019). Recently, The public as well as scientific organisations have both given the qualitative and quantitative qualities of rabbit meat considerable attention (**El-Hanoun *etl al.*, 2020; Elhanafy *et al.*, 2023**). As a result, limiting the use of both hormones and antibiotics in animal farms has become an international concern in an effort to provide safer and healthier alternatives. As a significant external environmental component, dietary supplements often have a significant direct impact on animal wellbeing (**Jung *et al.*, 2010; Abdelnour *et al.*, 2019**).

All bee products, together with bee venom (BV), have been used for medical purposes for a very long time. In fact, the Bible and the Holy Quran both mention the usage of bee products (**Fratellone *et al.*, 2015; Abd El-Wahab and Eita, 2015**; **Guha *et al.*, 2021**). At least 18 pharmacologically active substances, containing peptides like melittin, adolapin, and enzymes like phospholipase A2 and hyaluronidase, amino acids, and volatile chemicals, are known to be present in BV, which is produced by female worker bees (**Lee *et al.*, 2009**; **Moreno and Giralt, 2015**; **Bellik, 2015**; **Wehbe *et al.*, 2019**). In addition, BV can be regarded as one of the most efficient natural supplements because of its distinctive structure and plenty of advantageous enzymes and peptides (**Kim *et al.*, 2006**). BV, also known as apitoxin, is the major component of honeybee products such as propolis, pollen, royal jelly, and honey that are used in apitherapy (**Hellner *et al.*, 2008 Trumbeckaite *et al.*, 2015)**. Strong anti-inflammatory, antibacterial, analgesic, and immunological response-enhancing properties are obtained by natural BV material (**Curcio-Vonlanthen *et al*., 1997**; **Wehbe *et al.*, 2019**), anti-viral and anti-cancer properties (**Hood *et al.*, 2013**; **Rady *et al.*, 2017**; **Guha *et al.*, 2021**) and anti-infective, antidiabetic (**Memariani *et al.*, 2020**).

Animal diets can be supplemented with BV derived material to improve performance (**Rabie *et al.*, 2018**), provide health advantages (**Sturm *et al.*, 2002**), cure illness (Apitherapy), and function as an antibacterial agent (**Han *et al.*, 2010**). As a result, BV is a nutritional substance that also has medicinal and physiological effects. Along with adolapin (polypeptides), which serves a variety of medicinal purposes as an anti-inflammatory and an antibacterial agent, melittin and apamin are the active substance components of BV (**Sumikura *et al.*, 2003; Baqer and Yaseen, 2018**).

In an attempt to make full use of the useful BV characteristics, this study was directed to estimate the effects of BV injection under the neck skin of growing rabbits on productive, carcass characteristics as well as the economic efficiency of growing rabbits.

MATERIALS AND METHODS

Ethical Statement

The current study was conducted in collaboration with the Animal and Poultry Production Department, Faculty of Agriculture, Damanhour University and a Privet farm in El-Beheira Governorate, Egypt. The Institutional Animal Care and Use Committee of Damanhour University authorized all treatments and rabbit care practises. The directive 2010/63/EU of the European Parliament and of the Council on September 22, 2010, on the protection of animals and birds employed for scientific purposes, was complied with, the authors claim.

Injection solutions

BV samples were collected from *apis mellifera carnica* and saved at the Plant Protection Research Institute, Agriculture Research Centre, Egypt until use. The purification and separation process of BV was performed according to **Hind *et al.* (2018).** To achieve a solution of BV, an fitting weight was melted in saline solution immediately before injection.

Experimental Design and Rabbits Management

A total of forty-five males weaned rabbits (V-line), with an average starting weight at 35 days (961.62 ±5.05g). Rabbits were divided into five treatments (n= 9). Three identical replicates, each with three rabbits, were used for each treatment. The 1st group was untreated as a negative control. The 2nd group was injected with dilution liquid (normal saline solution, 0.9%) as a positive control. The 3rd, 4th and 5th groups were injected by 0.1, 0.2 and 0.3 mg of BV/rabbit, correspondingly. Rabbits were injected under the neck skin and the injection volume was 0.1 ml/ rabbit. All treated animals were injected at two times (5 and 7 weeks of age).

The rabbits were kept in a one-level, naturally ventilated housing (open house) with galvanized cages. The cage was 40 by 50 by 35 centimeters in size. A metallic feeder and nipple drinkers for water were provided in each cage. The same management and environmental circumstances were used to raise rabbits. Temperature and ventilation were normal. During the trial period, the surrounding temperature, relative humidity, and daylight duration varied from 23 and 27°C, 60 and 65%, and 14 hours, respectively. Throughout the trial, feed and water were freely available at all times. The commercial pellet diet offered all necessary vitamins and minerals as suggested by (NRC, 1994) and contained 17.24% crude protein, 13.46% crude fibre, 2.80% fat, and 2464 kcal/kg (Table 1). Rabbits always have access to clean, fresh water.

Table (1): Experimental diet ingredient and composition analysis

Diet ingredient	
Item	Kg/ ton
Clover hay	395.0
Soybean meal	175.0
Wheat bran	150.0
Barley	130.0
Yellow corn	100.0
Molasses	30.0
Dicalcium phosphate	8.0
Limestone	5.0
Sodium chloride	3.0
Vitamin and minerals mixture*	3.0
DL-methionine	1.0
Composition analysis	
Item	g/kg
Dry matter	903.2
Organic matter	804.8
Nitrogen-free extract	569.8
Crude protein	172.4
Digestible energy (kcal/kg)	2464
Ether extract	28.00
Crude fiber	134.6
Ash	95.20

* Each premix given for a 3 kg/ton diet of rabbits includes the following ingredients: vitamin A 12,000,000 IU; vitamin B1 1,000 mg; vitamin B2 5,000 mg; vitamin B6 1,500 mg; vitamin B12 10 mg vitamin D3 2,000,000 IU; vitamin E 10,000 mg; vitamin K3 2,000 mg; biotin 50 mg; choline chloride 250,000 mg; pantothenic acid 10,000 mg; nicotinic acid 30,000 mg; folic acid 1,000 mg; iron 30,000 mg; copper 10,000 mg; manganese 60,000 mg; iodine 1,000 mg; selenium 100 mg; cobalt 100 mg; zinc 50,000 mg and antioxidant, 1,000 mg to 3,000 g.

Performance Traits

The cumulative body weight (BW), body weight gain (BWG), and feed conversion ratio FCR, (g feed/ g body gain) were estimated over the collection of data by time. For each treatment, the number of dead rabbits was documented throughout the whole experimental period. The survival rate was then determined as the ratio of the number of alive rabbits at the conclusion of the research (10 weeks old) to the initial overall number of rabbits.

Carcass Traits

At the final stage of the experiment, six randomly selected rabbits from each group were slaughtered following a 12-hour fast to determine the corpse features. The fresh carcass components, including the liver, heart, kidneys, lungs, pancreas, spleen, intestine, and cecum were weighed, and categorized, their relative weight from the live BW was estimated and was determined as definite as g/kg of the weight before slaughter. Carcass % is equal to carcass weight × 100/ LBW. Dressing % is equal to (carcass weight and giblets weight) × 100/ LBW.

Performance Index and Economic Study

The final stage of the experiment, the performance index was estimated using the equation of **North (1981)**, as follows; Performance index = (final live BW (kg)/ FCR) × 100. According to Abdella et al. (1988), economic efficiency was calculated for every group in the study as the difference between total costs and total income during the course of the experiment. Feeding expenses, rabbit purchases, and veterinary care expenses are included in the overall expenditures. The overall income also included the amount of money from the rabbit's ultimate live weight. According to the cost of the components in the regional marketplace at the time of the experiment (2021), all these characteristics were approximated in LE.

Statistical Analysis

Data were analyzed using the General Linear Model (GLM) procedure procedure of Statistical Package for Social Sciences (SPSS®) software program (**SPSS, 2016**). Data were analyzed in one-way ANOVA in CRD. The significant differences among treatment means were tested according to **Duncan (1955)**. The statistical model looked like this: $y_{ij} = \mu + \tau_j + \varepsilon_{ij}$, where μ = general mean, τ = treatment effect and ε = experimental random error. The Duncan's multiple range test was used to identify the significant variations between means at 5% level of significant (**Duncan, 1955**).

RESULT AND DISCUSSIONS

Performance Traits

The influence of BV injection on developing rabbits' productive performance throughout the period from 5 and 10 weeks of age is existing in Table 2. The results of body weight (BW) showed no significant differences among all studied groups at the 5th weeks of age, however, it was highly significant at the 10th weeks. The BV injected groups (0.1, 0.2, and 0.3 mg) had a higher and significant BW compared to the negative and positive control groups at 10 weeks of age (2086.00, 2088.30, 2180.80, 1965.30 and 1991.00g, respectively) with significant superiority for 0.3 mg BV injected group among all studied groups in this respect.

Table 2. Influence of bee venom (BV) injection on productive performance of growing rabbits during 5 and 10 weeks of age.

Items	Control	Saline	BV (mg/ rabbit)			SEM	*P-value*
			0.1	0.2	0.3		
5 Wk BW, g	977.56	972.22	944.44	957.78	956.11	5.05	0.240
10 Wk BW, g	1965.30^{c}	1991.00^{c}	2086.00^{b}	2088.30^{b}	2180.80^{a}	15.80	0.000
5-10Wk BWG, g	987.74^{c}	1018.78^{c}	1141.56^{b}	1130.52^{b}	1224.69^{a}	16.97	0.000
5-10Wk FC, g	3278.40^{d}	3474.60^{c}	3854.60^{ab}	3742.40^{b}	3888.40^{a}	46.97	0.000
5-10Wk FCR, g/g	3.32^{ab}	3.41^{a}	3.38^{ab}	3.31^{b}	3.18^{c}	0.02	0.000

^{a,b,c} Means with various characters in an identical row differ significantly from one another ($P \leq 0.05$). **SEM**= pooled standard error; BW = body weight; BWG = body weight gain; FC = feed consumption; FCR = feed conversion ratio

Similarly, to BW trend, the BV injected groups (0.1, 0.2 and 0.3 mg) had a higher and significant BWG in contrast to the negative and positive control groups throughout the whole experimental period, BWG 5-10 (1141.56, 1130.52, 1224.69, 987.74 and 1018.78 g, respectively) with a significant superiority for 0.3 mg BV injected group among all studied groups in this respect.

There is a lack of tangible information noting the effect of BV on the growth of rabbits, however, the herein results are in harmony with the outcome results with broiler chickens. **Jung *et al.* (2013)** discovered that BV spray enhanced broilers BWG, in particular, in the presence of infection. While, after injecting BV (0.5, 1.0, and 1.5 mg) weekly till 5 weeks of age, **Ali and Mohanny (2014)** pointed out that BV decreased significantly the BW and daily BWG of unsexed Ross 308 broiler chicks throughout the interval of 0-3 weeks of age. However, there has been no significant differences in BW and BWG at 6 weeks of age. **Han *et al.* (2016)** noted that including BV in the drinking water significantly increased BWG of Arbor Acres broiler chickens at 28d of age compared to the control birds. The increase in BWG was more prominent alongside with the supplementation of 1mg/L of BV compared with 0.5 mg BV/ L. It could be concluded that BV is an alternative to the antimicrobial growth promoters in broiler nutrition. Adding BV to Ross 308 broiler diet (0, 10, 50, 100, and 500 μg BV per kg of diet) was studied by **Kim *et al.* (2018)** who summed up that BV could be included into the feed of broiler chickens to enhance growth and boost animal health.

The results of FC gave us an idea that the BV injected groups (0.1, 0.2, and 0.3 mg) showed a higher significant FC compared to the negative and positive control groups throughout the whole experimental period, FC 5-10 (3854.60, 3742.40, 3888.40, 3278.40, and 3474.60 g, respectively). The 0.1 and 0.3 mg BV injected groups had the highest figures in that respect among BV injected groups; however, the 0.2 mg BV injected group expressed a fluctuating trend all along the studied intervals. The 0.3 mg BV injected group had better and significant FCR (lower values) compared to the negative and positive control groups by 5-10 week intervals (2.69, 3.15, 3.51 and 3.18 g feed/ g BWG, respectively) compared with the values of control and saline groups. **Han *et al.* (2010)** noticed an increase in feed intake of *Arbor Acres* broiler chickens in the groups supplemented with BV as compared to control chicks. After injected BV (0.5, 1.0 and 1.5mg) weekly till 5 weeks of age, **Ali and Mohanny (2014)** pointed out that BV caused a decrease in daily feed intake of the unsexed Ross 308 broiler chicks in the course of the periods from 4-6 and 0-6 weeks of age.

Generally, the grown rabbits` performance traits expressed significant positive effects during 5-10 weeks of age (Table 3) as a result of different BV injected levels compared to the control value, except the only negative effect observed on FCR of 0.1 mg BV group (+1.81%). Among the BV injected groups, the rabbits of 0.3 mg BV injected group Having a notably higher/ better values of BW, BWG, FC and FCR traits (+10.97, +23.99, +18.61 and -4.22%, respectively).

Table 3. The significant changes/improvements (%) of BV treatments compared to control group during 5-10 weeks of age.

Items	Control	Changes of BV Treatments (%)		
		0.1 mg	0.2 mg	0.3 mg
BW	1965.30g	+6.14	+6.26	+10.97
BWG	987.78g	+15.57	+14.46	+ 23.99
FC	3278.40g	+17.58	+14.15	+18.61
FCR	3.32	+1.81	-0.30	-4.22

BW = body weight; BWG = body weight gain; FC = feed consumption; FCR = feed conversion ratio

Slaughter Characteristics

The effects of BV injection on carcass traits of growing rabbits at 10 weeks of age are shown in Table 4. The outcome of all studied traits of carcass showed highly significant differences among the studied groups. Rabbits of 0.1 mg BV injected group had significantly higher carcass, dressing, head and abdominal fat percentages (56.41, 62.84, 5.58, and 0.80%, respectively) compared with all other groups. Rabbits of 0.2 and 0.3 mg BV groups have non-significant carcass (50.26 and 52.59%, respectively) and dressing (58.17 and 58.29%, respectively) percentages in comparison to the associated value for both the control and saline. Furthermore, rabbits in 0.2 mg BV injected group had significantly higher giblets percentages (7.91%) compared with all other groups.

Table 4. Effect of bee venom (BV) injection on carcass traits (%) of growing rabbits at 10 weeks of age

Items	Control	Saline	BV (mg/ rabbit)			SEM	*P-value*
			0.1	0.2	0.3		
Carcass, %	50.52^{b}	52.00^{b}	56.41^{a}	50.26^{b}	52.59^{b}	0.57	0.001
Dressing, %	56.30^{b}	58.68^{b}	62.84^{a}	58.17^{b}	58.29^{b}	0.56	0.001
Giblets, %	5.77^{c}	6.68^{b}	6.44^{bc}	7.91^{a}	5.71^{c}	0.19	0.000
Head, %	4.75^{d}	4.85^{cd}	5.58^{a}	5.02^{bc}	5.15^{b}	0.09	0.007
Abd. Fat, %	0.38^{cd}	0.55^{b}	0.80^{a}	0.48^{bc}	0.31^{d}	0.05	0.003

^{a,b,c} Means with various characters in an identical row differ significantly from one another ($P \leq 0.05$). **SEM**= pooled standard error; ***P-value***= probability value and Abd. Fat= abdominal fat

The present results pointed out that the 10 wk rabbit dressing percentages scopes from 56.30 to 62.84%, which are in harmony with those values obtained without any diet supplementation reported as for 74-days rabbits by **Abdel-Azeem *et al*. (2007)** using four pure breeds and their crosses (ranged between 57.04 and 58.89%) and **Metzger *et al*. (2011)** for Pannon White growing rabbits (ranged between 56.4 and 59.7% for different body weight categories). However, **Murshed *et al*. (2014)** reported less dressing values of 6-months indigenous rabbits (47.92% in males and 48.55% in females). Whereas, **Fadare (2015)** reported greater values for 12-wks New Zealand (67.59%), California (64.76%), Havana black (65.15%) and a lower value for Palomino (55.23%) rabbits. In addition, the carcass traits discovered in the current study were within the range of the rabbits studied by **Elkhateeb *et al*. (2018)** and **Aljohani and Abduljawad (2018)** with different strains and ages. However, **Metzger *et al*. (2011)** reported higher values for abdominal fat (ranged between 0.83 and 2.09%) of different body weight categories of 74-day Pannon white growing rabbits.

Generally, 0.1 mg BV injected level promoted, in a significant figure, higher carcass and dressing percentages compared with all other groups, however, rabbits of 0.2 and 0.3 mg injected groups showed no significant differences in that respect when compared to the associated values of the negative and positive control groups.

The effects of BV injection on relative organ weights of growing rabbits at 10 weeks of age are shown in Table 5. The results pointed out that the relative liver, kidney, lung and pancreas weights had significant differences among the studied groups, meanwhile, the relative heart, spleen, intestine and cecum weights had no significant differences among the studied groups. Rabbits of 0.2 mg BV group showed significantly the highest relative liver and kidney weights (6.08 and 0.76%, respectively) compared with all other studied groups. Rabbits of positive control had significantly the highest relative lung and pancreas weights (0.73 and 0.25%, respectively) compared with all other studied groups.

Table 5. Effect of bee venom (BV) injection on relative organs weights (%) of growing rabbits at 10 weeks of age

Items	Control	Saline	BV (mg/ rabbit)			SEM	*P-value*
			0.1	0.2	0.3		
Liver	4.16[b]	4.78[b]	4.69[b]	6.08[a]	4.10[b]	0.24	0.037
Heart	0.31	0.41	0.37	0.40	0.37	0.02	0.331
Kidney	0.61[c]	0.69[b]	0.70[b]	0.76[a]	0.68[b]	0.02	0.026
Lung	0.60[b]	0.73[a]	0.61[b]	0.62[b]	0.48[c]	0.03	0.036
Spleen	0.09	0.07	0.06	0.06	0.07	0.01	0.423
Pancreas	0.13[c]	0.25[a]	0.13[c]	0.19[b]	0.15[c]	0.14	0.010
Intestine	8.01	7.96	8.22	8.25	8.09	0.23	0.996
Cecum	7.37	6.24	7.12	7.43	7.32	0.29	0.740

[a,b,c] Means with various characters in an identical row differ significantly from one another ($P \leq 0.05$).
SEM= pooled standard error and ***P-value***= probability value

Working on four pure breeds of rabbit and their crosses, **Abdel-Azeem *et al*. (2007)** noted that the 74-day rabbits have kidneys weight scoping between 13.62 and 13.76g and spleen weights scoping between 1.29 and 1.34g. **Abdel-Khalek *et al*. (2011)** pointed out that the caecal weight of NZW rabbits at 8 and 12 weeks of age was 18.5 and 23.1g, respectively. **Fadare (2015)** reported the relative weights of kidney for NZW, California, Palomino and Havana black 12-wk rabbits were 0.50, 0.52, 0.52 and 0.57%, respectively. **Aljohani and Abduljawad (2018)** discovered that the caecal weight and length were 169.77g and 11.98cm of 86-day NZW rabbits of the control group. **Elkhateeb *et al*. (2018)**

revealed that there were no real differences between male and female. of 87-days NZW rabbits in the relative cecum weight (0.347 and 0.383%, respectively). **Yu and Chiou (1997)** found that the caecum and intestine weights of 8-wk Californian male rabbits (weighed 1018g) were 90.8 and 65.3g, respectively. The cecum of a rabbit is proportionately the biggest cecum found in any animal. It makes up 40–60% of the gastrointestinal tract's overall capacity and is twice as long as the abdominal cavity (**Jenkins, 2000**).

On the other hand, after feeding Cobb 500 chicks diets with propolis (200 mg/ kg diet) or supplementing drinking water with BV (1 or 2 mg/ L), **Rabie *et al.* (2018)** found that bee-venom (2 mg/ L water) treatment had significantly greater relative spleen and bursa weights in comparasion to the control group. **Khalil *et al.* (2021)** found out that spleen and bursa relative weights were higher (0.09 and 0.15%, respectively) of Alexandria chicks *in-ovo* injected with 20µg BV/ egg group compared to the matching values of the control group. Moreover, in a mixture of Melittin in drink water and Thepax in formulated diets, **Elmalky *et al.* (2021)** pointed out that there was no major difference among the treatments group at the end of the experimental period (35 days of age) regarding gizzard, liver, heart, spleen, or intestine relative weights of Ross 308 broiler chicks. The lymphoid system (e.g. spleen and bursa play a countless role to give protection against the infections (body defense) with different etiological agents (**Kannan *et al.,* 2015**, **Ferreira Júnior *et al.,* 2018**; **Singh, 2019; Miller, 2020**).

The differences between the carcass results in this study and published results in rabbits might be due to the difference breed, age, sex, body weight, diet, slaughter age, month of kindling and climate, and estimation methods.

Performance Index and Economic Efficiency

The influence of BV injection on the performance index and economic efficiency of growing rabbits at 10 weeks of age are shown in Table 6. In respect of the performance index values, the results showed highly noteworthy differences among the studied groups.

Rabbits of 0.3 mg BV group had significantly the highest value (68.70%) compared with all other studied groups. In regard to relative economic efficiency values, the results showed highly significant differences among studied groups in all items of their estimation. Rabbits of 0.3 mg BV group had significantly the highest economic efficiency (52.88%) and relative economic efficiency (124.23%) values compared with all other studied groups.

Table 6. Influence of bee venom (BV) injection on performance index (PI, %) and relative economic efficiency of growing rabbits during 5 to 10 weeks of age

Items	Control	Saline	BV (mg/ rabbit)			SEM	*P-value*
			0.1	0.2	0.3		
PI, %	59.25[cd]	58.38[d]	61.83[bc]	63.08[b]	68.70[a]	0.77	0.000
BW, kg	1.97[c]	1.99[c]	2.09[b]	2.09[b]	2.18[a]	0.02	0.000
Total Rev., LE	92.37[c]	93.60[c]	98.03[b]	98.17[b]	102.50[a]	0.74	0.000
Total Feed Cost, LE	14.33[b]	14.97[b]	16.37[a]	15.77[a]	16.13[a]	0.17	0.000
Net Rev., LE	27.99[c]	28.58[c]	31.36[b]	31.79[b]	35.45[a]	0.58	0.000
EE, %	43.48[d]	43.95[cd]	47.06[bc]	47.90[b]	52.88[a]	0.79	0.000
REE, %	100.00[d]	103.25[cd]	110.53[bc]	112.51[b]	124.23[a]	1.92	0.000

[a,b,c] Means with various characters in an identical row differ significantly from one another ($P \leq 0.05$).
PI= production index, **SEM**= pooled standard error and ***P-value***= probability value
Rev= revenue, EE= Economic efficiency and REE= Relative Economic Efficiency

The existing findings are in contract with those pointed out by **Elmalky *et al.* (2021)** who discovered that groups which received Melittin and Thepax had promoted broilers relative economic efficiency while likened to the control group. Similar outcomes were found by **Attia *et al.* (2015)** who discovered that rabbits supplemented with or without propolis, or bee pollen exhibited a noticeably greater relative economic efficiency (61.9, 55.1, and 27.1%, respectively) compared to the control group. According to **Zeedan *et al.* (2017),** rabbits fed bee pollen in the diet showed the greatest economic efficacy. Similar results were obtained by **Hedia *et al.* (2007)**, **El-Neney and El-Kholy (2014),** and **Attia *et al.* (2014)**. In addition, **Zeedan and El-Neney (2014)** reported that rabbits treated with high levels of bee pollen showed high values of EE and REE in comparison to the control group.

CONCLUSION

In conclusion, this study clearly indicates that injecting growing V-line rabbits with bee venom under the neck skin twice throughout the period from 5 to 10 weeks of age with the studied doses, especially 0.3 mg/ rabbit of the BV, resulted in a significant improvement in performance traits, performance index and relative economic efficiency.

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الملخص العربي

تأثير حقن سم نحل العسل على نمو الأرانب: 1- الأداء الإنتاجي وصفات الذبيحة والكفاءة الاقتصادية

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تم استخدام خمسة وأربعين أرنبًا من ذكور الأرانب الفي لاين لدراسة تأثير حقن سم نحل العسل على الآداء الإنتاجي وصفات الذبيحة ووزن الأعضاء النسبي ودليل الإنتاج والكفاءة الاقتصادية من عمر 5-10 أسابيع. وزعت الأرانب عشوائياً إلى خمسة مجاميع متساوية وكل معاملة إلى ثلاثة مكررات. المجموعة الأولى كنترول سالب. والمجموعة الثانية تم حقنها بمحلول ملحي عادي (0.09٪) ككنترول موجب. وتم حقن المجموعات الثالثة والرابعة والخامسة 0.1 و0.2 و0.3 ملجم من سم نحل العسل/ أرنب على التوالي. كان حجم الحقن 0.1 مل/ أرنب عند عمر 5 و7 أسابيع، واستمرت التجربة لمدة 10 أسابيع. المجموعات المحقونة بسم نحل العسل أعطت أعلى وزن وزيادة لوزن الجسم واستهلاك علف مقارنة بمجاميع الكنترول السالب والموجب عند عمر 10 أسابيع. وكان أفضل معدل تحويل غذائي للمجموعة المحقونة بمعدل 0.3 ملجم من سم نحل العسل مقارنة بمجاميع الكنترول السالب والموجب خلال الفترة من 5-10 أسابيع. وأظهرت نتائج جميع صفات الذبيحة المدروسة فروق ذات دلالة إحصائية عالية بين المجموعات المدروسة. وأشارت الدراسة بوضوح أن حقن الأرانب النامية الفي لاين بسم نحل العسل مرتين خلال الفترة من 5-10 أسابيع من العمر بالجرعات المدروسة، وخاصة مستوى 0.3 ملجم إلى تحسن كبير في صفات النمو، ودليل الأداء الإنتاجي والكفاءة الاقتصادية النسبية.