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EFFECT OF SOME FEED ADDITIVES ON PERFORMANCE OF GROWING JAPANESE QUAIL

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A total number of 400 Japanese quail (*Coturnix coturnix japanica*) chicks at hatch.The quail chicks were housed in cages at hatch up to 42 days of age.

The experiment aimed to study comparative effect of some feed additives as growth promoters (medicinal plants feed additives) such as Black seeds cumin (*Nigella sativa*), Margoram leaves meal (*Origanum majorana*) or Enzyme preparation (Optizyme) on performance of growing Japanese quail.

Quail chicks were divided randomly into 4 equal experimental groups of 100 chicks in four replicates (25 chicks replicate). The first group was fed the basal diet as a control, while three dietary groups were obtained by adding the tested growth promoters to the control diet. Each one of growth promoters was added to the control diet. Either as Black cumin seed or Margoram leaves meal and enzyme preparation (Optizyme) were added to the control diet at an inclusion rate of 1.0, 0.5 or 0.5 g/kg, respectively. The experimental diets were isocaloric Metabolizable Energy (ME) (2900 kcal/kg), isonitrogenous (24% Crude Protein) (CP) and isofibrous.

Results obtained could be summarized as follows:

Live body weight and body weight gain of quail chicks were significantly ($P<0.05$) increased with dietary feed additives. The highest live body weight and body weight gain were recorded by using Black seeds (*Nigella sativa*) cumin and followed by Margoram leaves (*Origanum majorana*) meal as feed additives (medicinal plants), while those fed the control diet recorded the lowest values.

Feeding quail either black seeds cumin, Margoram leaves meal or and enzyme preparation resulted in 10.22, 5.23 and 3.27% higher in live body weight than that of the control group, respectively.

It is notice that feed intake significantly ($P<0.05$) increased among groups, compared to the control diet.

Black seeds cumin recorded the best values ($P<0.05$) of feed conversion ratio (g feed/g gain), while the control diet recorded the worst feed conversion ratio.

Mortality rate recorded a non-significant difference between groups. Black seeds cumin recorded the lowest values, while the control group recorded the highest ones.

Dressing percentage showed significant ($P<0.05$) increase with the feed additives. Black seeds cumin recorded the highest values, while edible giblets (liver, heart and gizzard) percentage were insignificantly increased affected by feed additives

Digestibility coefficients of Organic Matter (OM), Crude Protein (CP), Crude Fiber (CF), Ether Extract (EE), Nitrogen Free Extract (NFE) and the nutritive values expressed as Digestible Crude Protein (DCP), Total Digestible Nutrients (TDN) % and ME (kcal/kg) were significantly varied ($P<0.05$) among the different experimental groups.

Black seeds cumin group showed the best net return as well as the highest value of economic efficiency among experimental groups.

From the nutritional and economical efficiency points of view, it could be concluded that, using dietary medicinal plants such as Black seeds cumin (*Nigella sativa*) at 1.0 g/k of the diet could improve growth performance and economical efficiency of growing Japanese quail.

Keywords: Quail, Black seeds cumin, Margoram leaves meal or Enzyme preparation (Optizyme), growth performance, digestion trials, carcass traits and economic efficiency.

Many attempts have been made by nutritionists to improve the growth rate of Japanese Quail as well as feed efficiency in order to reduce the cost of feeding by using dietary additives such as antibiotics, probiotics, enzymes and medicinal plants.

Recently, many countries tended to prohibit the using of antibiotics as growth promoters because of their side effect on both birds and human health.

The natural feed additives as the medicinal plants such as Black seeds, Margoram leaves are a numerically large group of economically important plants, they include various species, which are used in the treatment of various diseases in human. These plants not only serve for a medicinal purpose but also contain aromatic substances and essential oils that are used in food industries for human. (Evans and Pharm, 1975).

Acceptable results were obtained with research reports using Black seeds or Margoram as medicinal plants and enzyme preparation in growing quail diets.

Black seeds (*Nigella sativa*) are cultivated in the Mediterranean region and Asia (Hutchinson, 1959). Black seeds are rich in oil, the major unsaturated fatty acids are oleic and linoleic and the major minerals are Ca, Ph, Mg and Na (Abdel-Aal and Attia, 1993).

Feeding broiler low levels (0.5 or 0.1%) of Black seeds cumin had no toxic effect on liver and kidney functions as confirmed by improvement of enzymatic activities and increases the concentration of thyroxine, calcium and zinc of serum, but the high levels (8%) of Black seeds decreased these parameters (Mandour *et al.*, 1998). Mandour and Rady (1997) reported that feeding *Nigella sativa* seed did not produce any toxic effect on liver and kidney functions.

In this connection, Abdel-Aal and Attia (1993); Khodary *et al.* (1996); Gill (1999) and Abaza (2001) indicated that addition of medicinal plants as natural feed additives improved reproductive performance of poultry.

There is a general agreement that using natural feed additives as the medicinal plants such as Black seeds cumin, Margoram leaves meal can improve the performance, health and immunity in poultry.

Black seeds cumin showed significant improvement of body weight, body weight gain, mortality rate and feed conversion ratio in broiler (El-Ghamry *et al.*, 2002); in ducks (Ghazalah and Ibrahim, 1996); in Japanese quail (Abou El-Soud ,2000) and in rabbits (Naser and Attia, 1998)

Abd El-Latif *et al.*(2002 and 2003) found that inclusion of either Black seeds cumin or Margoram leaves meal at rate of dietary 1.0 or 0.5 g/kg diet , respectively improved body weight, body weight gain, mortality rate and feed conversion ratio as well as the digestion coefficients of nutrients in growing Japanese quail diets.

The beneficial effects of some enzyme preparations for improving the nutrients availability and bird's performance are well established by Bedford and Morgan (1996), It could improve body weight, body weight gain, and nutrient absorption (Bunett, 1966; Sullivan, 1987; Easter, 1988 and Zeweil, 1996). Bedford and Sheppy (1995) reported that addition of enzyme to broiler diets improved their performance. Zeweil (1996) reported that dietary addition of enzyme preparations improved body weight, weight gain, mortality rate and feed conversion as well as digestion coefficients of nutrients in growing Japanese Quail diets.

The main objective of the present comparative study was to establish the utilization of some feed additives as growth promoters such as Black seeds cumin or Margoram leaves meal (medicinal plants) or enzyme preparations (optizyme) in growing Japanese quail diets and their effects on

growth performance, economic efficiency, digestion coefficients of nutrients and carcass traits.

MATERIALS AND METHODS

The present work was carried out at Maryout Experimental Research Station (South West Alexandria), which belongs to the Desert Research Center.

A total number of 400 Japanese quail (*Coturnix coturnix japanica*) chicks at hatch were used and kept under similar managerial, hygienic and environmental conditions. The quail chicks were housed in cages at hatch up to 42 days of age.

Quail Chicks were divided randomly into 4 equal experimental groups of 100 chicks in four replicates (25 chicks / replicate). The first group was fed the basal diet as a control, while three dietary groups were obtained by adding the tested growth promoters to the control diet. Each one of growth promoters was added to control diet. Either Black seed cumin or Margoram leaves meal that have been dried and ground were added at an inclusion rate of 1.0 or 0.5 g/kg to the control diet, respectively according to Abd El-Latif *et al.*(2002 and 2003).

The Optizyme (enzyme preparations), which contained cellulase, hemicllulase, amylase, lipase, protiase, beta-glucanase, pentozanase, zylinase, amylo-glucanase and α-glactozanase was added at 0.5 g/kg to the control diet, according to Zeweil (1996).

The experimental diets (Table 1) were formulated according to the N.R.C. (1994) to be isocaloric ME (2900 kcal /kg), isonitrogenous (24% CP) and isofibrous. Feed and water were offered *ad libitum*.

Chemical analysis of the experimental diets, meat and feces were assayed using methods of A.O.A.C. (1990). Live body weight and feed intake were determined biweekly. Body weight gain and feed conversion ratio (g feed/g gain) were calculated. Mortality rate % was also recorded daily.

At the end of the experimental feeding period, digestion trials were conducted using 20 quail males (five from each treatment) to determine the nutrients digestibility of the experimental diets. Birds were housed individually in metabolic cages. The digestibility trials extended for 9 days of them 5 days as a preliminary period followed by 4 days as collection period. The individual live body weights were recorded during the main collection period to determine any loss or gain in the live body weights. During the main period, excreta were collected daily and weighed, dried at 60°C bulked, finely ground and stored for chemical analysis. The faecal nitrogen was determined according to Jakobsen *et al.*(1960). Urinary organic matter was calculated according to Abou-Raya and Galal (1971).

Table (1). Composition and proximate chemical of basal diet.

Ingredients	%
Yellow corn	56.00
Soybean meal (44% CP)	15.60
Concentrate*	10.00
Corn gluten meal (60% CP)	10.00
Wheat bran	7.71
Vit. and Min. premix**	0.30
L-lysine	0.26
DI- methionine	0.13
Total	**100**
Proximate chemical analysis%	
Crude protein	24.15
Crude fiber	3.42
Ether extract	3.39
Calculated values	
Metabolizable energy (kcal/kg)***	2904
Calcium%	0.81
Available phosphorus%	0.39
Methionine%	0.53
Lysine %	1.30
Methionine + Cystin%	0.75
Price /k diet L.E.	1.529

* Protein concentrate contain: 52%Crude protein, 2.03% Crude fiber, 6.17% Ether extract, ME 2080 (kcal/kg) ,1.50 % Methionine, 2.00% Methionine and Cystine, 3.0 % Lysine, 7.00% Calcium , 2.93 % Avalailable Phosphorus, 2.5 % Nacl. Calcium, 2.93 % Avalailable Phosphorus and 2.5 % Nacl.

** Each 3 kg Vitamins and minerals premix contains (per ton of feed), Vit. A 12000000 IU, Vit. D_3 2000000 IU, Vit.E 10g, Vit.K_3 1000 mg, Vit. B_1 1000 mg, Vit. B_2 5g, Vit. B_6 1.5g, Vit. B_{12} 10 mg, Pantothenic acid 10g, Niacin 30g, Folic acid 1g, Biotin 50 mg, Iron 30g, Manganese 60g, Choline chlorite 10g, Iodine 300 mg, Copper 4g, Zinc 50g and Selenium 100 mg.

*** Calculated according to *NRC* of poultry (1994) .

****Calculated according to price of Additives / 1 kg at time of the experiment, price of one kilogram of Black seeds, Margoram or Enzyme =14.00 ,14.00 and 30.00 L.E respectively.

The price of diets was based on the price of ingredients in the Egyptian market during (2006).

The digestion coefficients % of organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE) and nitrogen free extract (NFE) of the experimental diets were estimated.

The nutritive values expressed as digestible crude protein (DCP), total digestible nutrients (TDN) were calculated. Metabolizable energy (ME) was calculated as 4.2 kcal per gram TDN as suggested by Titus (1961).

Ten quail from each treatment were chosen randomly for slaughter test. Dressing percentage was calculated as carcass weight divided by the pre-slaughter weight. Carcass parts were weighed and calculated as a percentage of live body weight.

Economical efficiency of feed was calculated from the input / output analysis according to the costs of the experimental diets and selling price of one kg quail.

Statistical analysis was carried out using General Linear Model (GLM) procedures by SAS program (1996) using simple one-way analysis of variance according to this model:

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

Where:

Y_{ij} = Represented observation in j^{th} feed additives (j =Black seeds, Margoram leaves, Enzyme preparation).

μ=Overall mean.

T_i = Effect of j^{th} feed additives.

e_{ij} = Random error.

Duncan's New Multiple Range Test (Duncan, 1955) separated differences among treatment means.

RESULTS AND DISCUSSION

Live Body Weight and Body Weight Gain

The effects of dietary additives on performance of growing Japanese quail are summarized in table (2). Average live body weight and body weight gain during the experimental period (0-6 weeks of age) showed a significant ($P<0.05$) variations among groups.

It is worthy to mention that live body weights at all ages were improved with dietary additives during the experimental period (0-6 weeks of age).

The live body weight and body weight gain in quail that fed Black seed cumin followed by those having Margoram leaves meal and enzyme preparation showed the highest values by calculation, they were 10.22, 5.23 and 3.27% higher in live body weight, while 10.67, 5.49 and 3.45% higher in body weight gain than that of the control group, respectively.

The increase in body weight gain may be due to the increase in feed intake and the improvement in nutrients digestibility of Black seeds cumin. Moreover, such improvement may be attributed to the biological function of Black seed components such as nigellene, thymoquinone and thymohydroquinone, which show to posses antimicrobial and pharmacological activities (Mahfouz and El-Dakhakhny, 1960).

These results are in agreement with those obtained by Abd El-Latif *et al*. (2002 and 2003) who found that, Black seed cumin or Margoram leaves meal as natural feed additives diets tended to improve live body weight and body weight gain of quail.

Similar finding were reported by Tollba and Hassan (2003) with broiler when added Black seeds cumin to the diets. Naser and Attia (1998)

and Abdel-Azeem *et al.* (1999) indicated that rabbits fed diets supplemented with Black seeds cumin had significantly higher live body weight and body weight gain. Horton, *et al.*(1991), Afifi (2001) and El-Ghamry, *et al.* (2002) who reported that added *Nigella sativa* seed to broiler diets improved (P<0.05) the final body weight, body weight gain and feed conversion ratio.

Table (2). Effect of tested feed additives on growth performance ($\bar{X}$ ± S.E) of growing Japanese quail.

Trails	Control	Feed additives			Sig.
		Black seed	Margoram	Enzyme	
		Live body weight (g)			
Initial	8.29 ±0.89	8.30±1.01	8.25±0.95	8.23±1.02	ns
2 weeks	53.41±1.02^{b}	57.61±1.01^{a}	55.91±1.11^{ab}	54.21±1.38^{b}	*
4 weeks	120.61 ±1.41^{b}	130.01±1.20^{a}	126.20±2.1^{ab}	123.50±1.21^{b}	*
6 weeks	193.40± 2.58^{b}	213.17±2.02^{a}	203.52±2.11^{ab}	199.72±2.51^{b}	*
		Body weight gain (g)/bird /period			
0-2 weeks	45.12±0.07^{b}	49.31±0.48^{a}	47.66±0.78^{ab}	45.98±0.95^{b}	*
2-4 weeks	67.20±0.97^{b}	72.40±0.82^{a}	70.29±1.01^{a}	69.29±1.21^{ab}	*
4-6 weeks	72.79±2.02^{b}	83.16±1.29^{a}	77.32±1.49^{ab}	76.22±2.02^{b}	*
0-6 weeks	185.11±2.22^{b}	204.87±2.09^{a}	195.27±2.20^{ab}	191.49±2.21^{b}	*
		Feed intake (g)/ bird /period			
0-2 weeks	125.83±2.30^{b}	128.1±2.21^{a}	126.10±2.10^{ab}	128.65±2.51^{a}	*
2-4 weeks	241.29±2.18^{b}	250.70±2.10^{a}	246.20±2.41^{ab}	242.69±2.20^{b}	*
4-6 weeks	336.83±2.13^{b}	341.50±2.05^{a}	339.90±2.13^{ab}	337.32±2.19^{ab}	*
0-6 weeks	703.95±2.20^{b}	720.30±2.04^{a}	712.20±2.02^{ab}	708.66±2.51^{b}	*
		Feed conversion ratio (g feed/g gain)			
0-2 weeks	2.79±0.06^{a}	2.60±0.03^{b}	2.65±0.05^{ab}	2.80±0.02^{a}	*
2-4 weeks	3.59±0.07^{a}	3.46±0.06^{b}	3.50±0.08^{ab}	3.50±0.07^{ab}	*
4-6 weeks	4.63±0.04^{a}	4.11±0.02^{b}	4.40±0.03^{ab}	4.43±0.02^{ab}	*
0-6 weeks	3.80±0.05^{a}	3.52±0.01^{b}	3.65±0.02^{ab}	3.70±0.04^{ab}	*
		Morality rate %			
0-6 weeks	3.81±0.48	3.60±0.42	3.74±0.40	3.78±0.34	ns

^{a,b} Means within a row with different superscripts are significantly different.
Sig. = Significant. *(P< 0.05). ns= not significant.

Feed Intake and Feed Conversion Ratio

Feed intake values during the whole experimental period gradually increased significantly (P<0.05) with the tested feed additives as shown in table (2). The feed intake values of the group fed Black seeds cumin (*Nigella Sativa)* are the highest, while the least amount of feed was for quail, which fed the control group.

The increase in feed intake may be attributed to improving the diets palatability and enhancing appetite of quail. These additives as those of natural feed additives had a beneficial effect for stimulation and activity of digestive system by improving the diets palatability and enhancing appetite

of poultry, thus increasing the amount of feed consumed (Namur *et al.*, 1988).

Results of feed conversion ratio (g feed/g gain) revealed a significant difference ($P<0.05$) among the experimental groups as shown in table (2). It was observed, that quail fed either Black seed cumin or Margoram leaves meal recorded the best feed conversion ratio values being 3.52 and 3.65, respectively. While the quail fed control diet recorded the worst (3.80) feed conversion ratio. Such improvement in feed conversion ratio may be attributed to significant increase in body weight gain.

These results are in agreement with those obtained by Erdman *et al.*(1980) who reported that *Nigella Sativa* seed contained volatile fatty acids, which improved feed conversion ratio. The *Nigella Sativa* seed contains high amount of unsaturated fatty acids, which are very essential to the animal (Ustun *et al.*, 1990). Also, The *Nigella Sativa* seeds can inhibit the formation of aflatoxins and accordingly led to a higher utilization efficiency of nutrients in the feed (Ghazalah and Ibrahim, 1996). Similar results were found by Nassar (1997); Abdel-Azeem *et al.*(1999) and Osman and El-Barody (1999). In the same time, Abd El-Latif *et al.*(2002) found that, Black seed cumin as feed additives diets tended to improve feed efficiency of quail.

Mortality Rate

Results on mortality rate % recorded a non-significant difference among groups fed diets containing feed additives and the control group. Quail fed Black seed cumin recorded the lowest values, while the control group recorded the highest ones.

It is noting that, mortality rate decreased in quail fed diets with natural fed additives as compared to the other groups.

Carcass Traits and Chemical Analysis of Meat

Results on carcass traits of quail and chemical analysis of meat are summarized in table (3). Data in the present study showed that dressing percentage with quail showed a significant ($P<0.05$) variations among groups.

It is worth to note that dressing percentage was improved with dietary additives, Black seeds cumin recorded the greatest values of dressing percentage, while the control group recorded the lowest values, the decrease in dressing percentage was due to the decrease in live body weight.

Edible giblets (liver, heart and gizzard) percentage was insignificantly increased by feed additives in diets of growing quail.

Similar trend was observed by Abd El-Latif *et al.* (2002) who reported that quail fed 1 g/kg diets *Nigella Sativa* seeds, as a feed additive recorded the greatest values of carcass and edible giblets compared with other dietary groups. Khalifah (1995) who found an improve in feed utilization and dressing percentage when added black seeds in broiler diets. Abdel-Azeem

et al. (1999) found also that feeding rabbits with different levels of *Nigella Sativa* seeds had an improvement in dressing percentage as compared to the control diet.

Chemical analysis of meat did not show significant differences among experimental groups in moisture, protein, EE and Ash %.

Table (3). Carcass traits of slaughtered quail and chemical analysis of meat ($\bar{X}$ ± S.E) as affected by feed additives.

Criteria	Control	Feed additives			Sig.
		Black seed	Margoram	Enzyme	
Live body weight (g)	187.65±1.51[b]	205.34±1.10[a]	195.01±1.21[ab]	191.80±1.30[b]	*
Dressing %	72.01±0.05[b]	73.72±0.04[a]	73.26±0.09[a]	72.58±0.07[ab]	*
Heart %	0.81±0.04	0.84±0.07	0.84±0.05	0.82±0.06	ns
Gizzard %	2.50±0.05	2.52±0.06	2.51±0.08	2.50±0.08	ns
Liver %	2.68±0.05	2.70±0.06	2.69±0.04	2.69±0.06	ns
Edible giblets* %	5.99±.0.09	6.06±0.07	6.04±0.09	6.01±0.08	ns
Moisture %	71.89± 0.09	72.08±0.06	72.01±0.07	71.75±0.09	ns
Protein %	22.05± 0.10	22.40±0.03	22.32±0.04	22.19±0.07	ns
Ether extract %	3.06± 0.32	3.25±0.57	3.21±0.67	3.19±0.98	ns
Ash %	1.36± 0.04	1.34±.0.02	1.34±0.03	1.35±.0.06	ns

[a,b] Means within a row with different superscripts are significantly different.
Sig= Significant, *(P<0.05), ns= not significant.
*Edible giblets = liver, heart and gizzard weights.

Digestibility and Nutritive Values

Apparent digestion coefficients values of dietary treatments are shown in table (4) and fig. (1), regarding those of organic matter (OM), crude protein (CP), ether extract (EE) and nitrogen free extract (NFE). Such values were significantly (P<0.05) differed among the experimental groups and the data indicated that, all nutrients digestibility values increased for quail fed Black seed cumin diet compared either to control or other supplemented diets.

Regarding the nutritive values, it is clear that DCP, TDN % and ME (kcal/kg) were increased significantly by adding Black seed cumin, compared to other treatments.

It is of great importance to mention that the results of the digestion trial were coincided generally with the differences in growth performance and feed conversion ratio in quail diets.

The improvement of nutrients digestibility and nutritive values might be due to *Nigella Sativa* seeds, which might stimulate the thyroid gland directly, and/or through the pituitary gland to secrete the thyroid hormones. Thyroid hormones increased metabolic rate (Hadley, 1984), which lead to increase total protein (More *et al.*, 1980). Furthermore, thyroid hormones accelerate cellular reactions in most organs and tissues of the body, including the liver in which total protein is formed (Smith *et al.*, 1983).

Moreover, the improvement in digestibility of Black seed cumin fed group might be due to the cholorelic effect of *Nigella Sativa* seeds which produced a definite increase in bile flow (Mahfouz *et al.*, 1962). Bile is an emulsifying agent, which activates pancreatic lipase, where it may aid in the digestion, absorption of fat and the absorption of fat soluble vitamins (Crossland, 1980). Further studies reported by Tollba and Hassan (2003) with broiler and Abd El-Latif *et al.*(2002) with Japanese quail found similar results when added black cumin to the diets.

In this respect, Mandour *et al.*(1998) indicated that feeding broiler diets supplemented with low doses of *Nigella Sativa* seeds increased thyroxin concentration. El-Husseiny *et al.* (2000) reported that *Sativa* seeds increased thyroxin concentration, and showed significant positive effect on the values of CP, EE, CF, NFE digestibility and metabolizable energy.

Table (4). Effect of tested feed additives on digestion coefficients % and nutritive values ($\bar{X} \pm$ S.E) of diets fed to growing Japanese quail.

Items	Feed additives				Sig.
	Control	Black seed	Margoram	Enzyme	
Apparent digestion coefficients %					
OM	80.10±1.20^{b}	82.52±1.25^{a}	82.01±1.30^{a}	80.73±1.43^{ab}	*
CP	80.20±1.50^{b}	83.62±1.21^{a}	82.70±1.35^{a}	81.02±1.41^{ab}	*
CF	25.13±1.40^{b}	27.55±1.22^{a}	26.24±1.90^{ab}	25.98±1.32^{b}	*
EE	85.34±1.52^{b}	88.62±1.63^{a}	86.93±1.54^{ab}	87.95±1.82^{a}	*
NFE	84.75±1.41^{b}	86.61±1.32^{a}	85.75±1.54^{ab}	85.68±1.62^{ab}	*
Nutritive values					
DCP %	19.37±0.52^{b}	20.19±0.11^{a}	19.97±0.14^{a}	19.57±0.15^{ab}	*
TDN%	65.38±1.21^{b}	67.31±1.12^{a}	66.52±1.20^{ab}	66.15±1.25^{b}	*
ME(kcal/kg)	2746±16.62^{b}	2827±12.33^{a}	2794±13.50^{a}	2778±15.01^{ab}	*

^{a,b}: Means within a row with different superscripts are significantly different.
Sig= Significant, * ($P< 0.05$), ns= not significant.

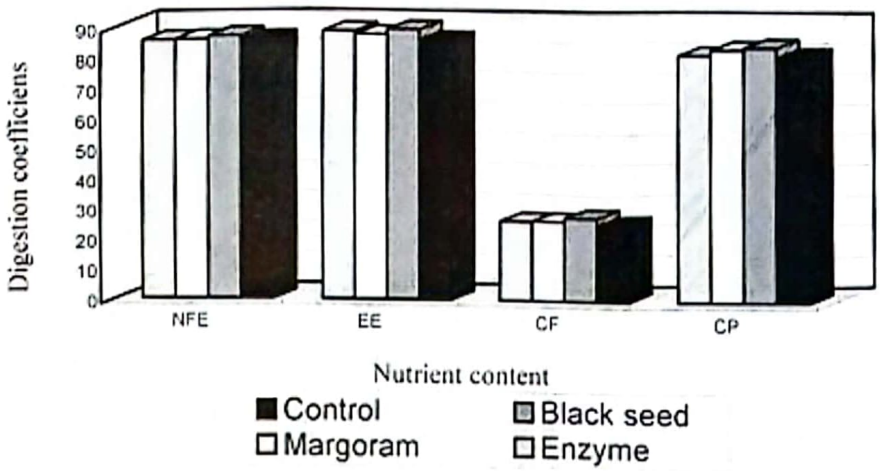

Fig.(1): Effect of tested feed additives on digestion coefficients of experimental diets.

The results of net return, economical efficiency and relative economical efficiency estimated for experimental diets used during the experiment are shown in table (5) and fig.(2). According to the input-output analysis, the best net return, economic efficiency and relative economic efficiency values are recorded by the group of quail fed Black seed cumin, compared to the other experimental groups.

Table (5). Economical evaluation of dietary treatments.

Item	Control	Feed additives		
		Black seed	Margoram	Enzyme
Feed conversion ratio	3.80	3.52	3.65	3.70
Cost of Kg feed (L.E)	1.529	1.543	1.539	1.559
Feed cost of kg meat (L.E)	5.810	5.431	5.617	5.768
Selling price of one Kg meat (L.E)	12.00	12.00	12.00	12.00
Net revenue (L.E)	6.190	6.569	6.383	6.232
Economic efficiency	106.54	120.95	113.64	108.04
Relative economic efficiency%	100	113.53	106.66	101.41

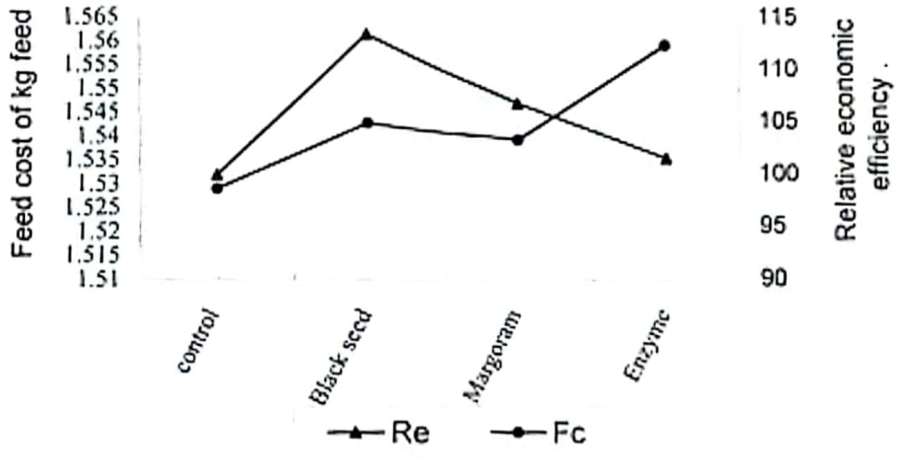

Fig.(2) : Relative economic efficiency(Re) and cost of kg feed (Fc) of experimental diets.

These results indicated that the Black seed cumin as dietary feed additive in growing quail diet improved economical efficiency more than the other experimental groups as well as control group. This may be due to the improvement in feed conversion ratio for quail fed Black seed cumin as a feed additive.

CONCLUSION

From the nutritional and economical efficiency stand points of view, it could be concluded that, the natural feed additives (medicinal plants) such as

Black seed cumin at 1 g/kg of the diet, could improve growth performance and economical efficiency of growing Japanese quail.

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تأثير بعض الإضافات الغذائية على أداء السمان الياباني النامي

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استخدم في هذا البحث عدد ٤٠٠ كتكوت سمان ياباني من الفقس حتى عمر ٦ أسابيع. حيث استهدف البحث مقارنة تأثير بعض الإضافات الغذائية مثل مجروش حبة البركة ومسحوق أوراق البردقوش (نباتات طبية) ومستحضر انزيمى (اوبتيزيم) على أداء السمان الياباني النامي. حيث قسمت الكتاكيت عشوائيا إلى أربع مجموعات تجريبية متساوية. إشتملت كل معاملة على ١٠٠ كتكوت سمان (٤ مكررات بكل منها ٢٥ كتكوت) وتم إخضاعهم لنفس الظروف من الرعاية. وقد تم تغذية الكتاكيت النامية حتى حد الشبع . على علائق متشابهة في نسبة البروتين الخام(٢٤%) والطاقة الممثلة (٢٩٠٠ كيلو كالورى /كيلوجرام) ,مع إضافة مجروش حبة البركة و مسحوق أوراق البردقوش و إنزيم (اوبتيزيم) بمعدل ١,٠٠ , ٠,٥٠ و ٠,٥٠ جم/كجم على التوالى إلى عليقة المقارنة.

ويمكن ايجاز أهم النتائج في النقاط التالية:

- سجلت معاملات الإضافات الغذائية تحسنا معنويا (عند المستوى ٥ %) في كل من وزن الجسم ومعدل النمو مقارنة بمجموعة المقارنة.
- سجلت المعاملة التي غذيت بمجروش حبة البركة أفضل وزن جسم ومعدل نمو مقارنة بباقي المعاملات.
- لوحظ زيادة معدل إستهلاك الغذاء خلال فترة التجربة زيادة معنوية (عند مستوى ٥%) وذلك مع الإضافات الغذائية في العليقة, وقد سجلت المعاملة المغذاة على مجروش حبة البركة أعلى تلك القيم, بينما سجلت مجموعة المقارنة اقل القيم خلال الفترة التجريبية .
- حققت المعاملة المغذاة على مجروش حبة البركة أفضل معدل تحويل غذائي خلال فترة التجربة مقارنة بباقي المعاملات .
- سجلت المعاملة المغذاة على مجروش حبة البركة تحسنا معنويا (عند المستوى ٥ %) في نسبة التصافي حيث سجلت أفضل القيم ,بينما زادت الأجزاء المأكولة زيادة غير معنوية نتيجة لهذه الإضافة.
- حققت المعاملات المغذاة على الإضافات الغذائية اقل معدل نفوق, حيث سجلت المعاملة المغذاة على مجروش حبة البركة أقل القيم, بينما سجلت مجموعة المقارنة أعلى معدل نفوق.

-أظهرت معاملات الهضم الظاهرية للمادة العضوية والبروتين الخام والألياف الخام و مستخلص الأثير والمستخلص الخالي من النتروجين إرتفاعا معنويا (عند مستوى ٥ %) بالإضافة الغذائية, في العليقة. حيث حققت المعاملة التي غذيت على مجروش حبة البركة افضل معاملات هضم وأفضل قيم غذائية مقارنة بباقي المعاملات.

- تحقق أفضل عائد إقتصادي للمعاملة المغذاة على مجروش حبة البركة خلال فترة التجربة مقارنة بباقي المجموعات, بينما سجلت مجموعة المقارنة أقل القيم.

يمكن التوصية من الوجهة الغذائية والإقتصادية إلى أفضلية إستخدام مجروش حبة البركة (كإضافات طبية) بمستوى ١ جم/كجم في علائق السمان النامي دون تأثير سلبي على أداء النمو.