EFFECT OF SOME FEED ADDITIVES ON PERFORMANCE OF GROWING JAPANESE QUAIL
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ABSTRACT

A total number of 400 Japanese quail (Coturnix coturnix japonica) 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 such as Black seeds cumin (Nigella sativa), Margoram leaves meal (Origanum majorana) (medicinal plants feed additives) 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 (2900 kcal ME/kg), isonitrogenous (24% 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 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 worthy noting 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 OM, CP, CF, EE, NFE and the nutritive values expressed as DCP, 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 stand 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.
**Abd El-Galil, k.**

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

**INTRODUCTION**

Many attempts have been made by nutritionists for to improve the growth rate and 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, the 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 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.

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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 is could be improved of 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 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 Maryiout Experimental Research Station (South West of Alexandria), which belongs to the Desert Research Center.

A total number of 400 Japanese quail (Coturnix coturnix japonica) 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 with dried grounds 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, hemicellulase, amylase, lipase, protease, 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 (2900 kcal ME/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.
Table (1). Composition and proximate chemical of basal diet

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow corn</td>
<td>56.00</td>
</tr>
<tr>
<td>Soybean meal (44% CP)</td>
<td>15.60</td>
</tr>
<tr>
<td>Concentrate*</td>
<td>10.00</td>
</tr>
<tr>
<td>Corn gluten meal (60% CP)</td>
<td>10.00</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>7.71</td>
</tr>
<tr>
<td>Vit. and Min. premix**</td>
<td>0.30</td>
</tr>
<tr>
<td>L-lysine</td>
<td>0.26</td>
</tr>
<tr>
<td>Dl- methionine</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100</td>
</tr>
</tbody>
</table>

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 /kg 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% Available Phosphorus, 2.5% NaCl.

** Each 3 kg Vitamins and minerals premix contains (per ton of feed), Vit. A 12000000 IU, Vit. D3 2000000 IU, Vit.E 10g, Vit.K3 1000 mg, Vit. B1 1000 mg, Vit. B2 5g, Vit. B6 1.5g, Vit. B12 10 mg, Pantothenic acid 10g, Niacin 30g, Folic acid 1g, Biotin 50 mg, Iron 30g, Manganese 60g, Choline chloride 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/1kg at the 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).

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).
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.
- \( \mu \) = Overall mean.
- \( T_i \) = Effect of \( j^{th} \) feed additives (\( j \) = Black seeds, Margoram leaves, Enzyme preparation).
- \( e_{ij} \) = 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 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 was reported by Tollba and Hassan (2003) with broiler when added Black seeds cumin to the diets. Naser and Attila, (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 (X ± S.E) of growing Japanese quail.

<table>
<thead>
<tr>
<th>Trails</th>
<th>Control</th>
<th>Feed additives</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Live body weight (g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial</td>
<td>8.29±0.89</td>
<td>8.30±1.01</td>
<td>8.25±0.95</td>
</tr>
<tr>
<td>2 weeks</td>
<td>53.41±1.02</td>
<td>57.61±1.01</td>
<td>55.91±1.11</td>
</tr>
<tr>
<td>4 weeks</td>
<td>120.61±1.41</td>
<td>130.01±1.20</td>
<td>126.20±2.1</td>
</tr>
<tr>
<td>6 weeks</td>
<td>193.40±2.58</td>
<td>213.17±2.02</td>
<td>203.52±2.1</td>
</tr>
<tr>
<td></td>
<td>Body weight gain (g)/bird /period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2 weeks</td>
<td>45.12±0.07</td>
<td>49.31±0.48</td>
<td>47.66±0.78</td>
</tr>
<tr>
<td>2-4 weeks</td>
<td>67.20±0.97</td>
<td>72.40±0.82</td>
<td>70.29±1.01</td>
</tr>
<tr>
<td>4-6 weeks</td>
<td>72.79±2.02</td>
<td>83.16±1.29</td>
<td>77.32±1.49</td>
</tr>
<tr>
<td>0-6 weeks</td>
<td>185.11±2.22</td>
<td>204.87±2.09</td>
<td>195.27±2.20</td>
</tr>
<tr>
<td></td>
<td>Feed intake (g)/ bird /period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2 weeks</td>
<td>125.83±2.30</td>
<td>128.1±2.21</td>
<td>126.10±2.10</td>
</tr>
<tr>
<td>2-4 weeks</td>
<td>241.29±2.18</td>
<td>250.70±2.10</td>
<td>246.20±2.41</td>
</tr>
<tr>
<td>4-6 weeks</td>
<td>336.83±2.13</td>
<td>341.50±2.05</td>
<td>339.90±2.13</td>
</tr>
<tr>
<td>0-6 weeks</td>
<td>703.95±2.20</td>
<td>720.30±2.04</td>
<td>712.20±2.02</td>
</tr>
<tr>
<td></td>
<td>Feed conversion ratio (g feed/g gain)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2 weeks</td>
<td>2.79±0.06</td>
<td>2.60±0.03</td>
<td>2.65±0.05</td>
</tr>
<tr>
<td>2-4 weeks</td>
<td>3.59±0.07</td>
<td>3.46±0.06</td>
<td>3.50±0.08</td>
</tr>
<tr>
<td>4-6 weeks</td>
<td>4.63±0.04</td>
<td>4.11±0.02</td>
<td>4.40±0.03</td>
</tr>
<tr>
<td>0-6 weeks</td>
<td>3.80±0.05</td>
<td>3.52±0.01</td>
<td>3.65±0.02</td>
</tr>
<tr>
<td></td>
<td>Morality rate %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-6 weeks</td>
<td>3.81±0.48</td>
<td>3.60±0.42</td>
<td>3.74±0.40</td>
</tr>
</tbody>
</table>

ns: 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 7230
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 fed additives and the control group. Quail fed Black seed cumin recorded the lowest values, while the control group recorded the highest ones.

It is worth 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 worthy 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 fed 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 (\( \bar{X} \pm S.E \)) as affected by feed additives

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

\(^a,b\): 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 Black seed cumin, compared to other treatments.

It is of great importance to note 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 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.**

<table>
<thead>
<tr>
<th>Items</th>
<th>Feed additives</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Black seed</td>
</tr>
<tr>
<td>Apparent digestion coefficients %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OM</td>
<td>80.10±1.20^b</td>
<td>82.52±1.25^a</td>
</tr>
<tr>
<td>CP</td>
<td>80.20±1.50^b</td>
<td>83.62±1.21^a</td>
</tr>
<tr>
<td>CF</td>
<td>25.13±1.40^b</td>
<td>27.55±1.22^a</td>
</tr>
<tr>
<td>EE</td>
<td>85.34±1.52^b</td>
<td>88.62±1.63^a</td>
</tr>
<tr>
<td>NFE</td>
<td>84.75±1.41^b</td>
<td>86.61±1.32^a</td>
</tr>
<tr>
<td>Nutritive values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DCP %</td>
<td>19.37±0.52^b</td>
<td>20.19±0.11^a</td>
</tr>
<tr>
<td>TDN%</td>
<td>65.38±1.21^b</td>
<td>67.31±1.12^a</td>
</tr>
<tr>
<td>ME (kcal/kg)</td>
<td>2746±16.62^b</td>
<td>2827±12.33^a</td>
</tr>
</tbody>
</table>

^ab^: 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.](image)

**Economical efficiency**

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**

<table>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>Feed additives</th>
<th>Feed additives</th>
<th>Feed additives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Black seed</td>
<td>Margoram</td>
<td>Enzyme</td>
</tr>
<tr>
<td>Feed conversion ratio</td>
<td>3.80</td>
<td>3.52</td>
<td>3.85</td>
<td>3.70</td>
</tr>
<tr>
<td>Cost of Kg feed (L.E)</td>
<td>1.529</td>
<td>1.543</td>
<td>1.539</td>
<td>1.559</td>
</tr>
<tr>
<td>Feed cost of kg meat (L.E)</td>
<td>5.810</td>
<td>5.431</td>
<td>5.617</td>
<td>5.768</td>
</tr>
<tr>
<td>Selling price of one Kg meat (L.E)</td>
<td>12.00</td>
<td>12.00</td>
<td>12.00</td>
<td>12.00</td>
</tr>
<tr>
<td>Economic efficiency</td>
<td>106.54</td>
<td>120.95</td>
<td>113.64</td>
<td>108.04</td>
</tr>
<tr>
<td>Relative economic efficiency</td>
<td>100</td>
<td>113.53</td>
<td>106.66</td>
<td>101.41</td>
</tr>
</tbody>
</table>

**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.

**Conclusively**, 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.

**REFERENCES**


Abd El-Galil, k.


تأثير بعض الإضافات الغذائية على أداء السمان الياباني النامي
خالد عبد الجليل
قسم تغذية الحيوان والدواجن – مركز بحوث الصحراء – القاهرة.

استخدم في هذا البحث عدد 400 كتكوت سمان بالياني من الفقس حتى عمر 6 أسابيع.

حيث استهدفت البحث مقارنة بعض الإضافات الغذائية مثل مجموعات حبة البركة ومحموع أوراق البردفوس (كإضافات طبية) ومستحضر الذي (أوتبيزيم) على أداء السمان البالياني النامي. حيث قسمت الكتكوتا عشوائيا إلى أربع مجموعات تجريبيت متساوية، اشتتمل كل مجموعة على 100 كتكوت سمان (4 مكررون بكل منها 25 كتكوت) وتمت علاجهم نفس الظروف من الرعاية. وقد غذت الكتكوتا فالية حتى حد الشبع على علاج مشابه في نسبة البروتين الخام (24%) والطاقة الممتلئة (1900 كيلو كالوري/كيلوجرام) مع إضافة مجروح حبة البركة ومحموع أوراق البردفوس وأوتبيزيم (أوتبيزيم) بعدد 1،000،000 جم/كم على التوالي.

إلى علبة المقارنة.

ويمكن إيجاز أهم النتائج في النقاط التالية:

- سجلت معالات الإضافات الغذائية تحسنا معنوية (عند المستوى 5%) في كل من وزن الجسم ومعدل النمو مقارنة بمجموعة المقارنة.
- سجلت المعالنة التي غذت بمجموعات حبة البركة أفضل وزن جسم و معدل نمو مقارنة بباقي المعالنات.
- لوحظ زيادة معدل استهلاك الغذاء خلال فترة التجربة زيادة معنوية (عند مستوى 0.05%) وذلك بإضافة الإضافات الغذائية في الطبق، وقد سجلت المعلنة المغذاة على مجروح حبة البركة أعلى تلك القم، بينما سجلت مجموعة المقارنة أقل القم خلال الفترة التجريبية.
- حققت المعلنة التي غذت على مجروح حبة البركة أفضل معدل تحويل غذائي خلال فترة التحية مقارنةً بباقي المعالنات.
- التحساني حيث سجلت أفضل القم بينما زادت الأجزاء الماكولة زيادة غير معنوية نتيجة لهذه الإضافات.
- حققت المعالنات المغذاة على الإضافات الغذائية أعلى معدل نفوذ، حيث سجلت مجموعة المغذاة على مجروح حبة البركة أعلى القم، بينما سجلت مجموعة المقارنة أعلى معدل نفوذ.
- أظهرت معالنات الهضم الظهرية للعذبية الخاصية والبروتينات والفيتامينات والبيوتامينات المستخلص من النوروزين ارتفاعا معنوية (عند مستوى 5%) بالإضافة الغذائية أو الاضافات الطبية، حيث تحققت المعالنة التي غذت على مجروح حبة البركة أفضل معالنات حمض وامتصاص في النتائج.
- حققت لأفضل قم مقارنة للمعالنة المغذاة على مجروح حبة البركة خلال فترة التجربة مقارنة بباقي المعالنات.
- إذن، سجلت مجموعات المقارنة أعلى القم.

يمكن التوصية بوجبة الغذائية والاقتصادية إلى أعضاء استخدم مجروح حبة البركة (كإضافات طبية) بمستوى 1 جم/كم في علاج السمان البالياني دون تأثير سلبي على أداء النمو.