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EFFECT OF USING COMMERCIAL AND NATURAL GROWTH PROMOTERS ON THE PERFORMANCE OF COMMERCIAL LAYING HENS

By

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Abstract : *The present study aimed to investigate the impact of probiotic as commercial growth promoter and either fenugreek or black seed as natural growth promoter at levels of 0.05, 0.1 and 0.15% in practical laying diets on productive performance and economical efficiency during 40-59 weeks of age.*

A total number of 240 Hy-Line White laying hens were distributed into 10 equal groups , each of 24 birds in four replicates .The first group received the basal diet without any supplementation, whereas the other groups were given the basal diet supplemented with either probiotic, fenugreek or black seed each at levels of 0.05 , 0.1 and 0.15% . The results obtained could be summarized as follows:

1- *The highest body weight at 59 weeks of age was obtained from 0.05% inclusion level of each of probiotic, fenugreek and black seed. However, fenugreek treatment was significantly surpassed over all dietary treatments.*

2- *The inclusion level of either 0.1% probiotic,0.05 and 0.15% fenugreek or 0.1and 0.15% black seed significantly gave higher egg production than those of control group. However, fenugreek and black seed were insignificantly superior than the probiotic group.*

3- *Inclusion levels of probiotic, 0.05% fenugreek or 0.05 and 0.15% of black seed significantly increased egg weight. Moreover, egg mass was significantly increased with all studied levels of probiotic, black seed and 0.05% and 0.15% fenugreek .*

4- *There were no significant differences in feed consumption among all dietary treatments including the control group. While, feed conversion was significantly ($P<0.05$) improved at levels of 0.1, 0.05 and 0.15% for probiotic, fenugreek and black seed, respectively.*

5- *There were insignificant increase (P<0.05) in egg shape index (SI), yolk index (YI) and shell thickness (ST) and significant effect on Haugh units (HU) for all treatments. Furthermore, probiotic at 0.1% level, fenugreek at 0.15% and black seed at all levels had significant increase on yolk color (YC).*

6- *Probiotic, fenugreek and black seed inclusion had significant effects (p<0.05) in decreasing yolk total cholesterol compared with the control group and had no significant effect on total lipids of egg yolk.*

7- *Either probiotic, fenugreek or black seed had no positive effect on unsaturated fatty acids of egg yolk oppositely, they had positive effect on some saturated fatty acids like Palmitic acid ($c_{16:0}$) .*

8- *Economic evaluation for egg production was improved by using all dietary treatments. However, the best value was achieved by using 0.05% fenugreek, 0.15% black seed and 0.1% probiotic .*

INTRODUCTION

Nowadays, there is a tendency to use herbs and probiotics as natural feed additives to avoid the residual cumulative effect for either antibiotics or synthetic drugs in final products of poultry, which has a negative effect on the human health.

Probiotics have been used for animals and poultry as feed additives or as growth promoter to replace the widely used antibiotics and synthetic chemical feed supplements with positive statistical effects on growth performance (**Onifade *et al*., 1999**) and egg production properties (**Mohan *et al*., 1995**). Furthermore, probiotics effects may be mediated by a direct antagonistic effect against specific groups of organisms, resulting in a decrease in their number (**Watkins, 1981; Watkins *et al*., 1982; and Hentges, 1983**) or by an effect on their metabolism (**Rantala and Nurmi, 1973 & Goldin and Gorbach, 1984**) or by simulation of immunity (**Parker, 1974 and Umesb, 1999**). **Mona osman (2003)** found that the use of probiotic up to 4g/kg diet improved the performance of laying hens.

Fenugreek as a medical plant is considered to be a good source of crude protein, crude fat and total carbohydrates (**Abd El-Aal and Rahma, 1986**). Also, it has anticarcinogenic, antiviral, antifungal and antioxidant activities (Mazur ***et al*., 1998**). **Morsy (1995)** showed a significant improvement in body weight gain and dressing percentage with broiler chicks fed diets containing 0.05% fenugreek. Similarly, **Nadia Radwan (2003)** observed an improvement of body weight gain and feed conversion by adding fenugreek seeds up to 2% level to broiler diets during the finishing period (29-

49 days old). Supplemented broiler diet with fenugreek seeds resulted to significant decrease in abdominal fat percentage (**El-Husseiny *et al*., 2002**).

Black seed (*Nigella sativa*) is becoming commonly used for medical purposes as antibacterial, antifungal, antihelminthic, antidiabetic bronchodilator, immune enhancing and anti spasmodic effects (**Mahdi, 1993**). Adding black seeds to poultry diets resulted in improving body weight in laying hens (**El-Kaiaty *et al*., 2002**), in growing and laying Japanese quail (**Zeweil, 1996**), in broiler chicks (**Tollba and Hassan, 2003, Nadia Radwan, 2003**) and improved feed conversion (**Abdo, 1998 and Tollba *et al*., 2005**) .Moreover, black seeds addition has been reduced the concentration of serum cholesterol and triglycerides (**Mandour *et al*., 1995**), serum total lipids and liver cholesterol in broilers (**Abdo, 1998**), reduce fat content of serum total lipids and cholesterol in ducks (**Ghazalah and Ibrahim, 1996**).

The present study aimed to investigate the effect of supplemented either probiotic, fenugreek or black seeds with different levels to laying hen diets on their productive performance and egg quality.

MATERIALS AND METHODS

This investigation was carried out at the 20 Million Egg Project belongs to the Ministry of Agriculture, Alexandria Governorate. The tested materials were a commercial probiotic (containing Saccharomyces cerevisiae, Enterococcus faecium and Lactobacillus acidophilus), fenugreek and black seed. They were obtained from commercial supplier.

A total number of 240 Hy-Line White-egg layers (Hy-line W36) as a commercial egg strain were randomly selected at 40 weeks old from the flock of the 20 Million Egg Project, randomly assigned equally to 10 groups; each group contains 4 replicates of 6 hens each. The birds were fed corn-soy basal diet (BD) containing 2850 kcal ME/Kg, 18.51%CP, 3.53% calcium and 0.60% available phosphorus. It was supplemented with commercial probiotic, fenugreek and black seeds to produce 10 experimental diets as follows:

1- Basal diet (BD) control
2- BD + 0.05% Probiotic
3- BD + 0.10% Probiotic
4- BD + 0.15% Probiotic
5- BD + 0.05% Fenugreek
6-BD + 0.10% Fenugreek
7-BD + 0.15% Fenugreek
8-BD + 0.05% Black seed
9-BD + 0.10% Black seed
10-BD + 0.15% Black seed

Feed was given according to the management guide under a total of 17 hours light /day. Water was provided all time. During the experimental period (40 to 59 weeks old), individual body weight (g) was recorded at 43, 51 and 59 weeks of age. Average feed consumption (g/hen/day) was monthly measured throughout the experimental period. Eggs were collected, counted and weighed till the termination of the experiment. In order to calculate egg mass, egg production was calculated as hen daily egg production (HD) and multiplied it by the average egg weight. Feed conversion ratio was monthly calculated by dividing Kg feed consumed by Kg egg mass.

At 51 weeks of age, three fresh eggs per replicate (12 eggs/treatment) were randomly collected to determine egg quality measurements including egg shape index (SI), yolk index (YI) and Hugh units (HU) according to **Stadleman (1977),** Yolk color (YC) using Hoffman La Roch color fan, Shell thickness (ST) using a micrometer to the nearest 0.01 mm and Shell weight per unit of surface area (SWUSA) using the equation of **Carter (1975**). Yolk cholesterol and total lipids were determined (at 51 and 59 weeks of age) according to the procedures of Fisher **and Leveille (1957)**. Fatty acids of egg yolk were carried out by gas liquid chromatography (GLC) technique

Economical efficiency (EEF) was estimated as feeding cost per Kg egg mass. While relative EEF was relatively calculated to the un supplemented control group as follows:

$$\text{Relative feeding cost} = \frac{\textit{Supplemented}\text{ group feeding cost /Kg egg mass}}{\text{un - sumpplemented group feeding cost/Kg egg mass}} \times 100$$

Data obtained were statistically analyzed using analysis of variance which was performed using SAS® software computer program (**SAS**, **1990)** and Duncan's new multiple range test **(Duncan , 1955**) was used to test mean differences if a significant probability value was obtained.

RESULTS AND DISCUSSION

Live body weight:

The effect of either inclusion levels of probiotic, fenugreek or black seeds on body weight changes is presented in Table (2). Results showed that during the first experimental period (43 weeks of age), average live body weight did not significantly affect by any level of the tested materials. Also, at 51 weeks of age, average body weight of the control group was insignificantly ($P<0.05$) differed than those of all dietary treatments. On the

other hand, with feeding the experimental diet to 59 weeks of age, significant increase in body weight had been observed for all dietary treatments and levels compared with those of the control group. The highest body weight was obtained from inclusion level of 0.05% for probiotic, fenugreek and black seed; however, 0.05% fenugreek significantly surpassed all dietary treatments. These results are agreed well with those of **El-Kaiaty *et al*., (2002)** and **Nadia Radwan (2003**) for black seed, **Morsy (1995)** and **Nadia Radwan (2003)** for fenugreek and **Onifade *et al*., (1999)** for probiotic. The improvement in body weight at 59 weeks of age may be due to the antioxidant, antibacterial, antifungal and antagonistic effect of experimental materials on the micro-organisms present in the gut. Such factors may positively affect digestion and/or absorption of feed ingredients in the digestive tract, and subsequently reflected on body weight.

Murray *et al*., (1991) reported that the improvement of body weight of chicks fed black seed containing diets may be due to that black seed contained 37.36% of EE which is rich in unsaturated fatty acids such as oleic, linoleic and linolenic acids, that have been considered essential for growth.

Egg production:

The effect of inclusion levels of probiotic, fenugreek and black seeds in laying hens diets on egg production is presented in Table (3). Generally, egg production of all dietary treatments along with the experimental periods (40-59 wks) surpassed that of the control group. The inclusion level of 0.1% probiotic, 0.05 and 0.15% fenugreek and 0.1and 0.15% black seed gave a significant higher overall mean of egg production over that of the control group, however, fenugreek and black seed were insignificantly superior than those of probiotic group. This result agree with those of **Abd El-Rahman (1988)** and **Mona Osman (2003)** who found that probiotic inclusion has significantly increased egg production. In contrast, **Cerniglia *et al*., (1983)** and **Bougon *et al*., (1988)** observed insignificant effect of probiotic on egg production. **El-Kaiaty *et al*.,(2002)** found that using fenugreek and black seed in diets at 2% level had no effect on egg production. It could be noted that using fenugreek and black seed at high level (2%) has no effect on egg production, while, their lower levels gave positive and significant increase in egg production.

The positive effect of using fenugreek on egg production my be due to the composition fenugreek of crude protein, crude fat and total carbohydrates (**Abd El-Aal and Rahma, 1986**). Also, it has anticarcinogenic, antiviral, antifungal and antioxidant activities **(Mazur *et al*., 1998)**, which represent suitable condition for higher egg production.

The role of black seed in increasing egg production my be due to its antibacterial, antifungal, antihelminthic, antidiabetic bronchodilator, immune enhancing and anti spasmodic effects (**Mahdi, 1993**).

Egg weight and egg mass:

The effects of treatments on average egg weight and egg mass are shown in Tables (4 and 5). As shown from Tables 4 and 5, all levels of dietary treatments of probiotic, black seed and fenugreek during 40-51 weeks of age significantly increased egg weight compared with control group. The same trend was observed up to 55 weeks with the exception of 0.1% fenugreek group. Up to 59 weeks of age, the groups received 0.1, 0.15 % fenugreek and 0.1% black seed resulted in statistically similar egg weight to the control , while the other dietary treatments significantly surpassed the control . Regarding to egg mass, up to 59 weeks of age all of the dietary treatments surpassed the control with the exception of 0.1% fenugreek which was similar to the control during the period from 48-59 weeks of age. Generally, 0.05% inclusion was the best supplementation for all dietary treatments studied. The descending order of the values of supplemented materials at 0.05% level were fenugreek followed by black seed then probiotic. Such increment in egg mass values could be attributed to the increase in egg weight laid by hens. In this connection, **Hamid *et al*., (1994), Cavazzoni *et al*., (1998)**, and **Mona Osman (2003)** found that adding probiotic to laying hens diets improved egg weight. **El-Kaiaty *et al*., (2002)** reported that inclusion of 2% black seed and 2% fenugreek in laying hens insignificantly improved both of egg weight and mass. Similar results were obtained by **Tollba *et al*., (2005)**, when they added 2% black seed to laying hen diet. It could be observed that higher levels of black seed (2%) and fenugreek (2%) does not improve egg weight or egg mass while, lower levels used in present study (0.05, 0.1 and 0.15%) had given the best results.

Feed consumption and feed conversion:

Results presented in Table (6) indicated no significant differences in feed consumption among all dietary treatments including the control group. In this respect, El-**Kaiaty *et al*., (2002)** with laying hens and **Nadia Radwan (2003)** with broilers reported that there were no effect of supplemented fenugreek or black seed on feed consumption. **Mona Osman (2003)** did not find any effect of addition probiotic to laying hens on feed consumption.

Feed conversion values (Table 7) revealed significantly improve by adding fenugreek at levels of 0.05% and 0.15%, black seed and probiotic up to 0.15% till 55 weeks of age compared with control group. The overall mean of feed conversion at all used levels for all treatments numerically improved

compared to control group .The significant (P<0.05) improvement of feed conversion were at levels of 0.1, 0.05 and 0.15% for probiotic, fenugreek and black seed, respectively. Similar results were confirmed by El-**Kaiaty *et al*.,(2002)** when used fenugreek and black seed in laying hens . **Mona Osman (2003)** observed slight improvement in feed conversion by using probiotic (0.4%). On the other hand, **Bougon *et al*.,(1988)** revealed no significant effect on feed conversion value as probiotic used.

This improvement my be attributed to that fenugreek can inhibit 85-90%of formation of aflatoxins (**El-Shayeb and Mabrouk, 1984**), which lead to improve feed conversion of hens. In this respect, **Mazur *et al*., (1998)** demonstrated that the presence of phytoestrogens in fenugreek have great value because of their antifungal and antioxidant activities. The improvements obtained from adding black seeds up to 0.15% my be attributed to that black seed can reduce mold growth and so can completely inhibit the formation of aflatoxins and accordingly lead to a higher utilization efficiency of nutrients in the feed (**Ghazalah and Ibrahim, 1996** and **Abd El-Latif *et al*., 2002**). Also, the marked improvement in feed conversion from the inclusion of probiotic may be due to the improvement occurs in the balance of the intestinal flora and their metabolites (Endo ***et al*., 1999**).

External and internal egg quality:

Results in Table (8) indicated that there are insignificant (P<0.05) increase in egg shape index (SI), yolk index (YI) and shell thickness (ST) for all treatments and levels studied except at level of 0.1% probiotic which has significant increase in SI. Probiotic and black seed had significant increase in YI at 0.15% level, while, fenugreek has no significant effect on YI. In this regard, **Mona Osman (2003)** did not observe differences in ST and found significantly differences in YI as using probiotic in laying hens diet. **Tollba *et al*., (2005)** revealed no significant effect in YI when used black seed at 2% level in laying hens .The probiotic, fenugreek and black seed had lower significant effect on haugh units (HU) except 0.1%fenugrek, which was similar to the control , same result obtained for probiotic on shell weight per unit of surface area (SWUSA). While, fenugreek and black seed significantly increased SWUSA at levels 0.05% and 0.1% for fenugreek and 0.1%for black seed. Furthermore, probiotic at 0.1% level, fenugreek at 0.15% and black seed at all levels had significant increase on yolk color (YC). Significant improvement of YC by using herbs may be due to the presence of natural colors in these materials.

Yolk cholesterol and total lipids:

Cholesterol concentration and total lipids of egg yolk among the tested groups fed the basal diet supplemented with different levels of probiotic, fenugreek and black seed (Table 9), revealed that probiotic, fenugreek and black seed inclusion had significant effects($p<0.05$) in lowering total cholesterol compared with the control group .Probiotic had no significant effect on total lipids, while fenugreek and black seed significantly recorded higher total lipids than the control at 51 and 59 weeks of age with the exception of 0.15% fenugreek at 59 weeks of which was similar to the control. On average, all dietary treatments had no significant effect on total lipids except 0.15% probiotic which had significantly decreased total lipids than the control. It is clear that the inclusion level of 0.05% either of probiotic, fenugreek or black seed gave the best results, economically, for producing eggs lowering in cholesterol content. **Khodary *et al*., (1996)** reported that the decrease of cholesterol may be due to the high content of unsaturated fatty acids in black seed which may stimulate the cholesterol excretion into the intestine and the oxidation of cholesterol to bile acids. **Petit *et al*., (1993)** stated that fenugreek seeds or extracts increased the excretion of bile acids and so reduced cholesterol content of plasma due to the presence of the unsaturated fatty acids in fenugreek seeds. While, **Lanksy *et al*., (1993)** attributed this activity to steroid saponins which may either compete with cholesterol at binding sites or interfere with cholesterol biosynthesis in the liver. They added that soluble fibers and mucilage content of fenugreek seeds may block cholesterol absorption from the intestine and so reduced its level of plasma. **El-Kaiaty *et al*., (2002)** declared that supplemented diet with either 2% fenugreek or 2% black seed significantly decreased the yolk cholesterol by about 9% and 15%, respectively. Similarly, **Nadia Radwan (2003)** reported that broiler chicks fed black seed at different levels had lower ($p<0.05$) values of plasma total cholesterol content than those fed the control diet. The decreasing effect of probiotic on total cholesterol agree with the findings obtained by **Mona Osman (2003)**. The results as shown in Table 9, revealed that the probiotic inclusion up to 0.15% significantly lowered total cholesterol and has no significant effect on total lipids. These results are in agreement with those of **Mervat Yossef *et al*., (2001)** who found that the use of *Saccharomyces cerevisiae* at the level of 0.1% significantly decreased egg yolk cholesterol. Similarly, **Mona Osman (2003)** found that the use of probiotic up to 0.1% significantly decreased the cholesterol and had no effect on total lipids of egg yolk.

Yolk fatty acids component:

As shown in Table (10), it was found that probiotic, fenugreek and black seed had no positive effect on unsaturated fatty acids except at level of 0.05% fenugreek and probiotic which insignificantly differed than the control group on palmitoleic acid. While, they had positive effect on some saturated fatty acids like palmitic acid which was significantly deceased among all dietary treatments and levels compared to the control. Furthermore, the level of 0.05% fenugreek gave significantly the lowest value of Palmitic acid compared with all dietary treatments.

Economic evaluation:

Economic evaluation provide further evidence for the economic beneficial of using probiotic, fenugreek and black seed in laying hens diets. Total production cost was calculated including prices of feeding.

As shown in Table (11), the incorporation of fenugreek and black seed supplementation in laying hen diets decreased total feeding cost, while, probiotic increased total feeding cost allover the experimental period. In general , the lowest feed cost needed to obtain one kg of egg mass had been obtained using fenugreek (90.37%) followed by black seed (90.82) and then by probiotic (94.03), all of which are superior compared to the control diet without supplementation.

In conclusion, from the obtained results, it could be recommended to use fenugreek, black seed and probiotic as feed additives in laying hens diets at level of 0.05% with the previous order for obtaining better and economical productive performance.

Table (1): Composition and calculated analysis of the basal experimental diet given to Hy-Line White laying hens throughout the period 40-59 weeks of age.

Ingredients	%
Corn yellow	53.000
Soybean meal (44%)	31.700
Vegetable oil	3.960
Bone meal	3.500
Limestone	6.883
DL-Methionine	0.158
Premix *	0.300
NaCl	0.300
Sand	0.199
Total	100
Calculated values**	
Crude protein %	18.51
M.E. kcal/kg	2850.60
C/P ratio	154.00
Methionine	0.46
Lysine	1.03
Calcium %	3.53
Available P	0.60
Fat	6.31
Fiber	2.96

* Vitamins and minerals premix provides per kilogram of diet: 10500 IU vitamin A, 11.0 IU vitamin E, 1.1 mg menadione (as menadione sodium bisulfite), 2100 ICU vitamin D3, 5 mg riboflavin, 12 mg Ca pantothenate, 12.1 µg vitamin B12, 2.2 mg vitamin B6, 2.2 mg thiamin, 44 mg nicotinic acid, 250 mg choline chloride, 1.55 mg folic acid, 0.11 mg d-biotin. 60 mg Mn, 50 mg Zn, 0.3mg I , 0.1 mg Co, 30 mg Fe,5mg Cu and 3 mg Se.

** Calculated according to NRC (1994).

Table (2): Effect of feeding laying hens different levels of probiotic, fenugreek and black seed on body weight (g) during the intervals and overall experimental periods (43-59 weeks) .

Trait / Treatments	Body weight (g)			
	Age (wks)			
	43	51	59	Overall mean
Control	1207.40±1.7	1479.98±14.0^{ab}	1499.58±16.1^{c}	1395.65±10.6^{c}
Probiotic (%)				
0.05	1200.81±1.5	1496.36±14.9^{a}	1616.33±13.8^{a}	1437.83±10.07^{b}
0.1	1203.29±1.7	1463.02±10.3^{b}	1570.42±14.6^{b}	1412.24±8.9^{bc}
0.15	1204.39±2.0	1519.69±7.0^{a}	1603.33±7.5^{ab}	1442.47±5.5^{b}
Fenugreek (%)				
0.05	1199.05±1.2	1525.66±9.6^{a}	1693.33±12.6^{a}	1472.68±8.0^{a}
0.1	1199.93±1.5	1518.42±14.9^{a}	1630.83±12.6^{a}	1449..73±9.7^{b}
0.15	1200.15±1.1	1499.08±14.7^{a}	1590.00±11.2^{ab}	1429.74±9.0^{b}
Black seed (%)				
0.05	1209.98±1.6	1478.15±9.6^{ab}	1614.58±17.2^{a}	1434.23±9.5^{b}
0.1	1209.84±1.4	1465.82±15.3^{b}	1585.96±16.4^{ab}	1420.54±11.0^{b}
0.15	1201.51±1.3	1467.48±13.1^{b}	1575.00±13.6^{b}	1414.66±9.3^{bc}

^{abc} Means within a column with no common superscripts differ significantly (P≤0.05) based on Duncan's separation of means.

Table (3): Effect of feeding laying hens different levels of probiotic, fenugreek and black seed on egg production during the intervals and overall experimental periods (40-59 weeks) .

Trait / Treatment	Egg production %					
	Age (wks)					
	40-43	44-47	48-51	52-55	56-59	Overall mean
Control	77.36±1.8^{b}	79.44±1.2^{b}	80.06±1.1^{b}	80.69±1.5^{b}	79.72±1.6^{b}	79.45±1.44^{b}
Probiotic (%)						
0.05	77.77±1.5^{b}	80.69±1.3^{ab}	81.11±1.3^{ab}	81.25±1.4^{ab}	79.72±1.4^{b}	80.11±1.4^{b}
0.1	81.25±1.8^{a}	80.97±1.0^{ab}	81.25±1.0^{ab}	81.39±0.7^{ab}	81.11±1.4^{a}	81.19±1.2^{a}
0.15	78.61±1.2^{b}	81.11±0.6^{a}	81.80±0.4^{ab}	82.92±0.5^{a}	79.58±1.1^{b}	80.80±0.8^{b}
Fenugreek (%)						
0.05	82.22±1.4^{a}	81.53±1.6^{a}	81.67±1.6^{ab}	81.11±1.4^{ab}	82.08±1.7^{a}	81.72±1.5^{a}
0.1	77.36±2.5^{b}	80.14±1.9^{ab}	80.83±1.9^{ab}	81.11±1.7^{ab}	80.00±1.4^{ab}	79.89±1.9^{b}
0.15	81.94±1.8^{a}	82.36±0.9^{a}	82.92±1.1^{a}	83.00±0.8^{a}	81.39±1.1^{a}	82.32±1.1^{a}
Black seed (%)						
0.05	78.47±1.4^{b}	80.83±0.8^{ab}	81.00±0.1^{ab}	81.94±0.7^{ab}	81.40±1.0^{a}	80.73±0.8^{b}
0.1	80.97±1.2^{a}	81.67±1.0^{a}	82.08±0.8^{a}	82.50±0.7^{a}	82.08±0.2^{a}	81.86±0.8^{a}
0.15	79.58±1.3^{ab}	82.77±0.9^{a}	82.92±0.9^{a}	83.75±0.8^{a}	81.11±0.8^{a}	82.03±0.9^{a}

^{ab} Means within a column with no common superscripts differ significantly (P≤0.05) based on Duncan's separation of means.

Table (4): Effect of feeding laying hens different levels of probiotic, fenugreek and black seed on average egg weight (g). during the intervals and overall experimental periods (40-59 weeks) .

Trait / Treatment	Egg weight (g)					
	Age (wks)					
	40-43	44-47	48-51	52-55	56-59	Overall mean
Control	59.82±1.6	57.02±2.1^{b}	59.95±1.7^{b}	62.77±1.8^{b}	65.15±1.8^{b}	60.94±1.8^{b}
Probiotic (%)						
0.05	61.05±1.3	59.38±1.0^{a}	63.35±0.6^{a}	64.65±0.6^{a}	67.05±0.6^{a}	63.10±0.8^{a}
0.1	61.33±1.2	60.92±1.7^{a}	64.07±0.6^{a}	65.37±0.6^{a}	67.77±0.6^{a}	63.89±0.9^{a}
0.15	62.03±0.9	56.60±1.7^{b}	62.37±0.8^{a}	63.67±0.8^{a}	66.07±0.8^{a}	62.15±1.0^{a}
Fenugreek (%)						
0.05	59.80±1.2	60.88±1.6^{a}	64.03±0.7^{a}	65.33±0.7^{a}	67.73±0.7^{a}	63.55±0.9^{a}
0.1	61.42±1.6	58.90±0.9^{a}	61.40±0.8^{a}	62.70±0.8^{b}	65.10±0.8^{b}	61.90±1.0^{b}
0.15	60.50±0.4	58.08±1.3^{a}	61.75±0.8^{a}	63.02±0.8^{a}	65.45±0.8^{b}	61.70±0.9^{b}
Black seed (%)						
0.05	61.82±1.9	59.82±2.0^{a}	63.50±1.3^{a}	64.80±1.3^{a}	67.20±1.3^{a}	63.43±1.6^{a}
0.1	60.38±0.7	58.17±1.0^{a}	62.07±0.5^{a}	63.37±0.5^{a}	65.77±0.5^{b}	61.95±0.6^{b}
0.15	60.70±0.7	60.53±1.4^{a}	62.98±0.9^{a}	64.28±0.9^{a}	66.68±0.9^{a}	63.03±0.9^{a}

^{ab} Means within a column with no common superscripts differ significantly (P≤0.05) based on Duncan's separation of means.

Table (5): Effect of feeding laying hens different levels of probiotic, fenugreek and black seed on egg mass (g/hen/day) during the intervals and overall experimental periods (40-59 weeks) .

Trait / Treatment	Egg mass (g/hen/day)					
	Age (wks)					
	40-43	44-47	48-51	52-55	56-59	Overall mean
Control	46.34 ± 2.0^{b}	45.26 ± 1.6^{b}	48.30 ± 1.6^{b}	50.59 ± 1.4^{b}	51.92 ± 1.6^{b}	48.48 ± 1.6^{b}
Probiotic (%)						
0.05	47.54 ± 1.7^{b}	47.89 ± 0.8^{a}	51.42 ± 1.2^{a}	52.55 ± 1.2^{a}	53.44 ± 0.9^{a}	50.57 ± 1.2^{a}
0.1	49.89 ± 1.7^{a}	49.26 ± 1.1^{a}	52.04 ± 0.6^{a}	53.19 ± 0.4^{a}	54.97 ± 1.1^{a}	51.87 ± 0.9^{a}
0.15	48.77 ± 1.1^{a}	45.94 ± 1.7^{b}	51.03 ± 0.8^{a}	52.79 ± 0.8^{a}	52.60 ± 1.2^{ab}	50.23 ± 1.1^{a}
Fenugreek (%)						
0.05	49.16 ± 1.2^{a}	49.68 ± 1.9^{a}	52.27 ± 0.8^{a}	52.96 ± 0.7^{a}	55.57 ± 1.1^{a}	51.93 ± 1.14^{a}
0.1	47.98 ± 2.2^{a}	47.29 ± 1.9^{a}	49.67 ± 1.7^{b}	50.91 ± 1.6^{b}	52.09 ± 1.3^{b}	49.75 ± 1.7^{ab}
0.15	49.59 ± 1.3^{a}	47.79 ± 0.8^{a}	51.21 ± 0.9^{a}	52.25 ± 0.8^{a}	53.26 ± 0.8^{a}	50.82 ± 0.9^{a}
Black seed (%)						
0.05	48.50 ± 1.7^{a}	48.35 ± 1.7^{a}	51.29 ± 0.9^{a}	53.08 ± 0.9^{a}	54.70 ± 1.4^{a}	51.18 ± 1.3^{a}
0.1	48.92 ± 1.1^{a}	47.53 ± 1.2^{a}	50.95 ± 0.7^{ab}	52.28 ± 0.6^{a}	53.98 ± 0.3^{a}	50.73 ± 0.8^{a}
0.15	48.29 ± 0.9^{a}	50.08 ± 1.1^{a}	52.22 ± 0.9^{a}	53.84 ± 0.9^{a}	54.11 ± 1.2^{a}	51.71 ± 1.0^{a}

[ab] Means within a column with no common superscripts differ significantly ($P\leq0.05$) based on Duncan's separation of means.

Table (6): Effect of feeding laying hens different levels of probiotic, fenugreek and black seed on feed consumption (g/hen/day) during the intervals and overall experimental periods (40-59 weeks).

Trait / Treatment	Feed consumption (g/day)					
	Age (wks)					
	40-43	44-47	48-51	52-55	56-59	Overall mean
Control	110.3±3.2	107.5±3.0	100.2±2.8	100.1±2.9	99.0±2.0	103.42±2.8
Probiotic (%)						
0.05	105.3±3.0	103.1±2.9	99.9±2.5	99.8±2.8	98.6±2.1	101.34±2.7
0.1	100.5±3.1	100.5±2.8	98.6±2.0	98.7±1.9	98.1±1.9	99.28±2.3
0.15	99.3±2.8	99.0±1.9	98.7±1.8	98.0±2.0	98.0±1.9	98.6±2.1
Fenugreek (%)						
0.05	100.9±2.3	100.0±2.4	100.0±2.3	100.0±2.0	99.7±1.9	100.12±2.2
0.1	100.0±1.9	99.3±2.3	99.1±2.0	100.6±2.1	99.5±2.1	99.7±2.1
0.15	99.7±1.8	99.0±2.4	99.5±1.9	100.0±1.9	99.7±2.0	99.58±2.0
Black seed (%)						
0.05	100.0±2.2	100.1±2.1	99.5±2.0	100.0±2.0	99.3±1.9	99.78±2.1
0.1	99.7±2.1	100.0±2.0	99.6±1.9	99.7±1.9	99.0±1.8	99.6±2.0
0.15	99.2±2.0	100.3±2.1	99.1±1.8	99.5±1.8	98.9±2.0	99.4±1.9

Table (7): Effect of feeding laying hens different levels of probiotic, fenugreek and black seed on feed conversion (g/day) during the intervals and overall experimental periods (40-59 weeks) .

rait / Treatment	Feed conversion (g/day)					
	Age (wks)					
	40-43	44-47	48-51	52-55	56-59	Overall mean
Control	2.38±0.4[a]	2.41±0.4[a]	2.10±0.3[a]	2.01±0.2[a]	1.91±0.2[a]	2.16±0.3[a]
Probiotic (%)						
0.05	2.21±0.3[ab]	2.20±0.3[b]	1.90±0.2[b]	1.91±0.1[b]	1.92±0.2[a]	2.03±0.2[a]
0.1	2.01±0.3[b]	2.04±0.3[b]	1.89±0.1[b]	1.86±0.2[b]	1.78±0.1[b]	1.92±0.2[b]
0.15	2.04±0.2[b]	2.15±0.2[b]	1.93±0.1[b]	1.86±0.1[b]	1.86±0.1[ab]	1.97±0.1[ab]
Fenugreek (%)						
0.05	2.05±0.2[b]	2.01±0.2[b]	1.91±0.1[b]	1.89±0.1[b]	1.79±0.1[b]	1.93±0.1[b]
0.1	2.10±0.3[b]	2.10±0.3[b]	2.00±0.2[ab]	1.98±0.1[a]	1.91±0.1[a]	2.02±0.1[a]
0.15	2.01±0.1[b]	2.07±0.3[b]	1.94±0.2[b]	1.91±0.2[b]	1.87±0.2[ab]	1.96±0.2[ab]
Black seed (%)						
0.05	2.06±0.2[b]	2.07±0.3[b]	1.94±0.2[b]	1.88±0.1[b]	1.82±0.3[ab]	1.95±0.2[ab]
0.1	2.04±0.2[b]	2.10±0.2[b]	1.95±0.3[b]	1.91±0.2[b]	1.83±0.2[ab]	1.97±0.2[ab]
0.15	2.05±0.2[b]	2.00±0.2[b]	1.90±0.1[b]	1.85±0.1[b]	1.83±0.2[ab]	1.93±0.2[b]

[ab] Means within a column with no common superscripts differ significantly (P≤0.05) based on Duncan's separation of means.

(8): Effect of feeding laying hens different levels of probiotic, fenugreek and black seed on egg weight (Egg w.) (g), egg sha index (SI), yolk color (YC), yolk index (YI), Haugh units (HU), shell thickness (ST) and shell weight per unit of surfa area (SWUSA) at 52 weeks of age.

Treatment	Traits						
	Egg w.	SI	YC	YI	HU	ST	SWUSA
Control	63.17±1.6^{b}	74.90±1.2^{b}	7.50±0.8^{b}	41.63±0.8^{b}	103.43±6.2^{a}	0.34±0.01^{ab}	96.72±2.2^{b}
Probiotic (%)							
0.05	64.97±1.9^{a}	75.21±1.5^{ab}	7.17±0.6^{b}	42.46±1.2^{b}	93.76±1.6^{b}	0.32±0.01^{b}	89.87±2.6^{c}
0.1	64.78±1.1^{a}	77.39±0.8^{a}	7.83±0.5^{a}	44.19±0.9^{ab}	95.17±2.1^{b}	0.35±0.01^{a}	95.63±3.1^{b}
0.15	65.02±1.8^{a}	73.99±1.2^{b}	7.67±0.2^{ab}	45.65±2.2^{a}	94.92±2.9^{b}	0.35±0.01^{a}	91.07±2.0^{c}
Fenugreek (%)							
0.05	65.59±0.91^{a}	74.36±0.8^{b}	7.50±0.6^{b}	43.99±1.1^{ab}	89.82±4.2^{c}	0.34±0.02^{ab}	99.39±3.4^{a}
0.1	63.98±1.04^{a}	75.77±0.6^{ab}	7.17±0.7^{b}	41.33±3.2^{b}	97.86±2.4^{a}	0.35±0.01^{a}	101.52±2.3^{a}
0.15	63.20±1.50^{a}	75.18±0.8^{ab}	8.00±0.6^{a}	42.88±1.0^{ab}	87.96±1.3^{c}	0.35±0.01^{a}	92.44±3.8^{c}
Black seed (%)							
0.05	65.07±0.9^{a}	74.98±0.9^{b}	7.90±0.4^{a}	43.24±0.6^{ab}	93.79±4.7^{b}	0.34±0.01^{ab}	88.04±2.9^{c}
0.1	63.34±1.5^{a}	75.34±1.5^{ab}	7.98±0.7^{a}	43.17±0.9^{ab}	90.89±1.2^{c}	0.35±0.01^{a}	98.91±3.6^{a}
0.15	64.68±0.9^{a}	74.08±1.4^{b}	8.00±0.6^{a}	46.79±0.4^{a}	89.99±1.0c	0.35±0.01^{a}	95.61±2.5^{b}

^{abc} Means within a column with no common superscripts differ significantly (P≤0.05) based on Duncan's separation of means.

Table (9): Effect of feeding laying hens different levels of probiotic, fenugreek and black seed on yolk total cholesterol and total lipids at 51,59 weeks of age.

Trait / Treatment	Total cholesterol			Total lipids		
	51 wk	59 wk	Overall mean	51 wk	59 wk	Overall mean
Control	17.56 ± 0.5^{a}	16.78 ± 0.7^{a}	17.17 ± 0.6^{a}	2.73 ± 0.3^{b}	2.62 ± 0.2^{b}	2.68 ± 0.3^{a}
Probiotic (%)						
0.05	14.83 ± 0.1^{b}	14.49 ± 0.6^{b}	14.66 ± 0.35^{b}	2.91 ± 0.1^{b}	2.59 ± 0.1^{b}	2.75 ± 0.1^{a}
0.1	14.50 ± 0.0^{b}	14.04 ± 0.5^{b}	14.27 ± 0.25^{b}	2.65 ± 0.1^{b}	2.22 ± 0.0^{b}	2.44 ± 0.1^{a}
0.15	14.16 ± 0.6^{b}	14.49 ± 0.3^{b}	14.33 ± 0.5^{b}	2.05 ± 0.2^{b}	1.84 ± 0.0^{b}	1.95 ± 0.1^{b}
Fenugreek (%)						
0.05	14.93 ± 0.1^{b}	14.94 ± 0.1^{b}	14.94 ± 0.1^{b}	3.05 ± 0.3^{a}	2.73 ± 0.3^{a}	2.89 ± 0.3^{a}
0.1	14.59 ± 0.3^{b}	14.30 ± 0.5^{b}	14.44 ± 0.4^{b}	3.13 ± 0.3^{a}	2.83 ± 0.2^{a}	2.98 ± 0.3^{a}
0.15	13.90 ± 0.2^{b}	13.80 ± 0.4^{b}	13.85 ± 0.3^{b}	3.11 ± 0.2^{a}	2.60 ± 0.2^{b}	2.90 ± 0.2^{a}
Black seed (%)						
0.05	14.63 ± 0.5^{b}	14.59 ± 0.1^{b}	14.61 ± 0.3^{b}	3.18 ± 0.0^{a}	2.86 ± 0.1^{a}	3.02 ± 0.1^{a}
0.1	14.44 ± 0.4^{b}	14.74 ± 0.2^{b}	14.59 ± 0.3^{b}	3.22 ± 0.2^{a}	3.21 ± 0.2^{a}	3.22 ± 0.2^{a}
0.15	14.12 ± 0.4^{b}	14.70 ± 0.3^{b}	14.41 ± 0.3^{b}	3.28 ± 0.2^{a}	2.98 ± 0.1^{a}	3.13 ± 0.2^{a}

[ab] Means within a column with no common superscripts differ significantly ($P\leq0.05$) based on Duncan's separation of means.

Table (10): Effect of feeding laying hens different levels of probiotic, fenugreek and black seed on yolk fatty acids component (%) at 59 week of age.

Trait / Treatment	Fatty acids component (%)						
	14:0	16:0	16:1	18:0	18:1	18:2	20:0
Control	0.278 ± 0.0^{c}	30.513 ± 0.0^{a}	2.714 ± 0.0^{a}	8.668 ± 0.5^{c}	46.847 ± 0.0^{a}	29.865 ± 0.0^{a}	0.616 ± 0.0^{d}
Probiotic (%)							
0.05	0.391 ± 0.0^{b}	25.672 ± 0.0^{c}	2.495 ± 0.0^{a}	8.606 ± 0.0^{c}	36.913 ± 0.0^{d}	24.943 ± 0.0^{b}	0.983 ± 0.0^{b}
0.1	0.473 ± 0.0^{b}	28.503 ± 0.0^{b}	1.828 ± 0.0^{c}	11.492 ± 0.0^{b}	36.572 ± 0.0^{d}	19.947 ± 0.0^{c}	1.187 ± 0.0^{a}
0.15	0.365 ± 0.0^{b}	25.316 ± 0.0^{c}	1.753 ± 0.0^{c}	9.642 ± 0.0^{c}	36.824 ± 0.0^{d}	24.84 ± 0.0^{b}	1.262 ± 0.0^{a}
Fenugreek (%)							
0.05	0.397 ± 0.0^{b}	20.822 ± 0.0^{d}	2.867 ± 0.0^{a}	11.638 ± 0.0^{b}	38.124 ± 0.0^{c}	25.355 ± 0.0^{b}	0.798 ± 0.0^{c}
0.1	1.123 ± 0.0^{a}	29.49 ± 0.0^{ab}	1.749 ± 0.0^{c}	10.302 ± 0.0^{b}	38.203 ± 0.0^{c}	18.662 ± 0.0^{c}	0.467 ± 0.0^{d}
0.15	0.477 ± 0.0^{b}	25.551 ± 0.0^{c}	2.187 ± 0.0^{b}	11.492 ± 0.0^{b}	35.571 ± 0.0^{d}	23.539 ± 0.0^{b}	1.182 ± 0.0^{a}
Black seed (%)							
0.05	0.317 ± 0.0^{c}	25.493 ± 0.0^{c}	2.144 ± 0.0^{b}	8.656 ± 0.0^{c}	40.676 ± 0.0^{b}	21.637 ± 0.0^{b}	1.079 ± 0.0^{a}
0.1	0.563 ± 0.0^{b}	32.593 ± 0.0^{a}	1.842 ± 0.0^{c}	9.089 ± 0.0^{c}	36.954 ± 0.0^{d}	18.395 ± 0.0^{c}	0.566 ± 0.0^{d}
0.15	0.401 ± 0.0^{b}	24.903 ± 0.0^{c}	2.001 ± 0.0^{c}	12.133 ± 0.0^{a}	35.195 ± 0.0^{d}	24.268 ± 0.0^{b}	1.102 ± 0.0^{a}

^{abcd} Means within a column with no common superscripts differ significantly ($P\leq0.05$) based on Duncan's separation of means.

14:0 Myrestic acid 16:0 Palmitic acid 16:1 Palmitoleic acid 18:0 Stearic acid
18:1 Oleic acid 18:2 Linoleic acid 20.0 Arachidic acid

Table (11): Effect of feeding laying hens different levels of probiotic, fenugreek and black seed on the economic return.

Treatments	Egg mass/ hen/day(kg)	Feed consumptionh en/day(kg)	Total feed cost/hen (LE)	Feeding cost /kg egg mass	Relative feed* cost/egg
Control	0.04848	0.10342	0.1055	2.18	100.00
Probiotic (%)					
0.05	0.05057	0.10134	0.1059	2.94	95.41
0.1	0.05187	0.09928	0.1062	2.05	94.03
0.15	0.05023	0.09860	0.1080	2.15	98.62
Fenugreek (%)					
0.05	0.05193	0.10012	0.1023	1.97	90.37
0.1	0.04975	0.09970	0.1021	2.05	94.03
0.15	0.05082	0.09958	0.1022	2.01	92.20
Black seed (%)					
0.05	0.05118	0.09978	0.1022	2.00	91.74
0.1	0.05073	0.0996	0.1024	2.02	99.08
0.15	0.05171	0.0994	0.1026	1.98	90.82

* Assuming the control group equals 100.

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الملخص العربي

تأثير إستخدام منشطات النمو التجارية و الطبيعية على الأداء الانتاجي للدجاج البياض

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تهدف الدراسة الى بحث تأثير البروبايوتيك (كمنشط نمو تجارى) والحلبة وحبة البركة (كمنشطات نمو طبيعية) على الأداء الانتاجى والكفاءة الاقتصادية للدجاج البياض عند إستخدام هذه المواد بمستويات 0.05 ، 0.1 ، 0.15% لكل منهم على التوالى فى العلائق وذلك على سلالة الهاى لاين الابيض من عمر 40 – 59 اسبوع .

استخدم فى الدراسة 240 دجاجة وزعت الى 10 مجموعات متساوية بكل مجموعة 24 طائر . غذيت المجموعة الاولى على عليقة المقارنه (بدون اضافة) أما المجموعاتالأخرىفغذيت على العليقه الأساسيه مضاف اليها البروبايوتيك، الحلبة، حبة البركة كل بمستويات 0.05 ، 0.10 ،0.15 على الترتيب.

ويمكن تلخيص النتائج فيما يلي :-

1- تم الحصول علي اعلى وزن للجسم عند عمر 59 اسبوع بإستخدام مستوى 0.05 % لكل من البروبايوتيك والحلبة وحبة البركة ، وقد تفوقت الحلبة على جميع المعاملات .

2- تم الحصول علي اعلى انتاج بيض من مستوى 0.1 % بروبايوتيك ، 0.05 و 0.1% حلبة ، 0.1 % و 0.15 % حبة البركة ، وقد تفوقت الحلبة وحبة البركة على البروبايوتيك فى انتاج البيض .

3- زاد وزن البيض عند كل المستويات للبروبايوتيك ، 0.05 % حلبة ، 0.05 و 0.15% حبة البركة .

4- زادت كتلة البيض بكل مستويات البروبايوتيك وحبة البركة وكذلك مستوى 0.05 و0.15% حلبة.

5- لا توجد فروق معنوية فى الغذاء الماكول (لجميع المعاملات) ، بينما زاد معدل تحويل الغذاء عند مستوى 0.1% بروبايوتيك ، 0.05 % حلبة ، 0.15% حبة البركة .

6- هناك زيادة غير معنوية فى دليل الشكل ودليل الصفار وسمك القشرة وزيادة معنوية فى وحدات HU لكل المعاملات كذلك كانت هناك زيادة معنوية فى لون صفار البيض عند مستوى 0.1 % بروبايوتيك ، 0.15 % حلبة وكل مستويات حبة البركة .

7- كان هناك تاثير معنوى لجميع المعاملات بكل المستويات المستخدمة فى تقليل كوليسترول صفار البيض بينما لم يكن هناك تاثير للمعاملات على لدهون الكليه فى صفار البيض .

8- لم يكن هناك تاثير للبروبايوتيك او الحلبة او حبة البركة على الدهون الغير مشبعة فى صفار البيض ولكن كان هناك تاثير ايجابي على بعض الدهون المشبعة مثل حمض البالميتك .

9- تحسنت الكفاءة الاقتصادية باستخدام كل المعاملات و كانت افضل المعاملات اقتصاديا هى 0.05% حلبة ، 0.15% حبة البركة ، 0.1 بروبايوتيك على الترتيب.