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THE IMPACT OF BOTANICAL EXTRACT, CAPSICUM (*Capsicum frutescence L)*, OIL SUPPLEMENTATION AND THEIR INTERACTIONS ON THE PRODUCTIVE PERFORMANCE OF L.S.L LAYING HENS

Mariam A. Eldeeb, M.A. Metwally and A. E. Galal

Department of Animal and Poultry Science, Faculty of Agriculture, University of Assiut, Assiut 71516, Egypt

SUMMARY

A total number of 72 LSL laying hens, 21 week-old till 49 wks old, were used to study the impact of dietary herbs supplementation in presence of two levels of corn oil 3.7% and 6%, respectively on productive performance. Hens were distributed into 8 treatment diet groups (9 birds/ group) as follows; control group (G1) received commercial layer diet containing 3.7% corn oil without any herbs supplementation (17.5% CP, 2900 kcal ME/kg diet), group2 (G2) received control diet plus botanical extract (garlic, anise, cinnamon, rosemary and thyme) at level 150ppm; group3 (G3) received control diet plus capsicum at 150ppm; group4 (G4) received control basal diet supplemented with 150ppm botanical extract plus 150ppm capsicum; group5 (G5) received diet containing 6% corn oil; group6 (G6) received basal diet containing 6% corn oil plus 150ppm botanical extract; group7 (G7) received diet containing 6% corn oil plus 150ppm capsicum and group8 (G8) received all dietary supplementations. Results obtained indicated no differences in body weight gains from the onset of first egg till the end of first phase of egg production (7 months laying period) either due to main effect of treatments or to interactions among treatments. Likewise, no main treatments or interaction effects were recorded in feed intake. However, feed conversion ratio was significantly improved in G 4 fed combination of botanical and capsicum (150ppm each) at low oil level. Dietary treatments had no effect on the averages of egg weight, egg mass, and egg laying rate during whole 7 months egg production. With respect to egg quality values, results showed significant improvement in egg weight in group received capsicum (150ppm) due to significant increase in weight and percentage of albumen ($p<.05$). On the contrary, feeding layers' diet containing 6% oil decreased egg weight as a result of decreased albumen weight and percentage. Generally, internal egg quality data indicated significant improvement in shape index due to oil supplementation at 6%, while yolk color and shell thickness increased due to capsicum supplementation ($p<.05$). Highest yolk index and Haugh Unit (HU) values of all groups were obtained due to interaction effect between botanical extract and capsicum (G4)

Results of sera total protein and total lipids indicated no consistence trend due to dietary treatments. Capsicum and botanical extract inclusion in hens' diet significantly ($p<.05$) lowered serum triglycerides and borderline cholesterol levels. Also, feeding capsicum combined either with botanical or oil at 6%, significantly decreased TG concentration. Interestingly, sera cholesterol concentration was dramatically decreased when all dietary supplementations were combined in one diet

(G8). Enzyme activity, GOT and GPT showed significant but not consistent trend implying normal liver function in spite of dietary treatments. The lowest value of economic efficiency rate (59%) was recorded in groups received botanical mixed with oil (G6).On the contrary, the highest score value of economic efficiency rate (93 %) was achieved in group received combination of botanical and capsicum at 150ppm each (G4). In conclusion, selected feed additives effect is comprehensive in different types of poultry. Oil supplementation at 6% gave the highest feed cost while combination of botanical extract and capsicum resulted in the highest economic efficiency rate. However, the liver function was normal as evaluated by GOT and GPT indicating no adverse effect and that 150ppm of botanical extract and capsicum are physiologically tolerable to hens.

***Keywords**: botanical extract, capsicum, oil, LSL, hens' performance*

INTRODUCTION

Feed cost was a driving force encouraging egg producers to do everything possible to place themselves in a profit making position. Continual use of antibiotic growth promoting substances in modern animal ration for the sake of health and cost efficiency has led to the development of bacterial resistance to drug used in human medicine (Hardy, 2002). As a result, fears of antibiotic resistance spreading via food chain imposed ban on antibiotics in Europe and USA.

Herbs and spices are one of the more recently celebrated concepts in animal and poultry rations (Wenk, 2003). These ingredients developed largely from the ancient art of Chinese herbal medicine in human nutrition to become more acceptable as means of promoting the growth of animals. Capsicum or hot pepper (Rosengarten, 1969), can be used as an alternative feed ingredient in layer (Gurbuz *et al.*, 2003; Austic *et al.,* 2002 and Brown *et al., 2002*) and broiler (ELdeeb *et al*., 2006) diets without significant alteration in birds performance. Also, botanical processed plants or their extracts can be used as feed additives in layer diet as well. It contains antioxidants that protect against oxidation and free radical damage to lipid, protein, carbohydrate and DNA. Inclusion of botanical extract in poultry diet was reported to be active against undesirable compounds and fungal toxins, present in grains and hence protect liver from damage (Tucker, 2002 and Tucker 2001, personal communication).

These products, known as herbs, herbal medicine and phytomedicine, tend to be incorporated into the same group of "natural health product" in the eye of the public
The aim herein was to study the effect of botanical extract and Capsicum as feed additives on performance, egg production, internal egg quality, and some blood parameters of L.S.L hens for 7 months production period.

MATERIALS AND METHODS

Seventy two L.S.L poult at the age of 17 weeks were purchased from a commercial source, housed in standard individual wire-mesh cages in open system house, where feed and water were provided ad libitum and hens were exposed to 17 hr. incandescent light/day. Hens were fed basal layer diet (Table 1) that met all nutrients requirements recommended by NRC (1994). Treatment diets started when

production rate reached 25% among birds and was considered to be the age of sexual maturity of the flock (21 week old) and continued for 7 months (49 week- old). Hens were distributed into 8 group diets (9 birds / group) as follows: control group (G1) received commercial layer diet containing 3.7% corn oil without any herbs supplementation (17.5% CP, 2900 kcal ME/kg diet), group2 (G2) received control diet plus botanical extract (garlic, anise, cinnamon, rosemary and thyme) at level 150ppm; group3 (G3) received control diet plus capsicum at 150ppm; group4 (G4) received control basal diet supplemented with 150ppm botanical extract plus 150ppm capsicum; group5 (G5) received diet containing 6% corn oil; group6 (G6) received basal diet containing 6% corn oil plus 150ppm botanical extract; group 7 (G7) received diet containing 6% corn oil plus 150ppm capsicum and group 8 (G8) received all dietary supplementations.

Table 1. Composition of the experimental diets for L.S.L laying hens

	g/100g diet	
Ingredients	Control	6 % oil
Yellow corn	59.79	53.01
Soybean meal 44%	24.40	24.30
Commercial vegetable oil	3.70	6.00
Wheat bran	2.10	6.95
Limestone	8.00	8.06
Dicalcium phosphate	1.30	0.99
Vitamin & minerals mixture[1]	0.40	0.40
Sodium chloride	0.25	0.25
DL- Methionine	0.06	0.04
Calculated analyses		
M E, (k cal/ kg)	2910	2937
Calcium, %	3.39	3.39
Available phosphorus, %	0.32	0.32
Lysine, %	0.88	0.88
Methionine, %	0.34	0.32
Chemical analyses		
Crude protein, %	16.40	16.50
Crude fiber, %	3.50	3.65
Crude fat, %	6.15	8.30

[1]vitamin and minerals supplemented/kg concentrate, vit. A 130,000 IU. D3 26,000 IU; vit. E 120 IU; vit b12 150 ug; vit. K3 msb 16 mg; vit b2 50 mg; Ca Pantothenate B3 120 mg; Nicotinic acid pp 250 mg ; Thiamine B1 25 mg; Folic acid 15 mg; Pyridoxine B6 15 mg; Betain-choline- HCL 5000 mg; Mn 700 mg;Zn 600 mg; Fe 400 mg;Cu 40 mg; Iodine 7 mg; Co 2 mg; Se 1.5 mg; B.H.T 1250mg

Body weight (BW) and feed conversion ratio (FCR)

Body weight was recorded individually at sexual maturity and at the end of the experiment. Feed consumption was recorded and feed conversion was calculated monthly through the experimental period according to the equation: FCR= total feed

consumed/ egg mass. Egg number and egg weight/ hen were recorded daily and both egg mass and egg laying rate were calculated.

Egg production and Egg quality

Egg weight and egg production were recorded daily /hen. Egg quality was performed on 5 consecutive laid eggs /hen in the last week of each month for 7 months. Egg quality recorded data included egg shape index, yolk index, yolk color, yolk weight, eggshell weight, egg shell thickness, weights of thick and thin albumin as measured by Stadelman and Cotterill (1986*)*. Haugh Units values were calculated as described in procedure of Nesheim *et al.* (1979*)*

Blood parameters

Blood samples were collected at the end of the experiment to evaluate some blood chemical constituents such as, total lipids, cholesterol, triglycerides, transaminases (GOT, GPT) and total protein. Four blood samples were obtained from 4 hens from each treatment and sera was obtained by centrifugation (10 minutes x 3000 ppm) and stored at-20 ºC for later analyses. Total lipids were assayed using kits from Pasteur Egypt, cholesterol and triglycerides were analyzed using kits from Biocon Germany, while, transaminases (GOT, GPT) and total protein were assayed using kits from Diamond Egypt.

Statistical analysis

All data were analyzed by analysis of variance (ANOVA) using general linear model procedure (GLM) of SAS software (SAS, 1996). Significant differences between treatments means were determined using Duncan Multiple Range Test (Duncan, 1955).

The statistical model used was as follows

$Y_{ijk} = \mu + (B)_i + (C)_j + (O)_k + (BxC)_{ij} + (BxO)_{ik} + (CxO)_{jk} + (BxCxO)_{ijk} + E_{ijk}$

Where;

Y_{ijk}	= Observation
μ	= Overall mean
$(B)_I$	= Botanical extract effect, i
$(C)_j$	= Capsicum effect, j
$(O)_k$	= Oil effect, k
$(BxC)_{ij}$	= Botanical extract x Capsicum interaction
$(BxO)_{ik}$	= Botanical extract x Oil interaction
$(CxO)_{jk}$	= Capsicum x Oil interaction
$(BXCxO)_{ijk}$	=Botanical extract x Capsicum x Oil interaction
E_{ijk}	= Random error

RESULTS AND DISCUSSION

Data of initial and final body weights as well as percentage of body weight changes of L.S.L laying hens during 7 months trial are presented in (Table 2). Results showed insignificant increase in percentages of body weight changes in botanical and capsicum fed group (G4) at low level of oil (3.7 %) followed by those (G8) received

botanical and capsicum at level 6% oil (11.81 and 7.48 %, respectively). Similar synergistic effect was found on body weight and overall average daily gain when combination of botanical, capsicum and oil were fed to broiler chicks from day old till marketing age (ELDeeb *et al.,* 2006) A slight negative impact but not significantly different on body weight changes, was observed in group (G3) fed on capsicum (- 0.16%). The negative effect of capsicum could be attributed to the lack of the hygienic condition during the experimental course (Portsmouth, 2001). The approach to enhance animal performance could be through; first direct the nutritional strategy to support the intestinal environment function. Second; direct manipulation of the microbial population in the gut and third; support the immune system by various nutritional supplements. These concepts can be implemented independently or in combination (Hardy, 2003).

Table 2. Effect of botanical, capsicum, oil and their interactions on body weight changes of L.S.L laying hens. (MEAN ± SE)

Treatments	Initial body weight (G)	Final body weight (G)	Body weight changes (%)
Group (1) [1]	1380.0± 40.04	1397.5±34.21	1.27
GROUP (2)	1330.0±33.07	1418.3±51.54	6.64
GROUP (3)	1389.3±75.52	1387.1±72.40	0.16-
GROUP (4)	1276.4±49.75	1427.1±19.36	11.81
GROUP (5)	1338.1±32.73	1386.3±40.75	3.60
GROUP (6)	1325.0±86.40	1402.0±46.20	5.81
GROUP (7)	1382.5±59.63	1397.5±69.92	1.08
GROUP (8)	1351.0±44.96	1452.0±47.58	7.48

[1]groups 1to 8= (1) control, (2) 3.7% oil + 150 botanical + 0.0capsicum. (3) 3.7% oil + 0.0 botanical + 150 capsicum. (4) 3.7% oil + 150 botanical + 150capsicum. (5) 6% oil + 0.0 botanical + 0.0capsicum. (6) 6% oil + 150 botanical + 0.0capsicum. (7) 6% oil + 0.0 botanical + 150capsicum. (8) 6% oil + 150 botanical + 150capsicum

Averages of egg weight, egg mass, egg laying rate, feed intake, and feed conversion ratio for the whole 7 months production are summarized in Table3. Results indicated no significant differences due to main or interaction effects of dietary treatments on egg weight, egg mass, egg laying rate or feed intake. In agreement with these results, feeding hot pepper was reported to have no effect on egg production in laying hens *(*Gurbuz *et al*., 2003, Austic *et al*., 2002 and Brown *et al*., 2002). However, feed conversion ratio was improved ($p<0.05$) in group 4 (2.55) due to synergistic effect between dietary supplementation of both botanical extract and capsicum at low level of oil. While, lowest ($p<0.05$) feed conversion ratio was recorded in groups 6 & 7 when either botanical extract or capsicum was fed to hens in presence of 6 % oil (2.84 and 2.7, respectively). Feeding layers a standard diet with 10% animal tallow was reported to decrease feed intake and egg size (March and Biely, 1963*)*.

Table 3. Effect of botanical, capsicum, oil and their interactions on egg weights, egg mass, egg laying rate, feed intake and feed conversion of LSL laying hens during average of whole experiment of production (Mean ± SE)

Feed Conversion[2]	Feed intake (g/day)	Egg laying rate (%)[1]	Egg mass (g/day)	Egg weight (g)	Treatments
2.60±0.07^{AB}	77.94±2.61	60.17±2.75	30.0 ±1.37	51.08±0.58	GROUP (1)[3]
2.67±0.19^{AB}	75.93±3.20	56.80±4.92	28.4±2.39	50.00±1.37	GROUP (2)
2.63±0.12 ^{AB}	81.41±2.31	58.43±4.44	30.9±1.96	52.86±1.26	GROUP (3)
2.55±0.13 ^{B}	72.16±2.91	56.25±2.45	28.3±1.05	50.35±0.74	GROUP (4)
2.58±0.04 ^{AB}	75.76±4.17	57.86±3.65	29.4±1.37	50.80±1.47	GROUP (5)
2.84±0.29 ^{A}	77.02±5.07	53.86±7.44	27.1±3.74	50.38±1.92	GROUP (6)
2.70±0.07 ^{AB}	79.25±1.81	57.78±2.72	29.4±1.32	50.81±1.20	GROUP (7)
2.63±0.10 ^{AB}	82.20±3.40	60.20±4.61	31.3±2.12	51.99±1.52	GROUP (8)

$^{A-B}$ Means Within The Same Column With Different Superscripts Are Significantly Different (P <0.05)
[1] Egg Laying Rate = Egg Laid Within 28 Days X 1
[2] G Feed/ G Eggs 00

Results of egg quality traits, where 15 eggs from each treatment were collected for the last 5 consecutive days at the end of each month of production and analyzed for egg quality (absolute and percentages of whole egg, yolk, albumen and egg shell weights) as well as internal egg quality (shape, yolk indexes, yolk color, Haugh Units (HU), and egg shell thickness) are summarized in (Tables 4 and 5). In general, a significant improvement in egg weight (52.6g) was found in group 3 which received capsicum (150ppm) at low level of oil supplementation due to increased albumen absolute weight and percentage (34.3g and 65%, respectively). While, lowest egg weight (48.9g) was obtained in group 5 fed 6% oil as a result of lower albumen and eggshell weights (31.8g and 4.8g, respectively). Examining the effect of feed additives on internal egg quality indicated that inclusion of both botanical extract and capsicum each at level 150 mg/kg diet, significantly ($p<0.05$) increased yolk index and HU (46.01 and 91.57, respectively). While, no significant effect was detected due to feeding botanical extract on other quality traits. Feeding hens diet supplemented with 150 mg/kg capsicum significantly ($p<0.05$) improved internal egg quality such as yolk color. These results are in agreement with those of Yami *et al*. (2002*)* who claimed that egg yolk color was increased in White Leghorn layers by increasing capsicum from 0 to 5%. In addition, natural egg yolk color was improved as a result of red substances present in hot pepper that could impart reddish tones to egg yolk (Scott *et al.*, 1968)

Data of plasma constituents (total protein, GPT, GOT, cholesterol, TG and total lipids) of laying hens as affected by different feed additives are displayed in (Table 6). Results indicated that total protein and total lipids were not affected by botanical extract, capsicum, oil or their combination. However, combination of capsicum and botanical extract (G4) supplementation at low (3.7%) or capsicum at high (6.0%) level of oil (G7) significantly decreased plasma (TG). Also, the lowest cholesterol level ($p<0.05$) was detected in group 8 which received all dietary treatments. The reported normal range of plasma cholesterol and triglycerides were 80-130 mg/dl and 270 mg/l, respectively (Freeman, 1984*)*. This may be explained by the mode of action of capsaicin in mobilization of lipid from adipose tissues thus lowering serum TG concentration indirectly by beta-adrenergic action (Kawada *et al.*, 1986). Hence, its deposition in the ova as confirmed by increased yolk weight in response to dietary treatment. Enzyme activities GPT and GOT indicated higher activities due to feeding

combination of all dietary treatments (Gs 8, 2 and 3, respectively) . Regarding GPT, GOT values of treated and control groups were all in the normal range indicating that treatments had no effect on normal liver functions. In agreement, Al-Harthi *(2004a and b)* found that plasma GPT and GOT were not affected by hot pepper in the diets of laying hens, indicating no adverse effects on liver and intestinal function. Similar results regarding lower plasma triglycerides were also reported by Al-Harthi (2004a and b) and Negulesco *et al.* (1989*)*.

Table 4. Effect of botanical, capsicum, oil and their interactions on the whole average of internal egg components of LSL laying hens (Mean ± SE)

	Weight(g)				Percentage%		
Treatments	Egg	Yolk	Albumen	Eggshell	Yolk	Albumen	Eggshell
GROUP(1)[1]	50.7±0.60^{ABCD}	12.8±0.19^{AB}	33.2±0.40^{AB}	4.9±0.08^{BC}	25.2±0.21^{B}	65.0±0.23^{A}	9.6±0.10^{B}
GROUP(2)	50.1±0.61^{BCD}	13.1±0.20^{AB}	32.5±0.43^{BC}	4.9±0.09^{BC}	26.0±0.23^{A}	64.3±0.28^{AB}	9.7±0.11^{AB}
GROUP(3)	52.6±0.64^{A}	13.3±0.20^{AB}	34.3±0.43^{A}	5.1±0.09^{AB}	25.2±0.22^{B}	65.0±0.23^{A}	9.7±0.11^{B}
GROUP(4)	49.8±0.60^{CD}	12.7±0.18^{B}	32.2±0.41^{BC}	4.9±0.08^{ABC}	25.5±0.21^{AB}	64.6±0.27^{AB}	9.9±0.11^{AB}
GROUP(5)	48.9±0.67^{D}	12.7±0.17^{B}	31.8±0.51^{C}	4.8±0.07^{C}	25.8±0.18^{AB}	64.6±0.39^{AB}	9.9±0.12^{AB}
GROUP(6)	50.5±0.75^{BCD}	13.1±0.26^{B}	32.7±0.51^{BC}	5.0±0.09^{ABC}	25.8±0.28^{AB}	64.3±0.33^{AB}	9.9±0.12^{AB}
GROUP(7)	51.5±0.64^{ABC}	13.4±0.22^{A}	33.0±0.42^{ABC}	5.2±0.08^{A}	25.9±0.21^{AB}	64.1±0.23^{B}	10.0±0.10^{AB}
GROUP(8)	51.9±0.62^{AB}	13.4±0.20^{A}	33.6±0.42^{AB}	5.1±0.08^{AB}	25.7±0.21^{AB}	64.4±0.25^{AB}	9.8±0.10^{AB}

[A-D] Means within the same column with different superscripts are significantly different ($p < 0.05$)

Table 5. Effect of botanical, capsicum, oil and their interactions on the whole average of internal egg quality traits of LSL laying hens (Mean ± SE)

Treatments	Shape index	Yolk index	Yolk color	Haugh units	Shell thickness (mm)
GROUP(1)[1]	73.64±0.44^{C}	44.93±0.43^{ABC}	5.25±0.09^{AB}	89.84±0.62^{ABC}	0.37±0.004^{B}
GROUP(2)	74.41±0.27^{BC}	44.27±0.55^{BC}	5.20±0.09^{AB}	89.24±0.80^{ABC}	0.38±0.005^{AB}
GROUP(3)	74.26±0.26^{BC}	44.33±0.63^{BC}	5.44±0.08^{A}	90.23±0.68^{ABC}	0.38±0.005^{AB}
GROUP(4)	74.74±0.33^{B}	46.01±0.36^{A}	5.25 ±0.09^{AB}	91.57±0.78^{A}	0.38±0.005^{AB}
GROUP(5)	76.04±0.39^{A}	43.63±0.58^{C}	5.21±0.08^{AB}	90.84±0.67^{AB}	0.38±0.004^{AB}
GROUP(6)	74.14±0.25^{BC}	45.68±0.43^{AB}	5.15±0.08^{B}	88.34± 0.85^{C}	0.38±0.005^{AB}
GROUP(7)	74.23±0.40^{BC}	44.81±0.34^{ABC}	5.36±0.08^{AB}	88.84±0.87^{BC}	0.39±0.004^{A}
GROUP(8)	74.60±0.23^{BC}	44.45±0.29^{BC}	5.30±0.08^{AB}	90.93±0.65^{AB}	0.38±0.004^{AB}

[A-D] Means Within The Same Column With Different Superscripts Are Significantly Different ($P < 0.05$)

Table 6. Effect of botanical, capsicum, oil and their interactions on serum total protein, GPT, GOT, cholesterol ,triglycerides and total lipids of LSL laying hens at the end of the experiment (Mean ±SE).

Treatments	Total protein (g/dl)	GPT (u/l)	GOT (u/l)	Cholesterol (mg/dl)	Triglycerides (mg/dl)	Total lipids (mg/ dl)
GROUP (1)[1]	5.93±0.45	7.54±1.14^{AB}	119.0±7.44^{AB}	268.5±48.84^{A}	421.1±31.35^{A}	765.4±88.72
GROUP (2)	6.35±0.71	13.74±5.21^{AB}	154.0±20.50^{A}	251.0±33.15^{A}	380.7±27.51^{A}	1049.4±159.66
GROUP (3)	4.89±0.80	8.97±0.18^{AB}	152.5±7.92^{A}	252.7±11.39^{A}	386.9±15.78^{A}	1100.0±177.39
GROUP (4)	6.03±0.42	4.85±0.87^{AB}	113.0±12.00^{AB}	229.9±16.35^{AB}	259.8±21.04^{B}	809.4±184.74
GROUP (5)	5.49±0.31	4.29±1.12^{B}	124.5±13.99^{AB}	186.3±13.48^{AB}	305.0±9.67^{AB}	874.7±192.04
GROUP (6)	4.99±0.39	8.09±1.61^{AB}	102.7±1.45^{A}	222.4±45.07^{AB}	347.4±77.83^{AB}	922.6±250.44
GROUP (7)	5.10±0.58	8.54±3.06^{AB}	123.3±6.80^{AB}	190.7±50.04^{AB}	236.9±38.37^{B}	931.7±188.27
GROUP (8)	5.32±0.12	14.65±3.38^{A}	137.5±2.50^{AB}	129.3±7.32^{B}	318.8±24.39^{AB}	1001.1±130.29

[Ad] means within the same column with different superscripts are significantly different ($p < 0.05$)

The economic efficiency of 8 treatment diets as affected by adding botanical extract, capsicum, oil and their combination is shown in (Table 7). Results indicated that the lowest values of relative economic efficiency were recorded in the groups received high level of oil supplementation. However, the highest score value of relative economic efficiency (93%) was recorded in the group received combination of botanical extract and capsicum at 150ppm each. From economic point of view, addition of oil (6%) was of no practical advantage since the control diet achieved the best value (100%).

Table 7. Input-output analysis and economical efficiency[1] as affected by different additives

Parameter	G1	G 2	G 3	G 4	G 5	G 6	G 7	G 8
Total feed intake/ hen	15.39	15.18	15.92	15.04	15.42	15.3	15.53	15.84
Price / kg feed; L.E	1.40	1.40	1.40	1.40	1.51	1.51	1.51	1.51
Total feed cost; L.E	21.51	21.22	22.25	21.02	23.30	23.12	23.47	23.93
Egg mass ; kg	5.69	5.38	5.71	5.44	5.6	5.34	5.76	5.9
Price / kg egg; L.E	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Total return; L.E	31.30	29.59	31.41	29.92	30.80	29.37	31.68	32.45
Net revenue; L.E	9.79	8.37	9.16	8.90	7.50	6.25	8.21	8.52
Economical efficiency (EE)	0.45	0.39	0.41	0.42	0.32	0.27	0.35	0.36
Relative of control; (%)	100	87	91	93	71	60	77	80

[1]calculated according to the following equations. Bayoumi (1980)., Total feed cost = A x B = C, Total revenue =D x E = F, Net revenue =F – C = G, EE = G/C,
Where: A = average FI (kg/ bird), B = price / kg feed (PT), D = Average live body weight gain LBWG (kg/bird), E = selling price of kg gain

It can therefore be concluded that, the effect of selected feed additives is comprehensive in different types of poultry. Oil supplementation at 6% gave the highest feed cost while combining botanical extract and capsicum resulted in the highest economical efficiency rate. However, the liver function was normal as evaluated by GOT and GPT indicating no adverse effect and that 150ppm of botanical extract and capsicum are physiologically tolerable to hens.

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تأثير إستخدام مستخلص نباتي، الفلفل الحار، الزيت والتداخل بينهم على الآداء الإنتاجي لدجاج LSL البياض

مريم أحمد الديب ، محمد متولي أحمد حامد، على السيد جلال

قسم الإنتاج الحيواني والدواجن، كلية الزراعة، جامعة أسيوط

تم استخدم ٧٢ دجاجة بياضة LSL (من عمر ٢١ حتى ٤٩ أسبوع) وذلك لدراسة تأثير إضافة الأعشاب فى وجود مستويان من الزيت (٣.٧ ، ٦%) على الأداء الإنتاجي للدجاجات. وزعت الدجاجات الى ٨ مجموعات (٩ دجاجات/مجموعة) كما يلى: المجموعة الاولى تم تغذيتها على علف بياض بدون إضافات وبحتوى على ٣.٧% زيت ذرة (كنترول) يحتوى على ١٧.٥% بروتين خام ، ٢٩٠٠ كيلو كالورى /كجم عليقة، غذيت المجموعة الثانية على عليقة الكنترول مضافا إليها المستخلص النباتي (يحتوى على الثوم واليانسون والزعتر والقرفة) و بمستوى ١٥٠ جزء فى المليون، غذيت المجموعة الثالثة على عليقة الكنترول المضاف إليها الفلفل الحار بمستوى ١٥٠ جزء فى المليون، غذيت المجموعة الرابعة على عليقة تحتوى على ٦% زيت ذرة، غذيت المجموعة الخامسة على عليقة الكنترول المضاف إليها ١٥٠ جزء فى المليون مستخلص نباتي+ ١٥٠ جزء فى المليون فلفل حار، غذيت المجموعة السادسة على عليقة تحتوى على ٦% زيت ذرة + ١٥٠ جزء فى المليون مستخلص نباتي، غذيت المجموعة السابعة على عليقة تحتوى ٦% زيت ذرة + ١٥٠ جزء فى المليون فلفل حار وغذيت المجموعة الثامنة على عليقة بها ٦% زيت ومضاف إليها ١٥٠ جزء فى المليون مستخلص نباتي و١٥٠ جزء فى المليون فلفل حار. أظهرت النتائج انه لا توجد فروق معنوية فى الزيادة فى وزن الجسم من بداية وضع البيضة الأولى حتى نهاية فترة إنتاج البيض (لمدة ٧ شهور) نتيجة للتأثير الرئيسي أو التداخل بين المعاملات، أيضا لا يوجد تأثير رئيسي او تداخل بين للمعاملات على العلف المستهلك. تحسنت كفاءة التحويل الغذائي معنويا فى المجموعة الرابعة المغذاة على عليقة بها زيت منخفض ومضاف إليها المستخلص النباتى والفلفل الحار (١٥٠ جزء فى المليون كل منهما) . لا يوجد تأثير معنوي للمعاملات على متوسطات وزن البيضة أوكتلة البيض وكذلك معدل وضع البيض طوال فترة الإنتاج. وبالنسبة لجودة البيض أوضحت النتائج تحسن وزن البيضة بالنسبة للإناث المغذاة على عليقة تحتوى على الفلفل الحار (١٥٠ جزء فى المليون) نتيجة لزيادة وزن ونسبة البياض. كما وجد تناقص فى وزن البيض بالنسبة للدجاجات المغذاة على عليقة بها ٦% زيت نتيجة للنقص فى وزن البياض ونسبته. وبوجه عام أوضحت نتائج الجودة الداخلية للبيضه تحسن دليل الشكل نتيجة لإضافة ٦% زيت ، وزيادة لون الصفار وسمك القشرة نتيجة لإضافة الفلفل الحار. ارتفاع قيم معامل الصفار ووحدات (Haugh Unit) فى كل المجموعات راجع الى التداخل بين المستخلص النباتي والفلفل الحار(مجموعة ٤). أظهرت نتائج تحليل الدم ان المعاملات ليس لها تأثير على البروتين الكلى والدهون الكلية. إضافة الفلفل الحار والمستخلص النباتى ادت الى انخفاض مستوى الكوليسترول والجلبسريدات الثلاثية. كما ان التغذية على الفلفل الحار مع المستخلص النباتى عند مستوى ٦% زيت أدت الى انخفاض تركيز الجليسريدات الثلاثية. لوحظ أيضا أن إضافة المعاملات الثلاث معا فى المجموعة رقم ٨ ادى الى انخفاض

الكوليسترول فى الدم. اظهرت نتائج النشاط الانزيمى (GOT, GPT) اختلافات معنوية غير ثابتة بين المعاملات ومجموعة المقارنة وكانت معظمها فى الحدود الفسيولوجية الطبيعية التي لا تؤثر على وظائف الكبد. كانت تكلفة التغذية اعلى مايمكن عند التغذية على عليقة تحتوى على ٦% زيت بينما كانت أعلى قيمة للكفاءة الاقتصادية (٩٣%) فى المجموعة ٤ المغذاة على المستخلص النباتي والفلفل بمستوى ١٥٠ جزء فى المليون لكل منهما .

ادى استخدام الزيت بمستوى ٦% الى ارتفاع تكاليف التغذية الا ان اضافة الفلفل الحار والمستخلص النباتى للعلائق المحتوية على ٣.٧% زيت ادى الى الحصول على اعلى قيمة اقتصادية. ولم يكن للمعاملات بوجه عاماى تأثير عكسى على وظائف الكبد والأداء الانتاجى للطيور.