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THE BIOEFFICACY OF THYME IN PRACTICAL LAYER DIETS VARYING IN THEIR ENERGY CONTENT

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SUMMARY

Ninety Bovans White laying hens 25 weeks old were used in this study to evaluate the bioefficacy of thyme, as a natural feed additive, in layer diets varying in their metabolizable energy content. The hens were randomly distributed into 6 groups of 15 birds each and assigned randomly for one of the experimental diets. Two experimental diets were formulated using linear programming to be isonitrogenous (18.5% CP) but varying in their metabolizable energy content. The first experimental diet contained low energy level (2700 Kcal/Kg diet) and was considered as negative control (E1), while the second experimental diet contained 2900 Kcal/Kg diet, according to the strain catalog recommendation (E2). Thyme was used to substitute 0, 1.5 or 3% of the total feed mixture of each of the experimental diets. Accordingly, a total of 6 experimental diets were used in (2X3) factorial design.

Ground thyme contained 8.19% moisture, 91.81% dry matter (DM), 80.84% organic matter (OM), 10.65% CP, 3.17% EE, 17.29% CF, 10.97% ash and 49.22% NFE (on air dry basis), indicating its nutritious value in addition to its active medicinal substances. Regardless of the diet energy, addition of thyme decreased ($P \leq 0.05$) both of average egg weight (g) and feed intake (g/day/bird), while improved feed conversion, significantly and egg production rate, insignificantly. Thyme at 1.5% of low energy diets improved egg production, egg mass, feed conversion and the viability of the birds, as compared to their control (96.6 vs. 88.9%, 53.4 vs. 51.5 g, 2.0 vs. 2.2 and 100 vs. 73%, respectively). No significant differences ($P \leq 0.05$) were found between low energy level (E1) and catalog recommendation (E2). However, recommended energy diets (E2) improved ($P \leq 0.05$) egg weight and viability of the birds, as compared with E1 diets. Neither external nor internal egg quality values were affected, significantly ($P \leq 0.05$), by the treatments. Thyme at 1.5%, regardless of diet energy, scored the best digestion coefficient values when compared with the control (without thyme supplementation) or 3% thyme. Addition of this level to low energy diets improved digestion coefficient and nitrogen balance values, except EE value, when compared with either their control (E1) or the control of recommended energy diets (E2). This treatment, also improved both economical efficiency and relative economical efficiency, when compared with the control of recommended energy diet (0.52 vs. 0.42 and 124 vs. 100, respectively). The results also indicate that it is not reasonable to use thyme at 3% of the laying hen diet, not only from economic point of view but also because it had no improving effects on laying hen performance, as compared with 1.5%.

The previous results suggest to add not more than 1.5% thyme to low energy diet of laying hens to improve their performance, bird viability and economic efficiency. Further studies are recommended to test lower levels (less than 1.5%) of thyme on laying hen performance

Keywords: *thyme, natural feed additives, metabolizable energy, laying hen*

INTRODUCTION

Thyme is one of the herbs that provide substantial amounts of flavonoids, plant pigments responsible for the colors of flowers, fruit and sometimes leaves. Flavonoids have health promoting properties, as they extend the activity of vitamin C, act as antioxidants, protect LDL cholesterol from oxidation, inhibit platelet aggregation, stimulate the immune system and act as anti-inflammatory and antitumor agents (Craig 1999). Juven *et al.* (1994) found that the essential oil of thyme had antibacterial action, in addition Farag *et al.* (1989) reported that thymol, the basic component of thyme essential oil, had antifungal activity. Abaza (2001) found an improvement in the values of nutrient digestibility, except crude fat, due to feeding broiler chicks on diets containing 0.50% thyme.

These studies indicate that thyme has the ability to reduce the activity of pathogens, thus eliminating the competitive bacteria for host nutrients. Therefore, this study was designed to evaluate the bioefficacy of thyme, as a natural feed additive, in layer diets varying in their metabolizable energy content.

MATERIALS AND METHODS

Ninety Bovans White laying hens 25 weeks old were reared under the same management conditions in egg production batteries. The hens were randomly distributed into 6 groups of 15 birds each. Each group was subdivided into five replicates (3 hens / replicate) and assigned randomly for one of the experimental diets. Two experimental diets were formulated using linear programming to be isonitrogenous (18.5% CP) but varying in their metabolizable energy content. The first experimental diet contained low energy level (2700 Kcal/Kg diet) and was considered as negative control (E1), while the second experimental diet contained 2900 Kcal/Kg diet, according to the strain catalog recommendation (E2). Thyme was used to substitute 0, 1.5 or 3% of the total feed mixture of each of the experimental diets. Accordingly, a total of 6 experimental diets were used in (2X3) factorial design.

The composition and chemical analyses of the control diets are shown in Table 1. Thyme was purchased from local market. All diets were formulated to satisfy nutrient requirements of laying hens according to the strain catalog recommendation. Artificial light was used beside the normal day light to provide 16-hour day photoperiod. Feed and water were provided *ad libitum*. The experiment lasted for three months.

Data on egg production (EP), egg weight (EW) and feed conversion (FC) were recorded during the experimental period at the Poultry Farm, Faculty of Agriculture, Cairo University, Giza, Egypt. Representative egg samples (5 eggs) from each treatment were collected monthly throughout the experimental period in order to determine egg and shell quality. Shape index and yolk index were determined according to Romanoff and Romanoff (1949) as follows:

Shape index (%) = (width / length) X 100

Yolk index (%) =(height/diameter) X 100

Egg shell thickness, including shell membranes, was measured using a micrometer at the equator. Haugh unit score was applied from a special chart using egg weight and albumin height which was measured by using a micrometer according to Haugh (1937), Kotaiah and Mohapatra (1974) and Eisen *et al.* (1962). The egg yolk visual color score was determined by matching the yolk with one of the 15 bands of the "1961, Roche Improved Yolk Color Fan".

At the end of the experimental period, a digestion trial was conducted using six birds from each treatment to determine digestion coefficients of nutrients. Proximate analyses of tested thyme, feed and excreta were carried out following A.O.A.C (1990). Chemical analyses were carried out at Animal Production Research Institute Laboratories, ARC, Ministry of Agriculture, Dokki, Giza, Egypt.

Economical efficiency of egg production was calculated from the input-output analysis which was calculated according to the price of the experimental diets and egg produced. The values of economical efficiency were calculated as the net revenue per unit of total cost.

Data from all response variables were subjected to a (2x3) factorial analysis using SAS (1990). Variables having a significant differences were compared using Duncan's multiple range test (Duncan, 1955).

Model: $X_{ij} = \mu + D_i + T_j + (DT)_{ij} + E_{ij}$

Where : X_{ij} = Any observation, μ =Overall mean, D_i = Diets energy (i=1and 2), T_j = Thyme levels (j=1, 2 and 3), $(DT)_{ij}$= Interaction between diets energy and thyme levels and E_{ij}= Experimental error.

RESULTS AND DISCUSSION

Proximate Analysis of Tested Ground Thyme:

Table 2 indicates the constituents of ground thyme, which were 8.19% moisture, 91.81% dry matter (DM), 80.84% organic matter (OM), 10.65% CP, 3.17% EE, 17.29% CF, 10.97% ash and 49.22% NFE (on air dry basis). The values of this study were within the range obtained by Abaza (2001) who used *Thymus vulgaris*, except ash which was lower (10.97 vs. 16.41%) and Radwan (2003) who used *Thymus vulgaris*, except crude protein which was higher (10.65 vs. 6.19%). The results indicated the nutritious value of thyme in addition to its medicinal substances such as caffeic acid, thymol and tannins which classified as terpenoid, phenolic alcohol, polyphenols, respectively. These substances found to have antimicrobial activity against viruses, bacteria and fungi (Cowan, 1999).

Laying Performance:

No significant differences ($P \leq 0.05$) were found between low energy level (E1) and catalog recommendation (E2) for egg productica rate, egg mass, feed intake and feed conversion values (Table 3). However, recommended energy diets (E2) improved ($P \leq 0.05$) egg weight and viability of the birds, as compared with E1 diets. Regardless of the diet energy, addition of thyme decreased ($P \leq 0.05$) both of average egg weight (g) and feed intake (g/day/bird), while improved feed conversion, significantly and egg production rate, insignificantly. The result of this study revealed that thyme at 3% in laying hen diets did not, generally, result in better performance than that obtained due to use of 1.5% thyme. Addition of thyme at 1.5%, especially to low energy diet improved most of laying hen performance, even when compared with the control of recommended energy diets (E2). Thyme at 1.5% in low energy diets improved egg production, egg mass, feed conversion and the viability of the birds, as compared to their control (96.6 vs. 88.9%, 53.4 vs. 51.5 g, 2.0 vs. 2.2 and 100 vs. 73%, respectively). Similar results were reported by Yannakopoulos (1995) who found that feeding laying Hisex hens on diets containing 3g *Thymus vulgaris*/kg decreased egg

Table (1): The composition and chemical analysis of the control diets

Ingredients	Control (E1)	Control (E2)
Yellow corn	56.13	51.20
Soybean meal (44%)	30.98	31.85
Limestone	7.80	7.80
Bone meal	2.84	2.84
Corn oil	1.45	5.50
Salt	0.31	0.31
Premix[1]	0.30	0.30
Methionine	0.19	0.20
Total	100	100
Calculated analysis:		
Crude protein %	18.5	18.5
Metabolizable energy (ME Kcal/Kg diet)	2700	2900
Available P%	0.48	0.48
Calcium %	3.91	3.91
Lysine %	0.98	0.99
Methionine %	0.48	0.49
Methionine + Cystine %	0.79	0.79

[1]Each 3 kg of Vit. & Min. Mixture contains: Vit. A 12000,000 IU, Vit. D_3 2200,000 IU, Vit. E 10,000 mg, Vit. k_3 2000 mg, Vit. B_1 1000 mg, Vit. B_2 5000 mg, Vit. B_6 1500 mg, Vit. B_{12} 10 mg, Pantothenic acid 10,000 mg, Niacin 30,000 mg, Folic acid 1000 mg, Biotin 50 mg, Choline 300,000 mg, Manganese 60,000 mg, Zinc 50,000 mg, Copper 10,000 mg, Iron 30,000, Iodine 1000 mg, Selenium 100 mg, Cobalt 100 mg, Ca CO3 to 3,000 gm.

Table (2): Chemical composition of thyme

Item		On air dry basis	On dry matter basis
Moisture,	%	8.19	---
Dry matter (DM),	%	91.81	100
Organic matter (OM),	%	80.84	88.05
Crude protein (CP),	%	10.65	11.60
Ether extract (EE),	%	3.17	3.45
Crude fiber (CF),	%	17.29	18.83
Ash,	%	10.97	11.95
Nitrogen free extract (NFE),	%	49.22	53.61

Table (3): Performance (Mean ± SE) of laying hens as affected by different treatments

Treatments			Item					
No	Diets	Thyme levels	Egg production (%)	Average egg weight (g)	Egg mass (g/d)	Feed intake (g/d)	Feed conversion (feed/egg)	Viability%
	E1		92.1±1.2	56.7^{b}±0.4	52.2±0.7	109.0±1.7	2.1±0.0	84
	E2		89.7±1.3	58.7^{a}±0.2	52.7±0.7	113.2±3.5	2.2±0.1	100
		Control	89.6±1.5	58.3^{a}±0.4	52.2±0.9	117.0^{a}±3.5	2.3^{a}±0.1	87
		1.5%	93.4±1.2	57.3^{b}±0.5	53.5±0.7	107.2^{b}±3.3	2.0^{b}±0.1	100
		3%	89.8±1.8	57.6^{b}±0.3	51.7±1.0	109.1^{b}±3.3	2.1^{ab}±0.1	90
1	E1	1	88.9±2.3	57.9^{bc}±0.8	51.5±1.5	110.9±2.9	2.2±0.1	73
2		2	96.6±1.0	55.2^{d}±0.3	53.4±0.8	107.3±3.2	2.0±0.0	100
3	E2	3	90.8±2.4	57.1^{c}±0.5	51.7±1.3	108.8±2.9	2.1±0.1	80
4		4	90.2±2.1	58.6^{ab}±0.3	52.8±1.2	123.1±6.1	2.4±0.1	100
5		5	90.2±1.9	59.4^{a}±0.3	53.6±1.2	107.1±5.8	2.0±0.1	100
6		6	88.8±2.6	58.1^{b}±0.3	51.6±1.5	109.3±5.9	2.1±0.1	100

a, b ....= Means in the same column within each factor differently superscripted are significantly different ($P \leq 0.05$)

weight, while increased total number of eggs produced in 15 days, when compared with the control (without thyme). On the contrary to the results of this study, Scheicher *et al*. (1998) found that feeding chickens on diet contained 1.5% dried thyme (*Thymus officinalis*), had no effect on feed conversion. While Abaza (2001), Abd El-Latif *et al*. (2002) and Tollba (2003) confirmed the results of this study, where they found improvements in feed conversion and viability of the birds due to adding thyme to poultry diets at levels ranged between 0.1-1.0%. The improvement in the performance was explained by the role of thyme in enhancing thyroid activity and its biological role in the metabolic functions and biosynthesis of hormones.

Egg Quality:

External egg quality was not affected, significantly by diet energy, thyme level or the interaction between them (Table 4). The values of the interaction between diet energy levels and thyme levels were ranged between 6.9-7.6 (g), 11.6-12.7(%), 0.359-0.380 (mm), 75.5-77.3 (%), for shell weight, shell percentage, shell thickness and shape index, respectively. Regarding the effect on internal egg quality, diet energy levels had no significant effect, except on haugh unit and yolk color. Recommended energy diets (E2) decreased haugh unit and yolk color values. The increase in yolk color for low energy diets (E1) as compared to recommended energy diets (E2) may be due to relatively high yellow corn level in E1 diets. Thyme levels decreased yolk index, significantly ($P \leq 0.05$). There were no significant effects on internal egg quality values due to interaction between energy diet levels and thyme levels. The values were ranged between 88.8-94.6, 5.7-6.6, 42.5-46.5 and 25.7-27.5 for haugh unit, yolk color, yolk index (%), yolk (%), respectively. Yannakopoulos (1995) found similar results due to feeding laying Hisex hens on diets containing 3g *Thymus vulgaris* /kg, where both egg specific gravity and haugh unit were very close, 1.0844 vs. 1.0820 and 82.72 vs. 82.30 for diet containing thyme and the control diet, respectively. Regarding egg quality, Botsoglou *et al.* (1997) and Tserveni-Gousi (2001) reported that thyme improved egg quality. Botsoglou *et al.* (1997) revealed that feeding diet containing 3.0% ground thyme (*Thymus vulgaris*) plant material, reduced oxidation of liquid yolk. They suggested that thymol, the main antioxidant constituent of thyme, cannot be considered totally responsible for the oxidative resistance of the thyme-treated yolk. It is suggested that there may be additional thyme components with antioxidant activity that pass into egg yolk providing antioxidant properties. Tserveni-Gousi (2001) found that eggs from hens fed flaxseed at dietary levels of 5, 10 or 10 plus 2% Thymus meal, compared to a corn-soya bean control diet, had the highest scores for odor, flavor, and overall acceptability as well as the lowest score for off-flavor.

Digestion Trials:

Regardless of thyme levels, recommended energy diets (E2) improved mean digestion coefficient and nitrogen balance values as compared to low energy diets (E1). The differences were significant ($P \leq 0.05$) for DM, OM, EE and CP (Table 5). Addition of thyme at 1.5%, regardless of diet energy, scored the best digestion coefficient values when compared with the control (without thyme supplementation) or 3% thyme. The differences were significant ($P \leq 0.05$) for DM, OM and CF. Thyme at 3% in laying hen diets decreased digestion coefficient of most values. Ground thyme at 1.5% of the low energy diets improved digestion coefficient and nitrogen balance values, except EE value, when compared with either their control (E1)

Table (4): Means ± S.E. of egg quality as affected by different treatments

No	Diets	Thyme levels	Shell weight (g)	Shell (%)	Shell thickness (mm)	Shape index (%)	Haugh unit score	Yolk color	Yolk index (%)	Yolk (%)
Treatments			Items							
			External egg quality				Internal egg quality			
	E1		7.3±0.27.3±0.1	12.4±0.2	0.368±0.5	76.6±0.6	93.0[a]±0.8	6.3[a]±0.2	45.1±0.6	26.7±0.3
	E2			12.2±0.2	0.370±0.5	76.4±0.5	90.2[b]±0.8	5.7[b]±0.1	43.5±0.7	26.3±0.4
		Control	7.3±0.2	12.3±0.2	0.373±0.6	76.6±0.7	92.4±1.0	5.9±0.2	46.0[a]±0.8	26.0±0.6
		1.5%	7.0±0.1	12.0±0.2	0.372±0.6	75.7±0.6	92.3±1.0	5.8±0.2	42.7[b]±0.6	26.5±0.3
		3%	7.6±0.2	12.7±0.3	0.361±0.6	77.3±0.5	90.0±1.0	6.1±0.2	44.3[ab]±0.8	27.0±0.4
1	E1	1	7.1±0.3	12.1±0.3	0.380±0.9	77.1±1.0	94.6±1.1	6.2±0.3	46.5±1.1	26.2±0.6
2		2	7.1±0.2	12.3±0.2	0.364±0.8	75.5±1.1	93.1±1.6	6.0±0.3	42.9±1.1	26.5±0.4
3		3	7.6±0.4	12.7±0.5	0.359±1.1	77.3±0.7	91.1±1.5	6.6±0.3	45.9±0.8	27.5±0.6
4	E2	4	7.4±0.2	12.5±0.4	0.367±0.8	76.1±1.1	90.3±1.4	5.7±0.2	45.5±1.2	25.7±1.0
5		5	6.9±0.2	11.6±0.3	0.379±1.0	75.9±0.8	91.4±1.1	5.7±0.2	42.5±0.8	26.5±0.5
6		6	7.6±0.3	12.6±0.3	0.363±0.6	77.3±0.9	88.8±1.5	5.7±0.2	42.6±1.2	26.6±0.4

a, b ....= Means in the same column within each factor differently superscripted are significantly different ($P \leq 0.05$)

Table (5): Means ± S.E. of digestion coefficients as affected by different treatments

Treatments			Items						
No	Diets	Thyme levels	DM (%)	OM (%)	EE (%)	CF (%)	CP (%)	NFE (%)	NB (%)
	E1		76.3^{b}±1.0	77.0^{b}±1.1	78.6^{b}±1.3	30.9±0.6	92.1^{b}±1.0	92.5±1.3	61.3±2.7
	E2		79.8^{a}±0.6	79.1^{a}±0.7	86.9^{a}±0.7	33.4±1.7	94.5^{a}±0.3	92.7±1.0	66.9±1.4
		Control	76.8^{b}±0.8	76.4^{b}±0.4	82.7±1.3	30.7^{b}±1.2	92.2±1.3	91.2±1.2	62.0±2.8
		1.5%	80.0^{a}±0.5	80.3^{a}±0.2	82.6±3.5	35.1^{a}±1.8	94.7±0.1	95.4±1.0	65.6±1.9
		3%	77.4^{b}±1.9	77.4^{b}±1.5	83.1±3.0	30.6^{b}±0.7	93.1±1.2	91.2±0.8	64.8±4.1
1	E1	1	75.4^{d}±0.1	75.9^{bc}±0.7	80.4±0.2	31.1±0.8	90.3±1.3	91.5±2.5	59.3±5.6
2		2	79.2^{bc}±0.3	80.3^{a}±0.4	77.4±4.3	32.1±0.0	94.6±0.3	95.2±2.3	66.2±4.4
3		3	74.1^{d}±0.8	74.8^{c}±0.5	78.1±1.8	29.5±1.0	91.4±1.3	90.9±1.9	58.4±4.5
4	E2	4	78.1^{c}±0.2	76.9^{b}±0.2	84.9±0.4	30.3±2.8	94.0±1.1	90.9±1.6	64.7±1.3
5		5	80.8^{a}±0.5	80.4^{a}±0.3	87.8±0.6	38.2±1.1	94.7±0.1	95.6±0.8	65.0±0.5
6		6	80.7^{ab}±0.0	80.0^{a}±0.0	88.1±0.0	31.6±0.0	94.8±0.0	91.6±0.0	71.1±0.0

a, b ....= Means in the same column within each factor differently superscripted are significantly different (P≤0.05)

Table (6): Input output analysis and economical efficiency of different treatments during the experimental period

Items	Control			Thyme 1.5%			Thyme 3%			Energy levels	
	E1	E2	Av.	E1	E2	Av.	E1	E2	Av.	E1	E2
Price/ kg feed (L.E.)	1.20	1.29	1.25	1.48	1.57	1.53	1.76	1.85	1.81	1.48	1.57
Total feed intake/hen (kg)	9.98	11.08	10.53	9.66	9.64	9.65	9.79	9.84	9.82	9.81	10.19
Total feed cost/hen (L.E)	11.98	14.29	13.14	14.30	15.13	14.72	17.23	18.20	17.72	14.50	15.87
Total number of eggs/hen	80.01	81.18	80.60	86.94	81.18	84.06	81.72	79.92	80.82	82.89	80.76
Total price of eggs /hen (L.E.)[1]	20.00	20.3	20.15	21.74	20.3	21.02	20.43	19.98	20.21	20.72	20.19
Net revenue / hen (L.E.)	8.02	6.01	7.02	7.44	5.17	6.31	3.20	1.78	2.49	6.22	4.32
Economical efficiency (E.E.)[2]	0.67	0.42	0.55	0.52	0.34	0.43	0.19	0.10	0.15	0.46	0.29
Relative EE[3]	160	100	130	124	81	103	45	24	35	110	68

1- The price of the egg = 25 P.T., 2- Net revenue per unit of total feed cost, 3- Relative economic efficiency % of the control, assuming that the relative EE of the control (E2) = 100.E1=2700 Kcal/Kg diet, E2=2900 Kcal/Kg diet, Av.= Average.

or the control of recommended energy diets (E2).

The results of this study agreed with those obtained by Ibrahim *et al.* (2000) who found that addition of 0.50% thyme leaves to rabbits diet improved nutrients digestibility than control group. Abaza (2001) found an improvement in the values of nutrient digestibility except crude fat digestibility, which was significantly decreased for broiler chicks fed diet with 0.50% thyme. Hernandez *et al.* (2004) studied the influence of some plant extracts on digestibility in broilers. They found that 5000 ppm Labiatae extract from thyme improved apparent whole-tract and ileal digestibility of the nutrients. Also it improved apparent faecal digestibility of DM ($P<0.01$) and starch ($P<0.01$) digestibility but not CP digestibility ($P>0.1$).

Economical Efficiency:

Economic evaluation revealed that adding graded levels of thyme (1.5 and 3%) to laying hen diets, regardless of diet energy. increased the total feed cost/hen. Low energy diets scored better economical efficiency (EE) and relative economical efficiency (relative EE) when compared with recommended energy diets (Table 6). Thyme supplementation at 1.5% to low energy diet improved both EE and relative EE, when compared with the control of recommended energy diet (0.52 vs. 0.42 and 124 vs. 100, respctively). Although the control of low energy diet scored the highest EE and relative EE, it scored the least viability of the birds (73%). The results also indicate that it is not reasonable to use thyme at 3% of the laying hen diet, not only from economic point of view but also because it had no improving effects on laying hen performance, as compared with 1.5%.

The previous results suggest to add not more than 1.5% thyme or may be less to low energy diet of laying hens to improve their performance, bird viability and economic efficiency.

Improving economical efficiency due to using low levels of thyme was supported by Ibrahim, *et al.* (2000), Abaza (2001) and Abd El-Latif *et al.*, (2002) who found that addition of 0.1-0.50% thyme gave the highest economical efficiency and relative economical efficiency.

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تقييم إضافة الزعتر إلي العلائق التطبيقية للدجاج البياض المختلفة في محتواها من الطاقة

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استخدم في هذه الدراسة عدد ٩٠ دجاجة بياضة عمر ٢٥ أسبوع من نوع البوفانز الأبيض بهدف تقييم إضافة الزعتر إلي علائق تطبيقية للدجاج البياض مختلفة في محتواها من الطاقة الممثلة. تم توزيع الدجاج عشوائيا إلي ٦ مجاميع بكل منها ١٥ دجاجة في بطاريات. تم تكوين عليقتين متساويتين في محتواهما من البروتين (١٨,٥% بروتين خام)، احتوت العليقة الأولي علي مستوى منخفض (٢٧٠٠ كيلو كالوري / كجم عليقة) بينما احتوت العليقة الثانية على احتياجات السلالة (٢٩٠٠كيلو كالوري / كجم عليقة). تم إضافة الزعتر ليحل محل صفر، ١,٥، ٣% من المخلوط الكلي لكل من العليقتين. و بالتالي تم استخدام ٦ علائق في تصميم إحصائي متداخل (٢x ٣).

أوضحت نتائج هذه الدراسة احتواء الزعتر (علي أساس المادة الجافة هوائيا) علي ٨,١٩% رطوبة، ٩١,٨١% مادة جافة، ٨٠,٨٤% مادة عضوية، ١٠,٦٥% بروتين خام، ٣,١٧% دهن خام، ١٧,٢٩% ألياف خام، ١٠,٩٧% رماد و ٤٩,٢٢% مستخلص خالي الازوت مما يوضح قيمته الغذائية بالإضافة إلي محتواه من المواد الاخري الفعالة. أدت إضافة الزعتر (بغض النظر عن مستوي طاقة العليقة) إلي انخفاض معنوي في كل من متوسط وزن البيض و المأكول و تحسين معنوي في معامل التحويل الغذائي و أدت إلي زيادة غير معنوية في معدل إنتاج البيض. أدت العلائق المحتوية علي الطاقة المنخفضة (المستوي الأول) المضاف إليها الزعتر بمستوي ١,٥% إلي أتحسين إنتاج البيض و كتلة البيض و معامل التحويل الغذائي و كذلك خفض نسبة النفوق بالمقارنة بالكنترول المنخفض في الطاقة و بدون إضافة الزعتر (٩٦,٦ مقابل ٨٨,٩% ، ٥٣,٤ مقابل ٥١,٥جم، ٢,٠ مقابل ٢,٢، ١٠٠ مقابل ٧٣%، علي التوالي). لم يتأثر الأداء الإنتاجي معنويا بمستوي الطاقة فيما عدا وزن البيض و حيوية الطيور التي تحسنت معنويا في حالة العلائق المحتوية علي احتياجات السلالة من الطاقة الممثلة. لم تتأثر صفات البيض الداخلية أو الخارجية معنويا بأي من المعاملات. إضافة الزعتر بمستوي ١,٥% (بغض النظر عن مستوي طاقة العليقة)، سجل أفضل القيم لمعاملات الهضم مقارنة بالكنترول (بدون زعتر) أو بالعلائق المحتوية علي ٣% زعتر. كما أدت إضافة هذا المستوي للعلائق المحتوية علي الطاقة المنخفضة إلي تحسين قيم معاملات الهضم و ميزان النيتروجين، فيما عدا معامل هضم مستخلص الاثير و ذلك مقارنة بكنترول الطاقة المنخفضة أو الكنترول المحتوي علي احتياجات السلالة من الطاقة. كما أدت هذه المعاملة إلي تحسين كل من الكفاءة الاقتصادية و الكفاءة الاقتصادية النسبية مقارنة بالكنترول المحتوي علي احتياجات السلالة من الطاقة (٠,٥٢ مقابل ٠,٤٢، ١٢٤ مقابل ١٠٠، علي التوالي) .

أظهرت النتائج العامة لهذا البحث خاصة عند أخذ الجدوى الاقتصادية في الاعتبار أن إضافة الزعتر بنسبة ١,٥% من العليقة المحتوية علي مستويات منخفضة من الطاقة الممثلة حسنت الاستفادة من هذه العلائق و سجلت أفضل قيم الأداء الإنتاجي و حيوية الطيور و الكفاءة الاقتصادية. و أنه لا داعي لاستخدام الزعتر بمستويات أعلي من ١,٥% في علائق الدجاج البياض بل توصي نتائج هذا البحث بمزيد من الدراسة علي مستويات زعتر أقل من ١,٥%.