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THE INFLUENCE OF SUPPLEMENTING CHAMOMILE AND TURMERIC POWDER ON PRODUCTIVE PERFORMANCE AND EGG QUALITY OF LAYING HENS

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ABSTRACT: An eight-week experiment was conducted to assess the effect of supplementing layer diets with various concentrations of chamomile (CH), turmeric (TR) and their combination (CH + TR) on the productive performance, egg quality traits and yolk chemical composition of laying hens. Total of 144 White Lohmann LSL layer hens, 43 weeks of age, were assigned to six treatments (6 replicates each x 4 birds). Treatments were control (no additives), 1.5 or 3.0 g CH/kg diet, 1.5 or 3.0 g TR /kg diet and 1.5 g CH + 1.5 g TR /kg diet. Egg weight, mass, production and feed conversion ratio were significantly improved by treatments. Chamomile 1.5 g or CH + TR resulted in the highest egg production, egg mass and the best feed conversion ratio. Egg weight was increased by TR or CH + TR inclusion. The treatments had no significant effect on feed intake. The effect of CH, TR and CH + TR on egg quality traits was inconsistent except for yolk color which was significantly improved by the treatments and was more pronounced by TR and CH + TR in comparison with the control. Treatments had no significant effect on the egg surface area, shell traits and albumen weight. Chamomile (1.5 g) improved shape index in comparison with the rest of the treatments except for CH + TR which significantly recorded the lowest index. Herbs supplementation negatively affected the yolk index. There was no significant effect on chemical composition of egg yolk, except for dry matter percentage which was significantly decreased by CH + TR combination. It can be concluded that chamomile, turmeric or their combination as feed supplementation to layer diets had favourable effects on the productive performance and yolk color; however, the effect on egg quality was inconsistent.

Key Words: Chamomile - Turmeric - Egg production - Egg quality

INTRODUCTION

There has been increased interest in the use of herbal plants as potential alternative feed additives to promote growth. Herbs have the advantages of being natural, safe and eco-friendly (Christaki et al., 2012). It has been shown that these plants stimulate birds' digestive system by increasing their digestive enzymes and improving digested products utilization by enhancing liver function (Platel and Srinivasan, 2001). Chamomile (CH) contains essential oils, flavonoid, coumarin glycosides and fatty acids which have anti-inflammatory, antiseptic, carminative, diaphoretic and sedative properties (Panda, 2005). Al-Kassie and Khalel (2011) stated that CH could be used as a natural growth promoter in poultry diets for its antimicrobial properties. Similarly, it was found that CH flower at 5.0 g/kg (Abaza, 2007) or up to 9.0 g/kg (AL Haddad, 2012) of laying diet improved egg production, egg weight and feed conversion ratio.

Turmeric (TR) is one of these herbal plants that contain many biologically active components such as curcumin, tetrahydrocurcumin, bismethoxycurcumin and dimethoxycurcumin (Lal, 2012). Tajodini et al. (2015) stated that TR possesses antioxidant, anti-mutagenic, anti-inflammatory and antimicrobial properties. Moreover, it protects the liver from the harmful effect of toxins. Pandian et al. (2013) reported that 2.0 g TR/kg addition to laying hens diet was economical and significantly improved egg production. Similarly, Park et al. (2012) mentioned that egg production, mass, weight and yolk's color were significantly higher for hens fed 5.0 g TR/kg diet than those of the control. However, Samarasinghe et al. (2003) reported that 1.0, 2.0 and 3.0 g TR or curcumin/kg of diet had no effect on feed consumption, egg weight, egg mass and rate of hens' egg production.

Previous work on the effect of these herbal additives has shown promising results. In addition, the optimal concentrations for balanced beneficial effects remain to be determined. Therefore, the aim of this study was to assess the effect of chamomile and turmeric, at different concentrations, and their combination on hens' productive performance, egg quality measurements and egg yolk chemical composition.

MATERIALS AND METHODS

Diets and experimental procedures:

This study was conducted at the College of Agriculture Experimental Farm, Suez Canal University, Egypt and compliance with relevant laws and institutional guidelines. White Lohmann LSL layers (144 hens, 43-week of age) were used to evaluate the effect of different concentrations of CH, TR powder and their combination (CH + TR) on hen productive performance, egg quality traits and yolk chemical composition. Treatments were: control (no additives), 1.5 or 3.0 g CH/kg diet, 1.5 or 3.0 g TR/kg diet and 1.5 g CH + 1.5 g TR/kg diet. The basal experimental diets were formulated according to strain manual recommendation. Hens were fed on the experimental diets for eight weeks (44-51 weeks of age). Diet formulation and chemical composition were illustrated in Table 1. Hens with similar body weight (1736±0.003 kg) and egg production rate (0.860±0.015 egg/hen per day) were randomly assigned to six treatments. Each dietary treatment was replicated six times (four birds/replicate). Hens were kept under similar conditions in battery cages at a semi-open layer house. Each replicate was represented by one cage (440 cm^2 /bird). A light schedule 16: 8 hr of light: darkness was provided daily. In each replicate, hens shared a feed trough and had access for drinking water cups ad-libitum. General management was applied in line with the breed management guide.

Productive performance measurements:

Hen's initial body weight (43-week of age) and final body weight (51-week of age) were recorded and body weight change was calculated. Feed intake (FI) was recorded at the end of the experimental period and calculated as gram/hen per day. Hen day egg production (EP) and egg weight (EW) were recorded daily. Egg mass (EM) was calculated via EM = (E number × EW)/period (days). The feed conversion ratio (FCR) was calculated via: FCR = FI/EM. The daily EW, EP and EM were calculated through 44-51 weeks of age during the experimental period.

Egg quality traits and Yolk chemical analysis:

At the middle of 47 and 51-week of age, four eggs (during two consecutive days) were taken from each replicate (48 eggs /treatment) for egg quality evaluation. Eggs were individually weighed using an electronic balance to the nearest 0.01 g accuracy and surface area of each egg was calculated using the formula: surface area (cm^2) = 4.67 × $W^{2/3}$, where W is the egg weight in g and 4.67 is a constant (Thompson et al., 1985). Measurements of egg length and egg width were obtained by using a digital caliper to an accuracy of 0.01 cm. Egg shape index was determined according to Tumova and Gous (2012) as given by the formula: Egg shape index (%) = [(egg width/egg length) × 100]. Each egg was carefully broken out on a flat surface to determine the internal components. Yolk height (mm) was measured by using a tripod micrometer and yolk diameter (mm) was measured by a digital caliper. Yolk index was calculated according to Kul and Seker (2004) as given by the following formula: Yolk index (%) = [(Yolk height / Yolk Diameter) × 100]. Yolk color was assessed subjectively using Roche Yolk Color Fan (Bovšková et al., 2014). The yolk was then carefully separated from albumen, placed in a Petri dish and then weighed. Shell was carefully washed and cleaned of any adhering albumen then dried for 48 hours at room temperature (25°C) and weighed. Shell index (g shell weight/100 cm^2 surface area) was calculated by the following formula: Shell index = (shell weight/surface area) × 100 (Guesdon et al., 2006). Albumen weight was calculated as following: egg weight – (shell weight + yolk weight). Percentages of yolk, albumen and shell weights relative to egg weight were calculated. The yolks (per replicate) were pooled and stored at -20°C for proximate analysis. Crude protein, ether extract, ash and dry matter were determined by Association of Official Analytical Chemists (AOAC, 2005) methods. Determination of dry matter was done by drying in an oven at 105°C for 6 hours (until reaching constant weight). Crude ash content was determined by calcinations of the sample at a temperature of 550°C until reaching constant weight, using a muffle furnace oven. The crude fat content was made by extraction with petroleum ether using Soxhlet method and crude protein was determined by the Kjeldahl method.

Statistical analysis:

Data were analysed by analysis of variance (one-way ANOVA) as a completely randomized design using the General Linear Models (GLM) procedures of the statistical system (Statistical Analysis System Institute, SAS, 2004). The following general model: $Y_{ij} = \mu + \alpha_i + e_{ij}$ was used, where Y_{ij} is the dependent variable observation, μ is the overall mean, α_i is the effect of the treatment and e_{ij} is the random error. Data of the productive performance, egg quality measurements and chemical composition of yolk were analyzed using the replicate average. Means comparisons were performed using Duncan's multiple range test (Duncan, 1955) and considered significant at P≤0.05.

RESULTS

Productive performance:

As shown in Table 2, treatments increased hens' FBW; however, hens fed control diet had the highest (P≤0.05) final body weight (FBW) and body weight change (BWC) values. The lowest (P≤0.05) FBW and BWC values were recorded for hens fed CH diets alone or CH + TR (1.5 g each/kg diet). The treatments had no significant effect on FI; however, FCR was significantly improved compared with the control. The best FCR was obtained by 1.5 g CH/kg diet alone or CH + TR (1.5 g each/kg diet). Egg weight was not significantly affected by the different treatments; however, TR (1.5 and 3 g/kg diet) and CH + TR increased EW compared with 1.5 g CH/kg diet and control. Egg production and EM were increased (P≤0.05) by all treatments in comparison with the control; CH (1.5 g/kg diet) or CH + TR were superior to the rest of the treatments.

Egg quality traits and yolk chemical composition:

Chamomile and turmeric supplementation had no significant effect on surface area (cm^2) shell traits (weight, percentage, and index) and Albumen weight (Table 3). The inclusion of 1.5 g CH/kg diet improved (P≤0.05) egg shape index in comparison with the combination of CH and TR which recorded the lowest values. Supplementation of CH and TR decreased yolk and increased albumen percentages. The highest (P ≤0.05) albumen and the lowest (P≤0.05) yolk percentages were observed with the combination treatment (CH + TR 1.5 g each). The data showed that the control diet had the highest (P≤0.05) value of yolk index compared with CH at both concentrations and CH + TR combination diet which recorded the lowest values. Yolk color was improved (P≤0.05) by all treatments in comparison with the control. Supplementation of TR powder and its combination with CH had the highest values of yolk color (Table 3). As shown in Table 4, CH + TR significantly (P≤0.05) reduced yolk dry matter percentage in comparison with the rest of the treatments. No significant differences between treatments were obtained for protein, ether extract and ash percentages. The highest protein and the lowest ether extract percentages were recorded with the control diet.

DISCUSSION

Productive performance:

Data showed that hens' FBW and BWC were increased by all treatment; however, the lowest (P ≤0.05) BWC values were obtained by CH and CH + TR in comparison with the control. Results agree with Poracova et al. (2007) who found a limited effect of chamomile oil on BW of laying hens. In the same direction, laying hen diet supplemented with 5.0 g CH/kg diet had no effect on BWC (Abaza, 2007). This effect could be due to the effective ingredients of chamomile reduce the lipid accretion by stimulating the bile acids secretion which reduces the intestinal fat absorption (Ibrahim et al., 2014). However, this finding conflicted with Abd El-Galil et al. (2010) who studied the effect of CH flower (0.25, 0.50 or 0.75 g/kg) supplementation on laying Japanese quail (4-22 weeks of age) and found that FBW and BWC significantly increased by increasing CH concentrations in the diet in comparison with the control. The contradiction between the results might be due to birds' age, species and CH concentrations used. Literature regarding the effect of TR on hens' body weight was out of reach; however, on broilers, Mondal et al. (2015) reported that TR (5 g/kg diet) inclusion increased body weight gain and reduced abdominal fat deposition. The effect on hens' body weight might be due to the influence of the effective components of TR on the reduction of adipocyte number resulted in decreased fat accretion which has an effect on BW. However, no significant effect of TR on broiler chicks BW was noticed by Emadi and Kermanshahi (2006). Feed intake reported here was not significantly affected by the treatments. However, FCR was improved by all treatments with significant differences by 1.5 g CH/kg diet and CH + TR supplementations. It could be suggested that CH or TR supplementation had no effect on feed palatability. This was in harmony with Saraswati et al. (2013) who concluded that feed palatability was not affected by supplementing TR powder to laying quail diet. The obtained data were in conflict with Abd El-Galil et al. (2010) and Pandian et al. (2013) who stated that supplementation of CH to laying Japanese quail or Rhode Island Red chickens diets, respectively, significantly increased FI in comparison with the control. On the contrary, 5.0 g CH/kg diet (Abaza, 2007) or 10 g TR/kg diet (Kanagaraju et al., 2016) significantly decreased FI and improved FCR of laying hens, whereas, FI was not altered by 2.5 or 5.0 g TR/kg of diet. In accordance, supplementation of 10 g/kg diet (Malekizadeh et al., 2012) or 20 g TR/kg diet (Lagana et al., 2011) powder significantly reduced FI and had no valuable effect on FCR.

In the present study, CH, TR and their combination increased EP and EM in comparison with the control. Egg weight was increased by TR and CH + TR addition. These were in agreement with Abd El-Galil et al. (2010) and Abaza (2007) who concluded that supplementation of CH flower up (to 0.75 g/kg) or (5 g/kg) of laying Japanese quail or laying hen diets, respectively, increased EW, EM and egg number. Besides, supplementation of TR powder up to 10 g/kg diet significantly increased hen day and hen housed EP (Kanagaraju et al., 2016; Pandian et al., 2013). In addition, Park et al. (2012) found that dietary 5.0 g TR/kg of diet improved EP, EM and EW of laying hens. On the contrary to the current results, AL Haddad (2012) demonstrated that CH inclusion at 3.0, 6.0 or 9.0 g to layer diet had no effect on EW. Moreover, Malekizadeh et al. (2012) reported that the TR powder inclusion in laying diet at 10 or 30 g/kg had no beneficial effect on EW and reduced EP and EM numerically in comparison with the control. In the present data, the increments in EP and EM without consuming extra feed can be attributed to that the birds utilized the supplemented diets more efficiently; consequently, FCR was improved. This may be due that the optimum antioxidant activity of CH and TR was achieved at the concentrations used which might stimulate protein synthesis. In harmony with the previous suggestions, Platel and Srinivasan (2001) stated that some herbs stimulated pancreatic digestive enzymes (lipase, amylase and proteases) and enhanced the activities of terminal digestive enzymes of the small intestinal mucosa leading to an acceleration of the digestion and a reduction in feed transit time in the alimentary tract. The action mode of TR was explored by Stanojević et al. (2015) who indicated that TR essential oil is a strong antioxidant and antimicrobial which can be added as a safe alternative to synthetic agents in pharmaceutical and food industries. In addition, TR improved indices of serum blood components of laying hens such as decreasing serum hepatic enzymes (AST & ALT) suggesting the nontoxic effect of TR addition on hepatic and renal tissues (Malekizadeh et al., 2012). Also, Saraswati et al. (2013) demonstrated that turmeric powder supplementation to laying quail diet improved liver function, which leads to increase the total capacity of the liver tissue to synthesize and secrete vitellogenin in the blood, the substrates for yolk deposition in the developing follicle. This action increased folliculogenesis and ovogenesis processes which resulted in increasing the total amount of the developing follicles in the ovary and increased egg production rate. Similarly, CH flowers inhibited the excessive growth of harmful intestinal microorganisms resulting in counteracting inflammation (Jakubcova et al., 2014). They found that increasing CH concentrations (3.0, 6.0 & 12 g/kg of diet) in growing broiler diets reduced the numbers of coliform microbes in the digestive tract and C. Perfingens population. Also, the active compounds of CH had antimicrobial, antifungal and anti-inflammatory actions, supported the normal microflora in the intestine and increased the accessibility of nutrients (Panda, 2005).

Egg quality traits and yolk chemical composition:

The different treatments, of the data here, revealed significant effects on egg quality traits except for albumen weight and shell traits. Yolk (percentage, weight and index), albumen percentage and egg shape index (%) were affected significantly by the treatments. Yolk color was improved significantly by all treatments especially TR with/out CH. The effect of CH and TR on egg quality traits was inconsistent, some results stated by previous researchers agreed with the presented data and others disagreed. AL Haddad (2012) found that the addition of CH flower to layer diet (3.0, 6.0 or 9.0g/kg) significantly increased yolk (index & color) and shell (weight & percentage) while weights and percentages of albumen and yolk were not significantly affected. With quail, Saraswati et al. (2013) concluded that TR powder at 13.5, 27 and 54 mg/quail per day lowered yolk (weight and index) but albumen weight and shell (weight, thickness and index) were not affected. Furthermore, Abd El-Galil et al. (2010) concluded that CH flower (0.25, 0.50 or 0.75 g/kg quail diet) resulted in no significant increases in yolk percentage whereas shell percentage and egg shape index were increased significantly by increasing CH flower concentration in comparison with the control. Besides, albumen weight and yolk index were decreased by increasing CH flower concentration. Conversely, Abaza (2007) reported that 5.0 g CH/kg of laying diet did not have any significant achievement on hens' egg quality traits. Concerning TR effect, the inclusion of 20 g TR/kg of layer diet had no valuable effect on egg quality parameters or provided good yolk pigmentation (Lagana et al., 2011). However, Park et al. (2012) observed improvement in yolk color with 5.0 g TR/kg diet, with no effect on egg quality traits. They found that curcumin content of egg yolk was significantly higher than that of the control and increased by increasing dietary TR powder. Curcumin (the main constituent of TR) is a natural yellow pigment obtained from the rhizomes powder of TR and has been widely utilized for imparting color to foods (Deshpande et al., 1997). Additionally, Jacqueline et al. (1998) reported that yolk color depends on the yellow or orange pigments (xanthophylls) in the diet. If hens fed a diet with plentiful of these plant pigments, they would deposit in the yolk. Thus, it is better to use these natural yellow-orange substances of TR in layer diets to enhance yolk color. In regards to yolk chemical composition, no significant variations were obtained except for dry matter percentage which was decreased significantly by CH and TR combination. Few studies were done dealing with the chemical analysis of yolk. The results found here were in conflict with those reported by Saraswati et al. (2013) who concluded that TR powder added to quail diet lowered egg fat and increased protein, ash and water contents. In concurrence with the current results, Keshavarz (1976) reported that TR (20 g/kg diet) or curcumin (0.4 and 5.0 g/kg diet) in laying hen diets had no effect on the fat content of the yolks. The contradiction between the results obtained here and some other reports may be owed to the differences in herbal sources, bird species, growth environment and/or the herbal concentrations that were used.

In conclusion, CH and TR powder at 1.5 & 3 g/kg diet individually or in combination (at 1.5 g each/kg of diet) significantly improved EP and yolk color in comparison with the control. Significant enhancements of FCR, EW and EM were observed by all supplementation. Turmeric or CH + TR improved egg weight. Treatments had no significant effect on surface area, shell traits and albumen weight. Herbs inclusion had no significant effect on egg yolk chemical composition (except for dry matter %). Chamomile and TR powder, individually or in combination, can be recommended as feed additives to layer diet for its beneficial effects on productive performance and yolk color.

Table (1): Composition of the basal diet

Ingredients (%)		**Chemical composition (%)**	
Yellow corn	63.0	ME (Kcal/kg)	2741.9
Soybean meal (44% CP)	18.0	Crude protein	18.28
Layer concentrates (50% CP)	10.0	Calcium	3.670
Dicalcium phosphate	1.5	Phosphorus	0.655
Limestone	4.0	Methionine + Cystine	0.657
Oyster shells	3.0	Lysine	0.926
Vit. & Min. Premix*	0.25		
Salt	0.25		
Total	100		

*Suplied per kg of diet: Vitamin A, 10 000 IU; Vitamin D_3, 1 000 IU; Vitamin E, 10 mg; Vitamin K, 1 mg; thiamine, 5 mg; riboflavin, 1.5 mg; pyridoxine, 1.5 mg; cyanocobalamin, 0.01 mg; pantothenic acid, 10 mg; niacin, 30 mg; biotin, 0.05 mg; folic acid, 1 mg; choline chloride, 600 mg; iron, 30 mg; manganese, 60 mg; zinc, 50 mg; copper, 5 mg; cobalt, 0.1 mg; iodine, 0.3 mg; selenium, 0.1 mg.

Table (2): Productive performance of laying hens as affected by chamomile (CH), turmeric (TR) and their combination (44-51 weeks)

Measurements	Treatments (g/kg diet)					
	Control	**CH 1.5**	**CH 3.0**	**TR 1.5**	**TR 3.0**	**CH1.5 + TR 1.5**
Initial BW at 43 wk (kg/hen)	1.736±0.007	1.742±0.006	1.742±0.005	1.733±0.008	1.729±0.009	1.737±0.009
Final BW at 51 wk (kg/hen)	1.851^{a}±0.022	1.759^{b}±0.020	1.774^{b}±0.013	1.782^{b}±0.021	1.825^{ab}±0.032	1.764^{b}±0.012
BW change (g/hen)	114.3^{a}±0.02	16.9^{c}±0.02	31.5^{bc}±0.01	48.7^{abc}±0.02	96.5^{ab}±0.03	27.1^{bc}±0.01
Feed intake (g/hen per day)	115.0±0.51	115.7±0.15	115.3±0.32	115.5±0.14	115.2±0.33	115.7±0.12
FCR (g feed/g egg mass)	2.14^{a}±0.113	1.91^{b}±0.018	1.97^{ab}±0.078	1.96^{ab}±0.069	1.95^{ab}±0.037	1.90^{b}±0.021
Egg weight (g/hen per day)	62.63±0.80	61.78±0.39	62.46±0.41	63.18±0.20	63.8±0.65	63.10±0.62
Egg production ((%)	87.0^{b}±4.44	98.2^{a}±1.22	94.3^{ab}±3.28	93.8^{ab}±3.19	93.0^{ab}±2.40	96.7^{a}±1.22
Egg mass (g/hen per day)	54.51^{b}±2.78	60.68^{a}±0.77	58.95^{ab}±2.26	59.26^{ab}±1.98	59.26^{ab}±1.24	60.98^{a}±0.95

$^{a,\,c}$ Mean values within the same row sharing a common superscript letter are not significantly different at $P \leq 0.05$.

Table (3): Egg quality traits of laying hens (44-51 weeks of age) as affected by chamomile (CH), turmeric (TR) and their combination

Egg traits	**Treatments (g/kg diet)**					
	Control	**CH 1.5**	**CH 3.0**	**TR 1.5**	**TR 3.0**	**CH 1.5 + TR 1.5**
Surface area (cm^2)	74.49±0.48	73.31±0.27	74.30±0.51	74.59±0.46	74.13±0.47	73.16±0.46
Shape index	73.11^{ab}±0.50	74.31^{a}±0.40	73.21^{ab}±0.24	73.70^{ab}±0.45	73.68^{ab}±0.47	72.62^{b}±0.53
Shell weight (g)	6.06±0.10	5.92±0.06	6.09±0.11	6.02±0.10	6.04±0.07	5.96±0.13
Shell (%)	9.51±0.15	9.52±0.11	9.58±0.13	9.44±0.15	9.56±0.12	9.60±0.17
Shell index (g/100 cm^2)	8.13±0.13	8.08±0.09	8.18±0.12	8.07±0.13	8.15±0.09	8.14±0.15
Albumen weight (g)	39.07±0.50	38.33±0.38	39.31±0.46	39.36±0.46	38.87±0.51	38.82±0.41
Albumen (%)	61.28^{b}±0.37	61.60^{ab}±0.38	61.90^{ab}±0.24	61.63^{ab}±0.39	61.40^{b}±0.35	62.57^{a}±0.24
Yolk weight (g)	18.60^{a}±0.26	17.95^{a}±0.12	18.10^{a}±0.24	18.47^{a}±0.30	18.36^{a}±0.23	17.25^{b}±0.19
Yolk (%)	29.21^{a}±0.37	28.88^{a}±0.36	28.52^{ab}±0.31	28.93^{a}±0.39	29.04^{a}±0.33	27.83^{b}±0.24
Yolk index	47.81^{a}±0.67	45.27^{c}±0.66	45.64^{bc}±0.61	47.27^{ab}±0.59	46.59^{abc}±0.54	44.68^{c}±0.73
Yolk color	5.75^{d}±0.08	6.80^{c}±0.09	7.05^{bc}±0.09	7.18^{ab}±0.09	7.43^{a}±0.10	7.35^{a}±0.10

[a, d] Mean values within the same row sharing a common superscript letter are not significantly different at $P \leq 0.05$.

Table (4): Yolk chemical composition of laying hens' egg (44-51 week of age) as affected by chamomile (CH), turmeric (TR) and their combination

Composition (%)	**Treatments (g/kg diet)**					
	Control	**CH 1.5**	**CH 3.0**	**TR 1.5**	**TR 3.0**	**CH 1.5 + TR 1.5**
Dry matter	54.67^{a}±0.21	54.85^{a}±0.15	54.93^{a}±0.25	54.31^{a}±0.39	54.33^{a}±0.15	53.47^{b}±0.20
Protein	16.21±0.30	15.94±0.59	15.58±0.43	15.22±0.30	15.76±0.41	15.04±0.38
Ether extract (fat)	34.47±0.24	35.19±0.45	35.23±0.28	35.07±0.33	34.96±0.23	35.37±0.29
Ash	1.48±0.14	1.62±0.17	1.46±0.11	1.65±0.12	1.60±0.23	1.89±0.25

[a, b] Mean values within the same row sharing a common superscript letter are not significantly different at $P \leq 0.05$.

REFERENCES

Abaza, I. M. 2007. Effect of using fenugreek, chamomile and radish as feed additives on productive, reproductive and digestibility coefficients of laying hens. Egypt. Poult. Sci., 27:199-218.

Abd El-Galil, K.; Mahmoud, H. A.; Hassan, A. M. and Morsy, A. S. 2010. Effect of chamomile flowers meal as feed additives in laying Japanese quail diets on productive and reproductive performance. J. Anim. Poult. Prod., Mansoura Univ., 1:517 -533.

Al Haddad, H. S. A. 2012. Effect of supplementing Anthemis nobilis (Chamomile) flower powder to diet of commercial layers on some egg quality traits. Tikrit Univ. J. Agri. Sci., 12:35-40.

Al-Kassie, G. A. M and Khalel, E.K. 2011. The potency of chamomile flowers (Matericaria chamomilla L.) as feed supplements (growth promoters) on productive performance and hematological parameters constituents of broiler. Int. J. Poult. Sci., 10:726-729.

Association of Official Analytical Chemists (AOAC) 2005. Official methods of analysis, 18th edition. Arlington, VA, USA.

Bovšková, H.; Míková, K. and Panovská, Z. 2014. Evaluation of egg yolk color. Czech J. Food Sci., 32:213–217.

Christaki, E.; Bonos, E.; Giannenas, I. and Paneri, P. F. 2012. Aromatic Plants as a source of bioactive compounds - a review. Agri., 2:228-243.

Deshpande, S. S.; lalitha, V. S.; Ingle, A. D.; Raste, A. S.; Gadre, S. G. and Maru, G. B. 1997. Subchronic oral toxicity of turmeric and ethanolic turmeric extract in female mice and rats. Toxicol. Lett., 95:183-193.

Duncan, D. B. 1955. Multiple range and multiple F-Test. Biometrics, 11:1-42.

Emadi, M. and Kermanshahi, H. 2006. Effect of turmeric rhizome powder on performance and carcass characteristics of broiler chickens. Int. J. Poult. Sci., 5:1069-1072.

Guesdon, V.; Ahmed, A. M.; Mallet, S.; Faure, J. M. and Nys, Y. 2006. Effects of beak trimming and cage design on laying hen performance and egg quality. Br. Poult. Sci., 47:1–12

Ibrahim, A. M.; El Ghamry, A. A.; El. Allawy, H. M. H.; Ali, F. A. F. and Magrabi, N. 2014. The effect of chamomile flower as feed additive on fat deposition in certain subcutaneous tissues, carcass quality and growth performance in Pekin duck

Global Veterinaria, 13: 767-773.

Jacqueline, P. J.; Richard, D. M. and Mather, F. B. 1998. Egg quality. Food and Agri. Sci. Univ. Florida, PS, 24:1-11.

Jakubcova, Z.; Zeman, L.; Mares, P.; Mlcek, J.; Jurikova, T.; Dostalova, L.; Mrazkova, E.; Mrkvicova, E.; Balla, S. and Sochor, J. 2014. Effect of chamomile supplements to feeding doses on antimicrobial parameters in poultry. Potravinarstvo, 8:228-232.

Kanagaraju, P.; Omprakash, A. V. and Rathnapraba, S. 2016. Effect of turmeric (Curcuma longa) rhizome powder supplementation on the production performance of Nandanam chicken 4 Laying hens. Indian Vet. J., 93:36 - 38.

Keshavarz, K. 1976. The influence of turmeric and curcumin on cholesterol concentration of eggs and tissues. Poult. Sci., 55:1077-1083.

Kul, S. and Seker, I. 2004. Phenotypic correlations between some external and internal egg quality traits in the Japanese quail (Coturnix coturnix japonica). Int. J. Poult. Sci., 3:400-405.

Lagana, C.; Pizzolaantee, C. C.; Saldanha, E. S. P. B. and Moraess, J. E. De, 2011. Turmeric root and Annato seed in second cycle layer diets: Performance and egg quality. Brazil. J. Poult. Sci., 13:171-176.

Lal, J. 2012. Turmeric, curcumin and our Life - a review. Bull. Environ., Pharmacol. Life Sci., 1:11-17.

Malekizadeh, M.; Moeini, M. and Ghazi, S. H. 2012. The effects of different levels of ginger (Zingiber officinale Rosc) and turmeric (Curcuma longa Linn) rhizomes powder on some blood metabolites and production performance characteristics of laying hens. J. Agri. Sci. and Technol., 14:127-134.

Mondal, M. A.; Yeasmin, T.; Karim, R.; Nurealam Siddiqui, M.; Raihanun-Nabi, S.M.; Sayed, M. A. and Siddiky, M. N. A. 2015. Effect of dietary supplementation of turmeric (curcuma longa) powder on the growth performance and carcass traits of broiler chicks. SAARC J. Agri., 13:188-199.

Panda, H. 2005. Handbook on medicinal Herbs with uses. Asia Pacific Business Press Inc. 106-E, Kamla Nagar, Delhi-110 007, India.

Pandian, C.; Sundaresan, A.; Omprak ash, A. V., Babu, M. and Prabakaran, R. 2013. Effect of phytobiotics on production performance in Rhode Island Red (RIR) chicken. Indian J. Anim. Nutr., 30:188-190.

Park, S. S.; Kim, J. M.; Kim, E. J.; Kim, H. S.; An, B. K. and Kang C. W. 2012. Effects of dietary turmeric powder on laying performance and egg qualities in laying hens. Korean J. Poult. Sci., 39:27-32.

Platel, K. and Srinivasan, K. 2001. A study of the digestive stimulant action of select spices in experimental rats. J. Food Sci. and Technol., 38:358-361.

Poráčová, J.; Zahatňanská, M.; Blasčáková, M.; Taylorová, B.; Sutiaková, I.; Tanishima, K.; Takabayashi, H. and Cheng, B.J. 2007. Effect of chamomile essential oil on eggs production and weight of laying hens Hisex Braun. Acta Hortic., 749:207-210.

Samarasinghe, K.; Wenk, C.; Silva, K. F. S. T anf Gunasekera, J. M. D. M. 2003. Turmeric (Curcuma longa) root powder and mannanoligosaccharides as alternatives to antibiotics in broiler chicken diets. Asian-Australas. J. Anim. Sci., 10:1495-1500.

Saraswati, T. R.; Manalu, W.; Ekastuti, D. R. and Kusumorini, N. 2013. The role of turmeric powder in lipid metabolism and its effect on quality of the first quail's egg. J. Indones. Trop. Anim. Agri., 38:123-130.

Statistical Analysis Systems Institute (SAS) 2004. SAS/STAT User's Guide, version 9.1. SAS Institute Inc., Cary, NC, USA.

Stanojević, J. S.; Stanojević, L. P.; Cvetković, D. J. and Danilović, B. R. 2015. Chemical composition, antioxidant and antimicrobial activity of the turmeric essential oil (Curcuma longa L.). Adv. Technol.. 4:19-25.

Tajodini, M.; Saeedi, H. R. and Moghbeli, P. 2015. Use of black pepper, cinnamon and turmeric as feed additives in the poultry industry. Worlds Poult. Sci. J., 71:175-183.

Thompson, B. K.; Hamilton, R. M. G. and Grunder, A. A. 1985. The relationship between laboratory measures of egg shell quality and breakage in commercial egg washing and candling equipment. Poult. Sci. 64:901–909.

Tumova, E. and Gous, R. M. 2012. Interaction of hen production type, age and temperature on laying pattern and egg quality. Poult. Sci., 91:1269–1275.

الملخص العربى

تأثير إضافة مسحوق البابونج والكركم بالعليقة على الاداء الانتاجى وجودة البيض للدجاج البياض

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إجريت تجربة لمدة ثمانية أسابيع بغرض إضافة تركيزات مختلفة من البابونج والكركم ومزيجهما (البابونج + الكركم) لعليقة الدجاج البياض على الأداء الإنتاجي للدجاج وصفات جودة البيض والتركيب الكيميائي لصفار البيض. تم توزيع 144 دجاجة بيضاء من لوهمان LSL، عمر 43 أسبوعًا، إلى ستة معاملات (6 مكررات لكل مكررة 4 طيور). كانت المعاملات كنترول (بدون إضافات) ، 1.5 أو 3.0 جم من البابونج/ كجم عليقة ، 1.5 أو 3.0 جم من الكركم/ كجم عليقة و 1.5 جم بابونج + 1.5 جم كركم / كجم عليقة. حسنت المعاملات معنويا من وزن البيض ، وكتلة البيض ، وإنتاج البيض ومعامل التحويل الغذائى. أسفرت التغذية على البابونج 1.5 جم أو البابونج + الكركم عن أعلى إنتاج للبيض ، وكتلة البيض وأفضل نسبة لتحويل الأعلاف. زاد وزن البيض بالتغذية على الكركم أو البابونج + الكركم. لم يكن للمعاملات أي تأثير معنوي على استهلاك الغذاء. كان تأثير البابونج والكركم ومزيجهما على صفات جودة البيض غير ثابت فيما عدا لون الصفار الذي تم تحسينه معنويا عن طريق المعاملات وكان التحسن أكثر وضوحًا بواسطة الكركم والبابونج + الكركم بالمقارنة مع الكنترول. لم يكن للمعاملات أي تأثير معنوي على مساحة السطح للبيضة وصفات القشرة ووزن الألبيومين. تحسن دليل شكل البيضة بواسطة البابونج (1.5 جرام) بالمقارنة مع بقية المعاملات باستثناء البابونج + الكركم التي سجلت اقل قيمة معنوية لدليل شكل البيضة. أثرت إضافة الاعشاب إلى عليقة البياض سلبيا على دليل الصفار. لم يكن هناك تأثير معنوي على التركيب الكيميائي لصفار البيض ، باستثناء نسبة المادة الجافة التي انخفضت معنويا بإضافة البابونج + الكركم إلى العليقة. من هذه الدراسة يمكن الأستنتاج أن البابونج ، الكركم أو مزيجهما كإضافة غذائية إلى عليقة الدجاج البياض لهم تأثير إيجابي على الأداء الإنتاجي ولون الصفار. ومع ذلك ، كان التأثير على جودة البيض غير متناسق.