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Influence of Paprika Extract Supplement on Egg Quality of Laying Hens Fed Wheat-Based Diet

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Abstract: This study was conducted to evaluate the effect of paprika extract (PE) on egg performance and egg quality of laying hens. A total of 960 fifty-three wk-old laying hens were randomly allotted into five groups and each of six replicates with 32 birds. The birds were fed wheat-soybean meal-based diets supplemented with 0, 0.1%, 0.2%, 0.4% and 0.8% PE respectively. The experiment lasted 4 weeks. RFC value linearly increased with an increase in dietary PE ($P < 0.01$) and achieved 9.9 when dietary PE added by 0.8%. L* value of egg yolk decreased with increase in dietary PE ($P < 0.05$), The a* value linearly increased with an increase in dietary PE ($P < 0.01$), while b* value unaffected ($P<0.05$). There were no effect of dietary PE on Haugh unit and cholesterol content in yolk ($P<0.05$). However, carotenoid content in yolk linearly increased with an increase in dietary PE ($P < 0.01$). No differences were observed in egg size, laying rate, feed intake and feed conversion among dietary treatments ($P<0.05$). The results indicated supplementation of paprika extract significantly improved egg yolk color when hens fed wheat-based diet and yolk coloration could reach an ideal grade when paprika extract added by 0.8%.

Key words: Paprika extract, yolk coloration, laying hen

Introduction

Yolk color has traditionally been considered as important characteristics of egg quality. Consumers customarily tend to associate golden yellow or orange yolk with good health (Brufau, 1997). Researches undergone had also demonstrated that carotenoid, especially lutein and zeaxanthin, play an important role in human health for preventing certain eye disorders or other diseases. The most effective prevention to date is increasing our intake of lutein, which accumulates in the macular region of the eye and seems to aid in prevention of such blindness. Lutein and zeaxanthin are able to absorb blue light to strike the retina, which is thought to initiate degeneration of the delicate surface membrane (Landrum and Bone, 2001). Lutein may also play a role as an antioxidant in macular surface membranes (Rapp *et al*., 2000). Lutein and zeaxanthin seem to be preferentially deposited in the retina, unlike â-carotene, which shows limited accumulation in the retina, despite being the most common xanthophyll pigment in our diets (Landrum and Bone, 2001). Landrum *et al*. (1997) showed that the optical density of the macular pigment increased by 30% in humans supplemented with lutein, which equates to a 40% reduction in blue light reaching the retina. Moeller *et al*. (2000) suggested that xanthophyll intake might also influence on development of cataracts. Eggs, although not normally the richest source of pigments, contain highly available and stable pigments that could be of important in preventing cataract and macular degeneration.

Although eggs normally contain 0.3 to 0.5 mg of total xanthophylls, it is just as over half precent as lutein (Steinberg *et al*., 2000). As with most fats and fat-soluble compounds, the composition of the egg is strongly responsive to manipulation of such nutrients in the layer diet, which not only depends on the level of pigmenting substances providing in the feeds, but also on the type and ratio of these compounds. Because wheat, if as feedstuff, not contain pigment, so laying hens diet should be supplemented with pigments by using synthetic or natural pigments in order to achieve an acceptable yolk coloration. However, With increasing concern for food quality and safety derived from animal products, there has been a marked trend toward the use of natural pigments in animal nutrition over the last decade, of which paprika (*Capsicum annuum*) is an ideal natural source of pigments, which has high levels of lutein and carotenoid. There is limited information available for the impact of paprika pigments addition in wheat-based diet of layers, so this study was conducted to evaluate the effect of paprika extract (PE) on egg performance and egg quality of laying hens in wheat-based diet.

Materials and Methods

Animals: A total of 960 fifty-three wk-old Lohmann commercial laying hens were randomly allotted into five groups and each of six replicates with 32 birds. All birds were reared in cages, provided feed and water *ad libitum* and managed according to guidelines approved by Lohmann Farm Ltd. The experimental diets were based on wheat-soybean meal and formulated to

Table1: Effect of paprika extract (PE) on yolk color of eggs[1]

PE (%)	RYCF value	L* value	a* value	b* value
0	1.7^{A}±0.6	53.13^{a}±2.7	0.73^{A}±0.52	34.24^{a}±1.67
0.1	3.7^{B}±0.8	50.49^{b}±1.56	2.26^{B}±0.92	34.78^{a}±1.91
0.2	5.7^{C}±1.2	49.91^{bc}±1.40	4.79^{C}±1.28	34.88^{a}±1.54
0.4	7.3^{D}±1.4	49.32^{c}±1.30	9.30^{D}±2.04	35.68^{a}±1.71
0.8	9.9^{E}±1.3	45.90^{d}±1.37	15.02^{E}±2.30	35.10^{a}±2.61

[1]Values in same column with no common superscript differ significant ($P < 0.05$ or $P < 0.01$).

Table 2: Effect of paprika extract (PE) on egg quality of laying hens[1]

PE(%)	Haugh unit	carotenoid (mg/g)	cholesterol (mg/g)
0	58.22^{a}±11.95	3.43^{A}±0.02	9.17^{a}±0.18
0.1	55.44^{a}±13.03	7.70^{B}±0.09	9.07^{a}±0.23
0.2	60.18^{a}±13.92	10.87^{C}±0.10	9.42^{a}±0.45
0.4	57.67^{a}±9.64	14.60^{D}±0.05	9.11^{a}±0.26
0.8	56.38^{a}±9.69	16.83^{E}±0.04	8.94^{a}±0.52

[1]Values in same column with no common superscript differ significant ($P < 0.05$ or $P < 0.01$).

Table3: Effect of paprika extract (PE) on egg performance of laying hens[1]

PE (%)	Egg size (g)	Laying rate (%)	Feed intake (g/d, bird)	Feed conversion
0	60.7^{a}±4.4	77.07^{a}±73.94	120.29^{a}±2.55	0.40^{a}±0.06
0.1	61.2^{a}±3.1	76.24^{a}±4.29	116.30^{a}±3.64	0.40^{a}±0.06
0.2	62.6^{a}±4.0	76.75^{a}±4.95	121.35^{a}±6.53	0.39^{a}±0.02
0.4	60.8^{a}±3.8	75.69^{a}±5.43	119.29^{a}±2.93	0.38^{a}±0.04
0.8	61.1^{a}±4.2	75.00^{a}±5.11	118.94^{a}±5.71	0.38^{a}±0.05

[1]Values in same column with no common superscript differ significant ($P < 0.05$ or $P < 0.01$).

meet NRC requirements (NRC, 1994) and supplemented with 0, 0.1%, 0.2%, 0.4% and 0.8% PE (carotenoid: 2.5 g/kg) respectively. The experiment lasted 4 weeks.

Sample collection: At the end of 4 weeks, ten of eggs from each treatment were collected and stored at 4°C for analysis of egg quality.

Haugh unit measurement: Albumen height were measured by using FHK FUJIHIRA meter (FHK FUJIHIRA INDUSTRY CO. LTD.) and Haugh units calculated in eggs.

Color measurement: Yolk color was determined by using the RYCF, a subjective method, and by means of a WSC-S colorimeter and expressed as color *L**-(lightness), *a**-(redness) and *b**-(yellowness) values.

Chemical analysis: Analysis of carotenoid and cholesterol content in yolk were performed in accordance with standards of the Association of Official Analytical Chemists (AOAC, 1990).

Statistical analysis: All results obtained in this study were subjected to statistically analyze by using Statistical Analysis Systems (SAS, 1989).

Results and Discussion

The effect of paprika extract (PE) on yolk color of eggs was placed in Table 1. RFC value linearly increased with an increase in dietary PE ($P < 0.01$) and achieved 9.9 when dietary PE added by 0.8%. This result is similar to the results of previous studies by Shu-Mei Lai (1996) and Maricela *et al.* (1999). L* value of egg yolk decreased with increase in dietary PE ($P < 0.05$), which is agreed with report of Maricela *et al.* (1999). The a* value linearly increased with an increase in dietary PE ($P < 0.01$), while b* value unaffected ($P<0.05$). Maricela *et al.* (1999) demonstrated that there is a positive correlation between a* value and RFC value, which indicated red carotenoid plays a main role in coloration of egg yolk.

The effect of PE on egg quality of laying hens was showed in Table 2. There were no effect of dietary PE on Haugh unit and cholesterol content in yolk ($P<0.05$). However, carotenoid content in yolk linearly increased with an increase in dietary PE ($P < 0.01$).

The effect of PE on egg performance of laying hens was placed in Table 3. There were no differences in egg size, laying rate, feed intake and feed conversion in dietary treatments ($P<0.05$). This result is in accord with previous report (Mackay *et al.*, 1963).

In conclusion, present study indicated that supplementation of paprika extract significantly improved egg yolk color of laying hens fed wheat-based diet and yolk coloration could reach an ideal grade when dietary paprika extract added by 0.8%.

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