

Effects of Dry Tomato Pulp on Egg Yolk Pigmentation and Some Egg Yield Characteristics of Laying Hens

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Abstract: The objective of this experiment was to determine the effects of dry tomato pulp on egg yolk pigmentation and some egg yield characteristics of laying hens. A total number of 75 Lohman brown layers, with 36 week old of age at the beginning of the experiment, was distributed in a completely randomized experimental design into 5 treatments, with three replicates of 5 hens each. Dry tomato pulp had a significant effect on the Final Body Weight (FBW), Feed Intake (FI) and Feed Conversion Ratio (FCR) whereas dry tomato pulp has no significant effect on the egg yield. Dry tomato pulp had a significant effect on the egg weight and egg shape index whereas dry tomato pulp had no significant effect on shell weight, shell thickness and shell strength. Dry tomato pulp had a significant effect on egg yolk index and roche color fan value whereas dry tomato pulp had no significant effect on the egg yolk weight, albumen index and haugh unite. Dry tomato pulp had a significant effect on lycopene and beta-caroten contents of egg yolk. As a conclusion dry tomato pulp had a significant effect on the internal and external egg quality characteristics. Dry tomato pulp up to 20% can be used in laying hen diets.

Key words: Laying hen, egg yolk pigmentation, tomato pulp, lycopene, beta-caroten, internal egg characteristics, external egg characteristics

INTRODUCTION

It is well established that the egg yolk color is one of the very important factors for marketing in many countries. Recently some feed additives and ingredients have been used to manipulate and obtain for the requested level of pigmentation in egg yolk color (Santos-Bocanegra *et al.*, 2004; Samli *et al.*, 2005; Hasin *et al.*, 2006; Jafari *et al.*, 2006; Nobakht and Safamehr, 2007).

The dry tomato pulp is the one of the feed ingredient, which has been widely used to manipulate the pigmentation in egg yolk color of laying hens. It was also suggested that dry tomato pomace can be used as a protein source due to high protein content (Elloitt *et al.*, 1981).

However, the information about the effects of dry tomato pulp on egg yolk pigmentation and some egg yield characteristics of laying hens is still limited. Therefore, the objective of this experiment was to determine the effects of dry tomato pulp on egg yolk pigmentation and some egg yield characteristics of laying hens.

MATERIALS AND METHODS

A total number of 75 Lohman white layers, with 40 weeks old of age at the beginning of the experiment, was distributed in a completely randomized experimental design into five treatments with three replicates of 5 hens each. Birds received water and experimental diets (Table 1) *ad-libitum* during the experimental period.

The performance characteristics of laying hens (feed intake, feed conversion ratio and egg yield), egg internal qualities (egg yolk weight, albumen index, egg yolk index, haugh unite, roche color value), eggs external quality (egg weight, shell weight, shell strength, eggshell thickness and egg shape) were determined.

Statistical analysis: One-way Analysis of Variance (ANOVA) was carried out to compare performance characteristics, egg internal qualities and eggs external qualities of egg using General Linear Model of Statistica for Windows. Significance between individual means was identified using the Duncan multiple range test. Mean differences were considered significant at $p < 0.05$.

Table 1: Ingredients and chemical composition of experimental diets (as fed basis)

| Ingredients (g kg ⁻¹) | Diets | | | | |
|---|-------|-------|-------|-------|-------|
| | I | II | III | IV | V |
| Maize | 441 | 441 | 441 | 440 | 440 |
| Barley | 105 | 105 | 68.1 | 43 | 18 |
| Dry tomato pulp | 0 | 0 | 100 | 150 | 200 |
| Soybean meal | 221 | 221 | 209 | 201 | 196 |
| Wheat bran | 98.8 | 98.8 | 44 | 25 | 0 |
| DL-metionin | 0.7 | 0.7 | 0.8 | 1 | 1 |
| L-lizin | 0 | 0 | 0.9 | 1.5 | 2 |
| Soybean oil | 33 | 33 | 36 | 39 | 42 |
| DCP | 13 | 13 | 14.7 | 15 | 16.5 |
| CaCO ₃ | 83 | 83 | 81 | 80 | 80 |
| NaCl | 2 | 2 | 2 | 2 | 2 |
| Vitamin + Mineral premiksi | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| Carophyll red (canthaxanthin) mg | 15000 | 15000 | 0 | 0 | 0 |
| Carophyll yellow (apo-carotenoic acid ester) mg | 0 | 500 | 0 | 0 | 0 |
| Toplam miktar (g) | 1000 | 1000 | 1000 | 1000 | 1000 |
| Composition (%) | | | | | |
| Dry matter | 91.27 | 91.63 | 90.9 | 91.56 | 91.45 |
| Crude protein | 16.80 | 16.80 | 16.80 | 16.80 | 16.80 |
| Ether extract | 5.59 | 5.59 | 6.64 | 8.00 | 7.93 |
| Crude ash | 12.4 | 13.2 | 13.3 | 14.4 | 14.5 |
| Starch | 35.37 | 35.37 | 33.02 | 30.20 | 30.17 |
| Water soluble sugar | 3.48 | 3.48 | 3.72 | 3.75 | 3.98 |
| Crude fiber | 3.8 | 3.8 | 5.8 | 6.9 | 8.4 |
| Calcium | 3.35 | 3.36 | 3.50 | 3.45 | 3.35 |
| Total phosorus, | 0.59 | 0.61 | 0.66 | 0.60 | 0.62 |
| Metabolic energy (MJ) | 10.87 | 10.88 | 10.87 | 10.87 | 10.88 |

*Vitamin premix (per 2.5 kg): 12,000,000 I.U. vitamin A, 2,400,000 I.U. vitamin D₃, 30,000 mg vitamin E, 2500 mg vitamin K₃, 3 000 mg vitamin B₁, 7000 mg vitamin B₂, 40,000 mg niacin, 8000 mg calcium-d-pantothenate, 4000 mg vitamin B₆, 15 mg vitamin B₁₂, 1000 mg folic acid, 45 mg d-biotin, 1500 mg canthaxantin, 500 mg apocarotenoic asit ester, 125,000 mg colin chloride, 50,000 mg vitamin C, 80,000 mg manganez, 80,000 mg Iron 60,000 mg zinc, 8000 mg cupper, 200 mg cobalt, 500 mg iod, 150 mg selenium ve 10000 mg antioxidant

Table 2: The effects of dry tomato pulp on hen performance of laying hens

| Parameters | Diets | | | | |
|---------------|----------------------------|----------------------------|-----------------------------|-----------------------------|----------------------------|
| | I | II | III | IV | V |
| FBW | 1861.33±14.08 ^a | 1851.00±26.58 ^a | 1918.67±14.68 ^{bc} | 1969.67±15.76 ^{ab} | 1993.00±32.01 ^a |
| FI | 118±0.58 ^c | 117±0.01 ^c | 122±0.58 ^b | 127±0.58 ^a | 125.7±0.88 ^a |
| FCR | 1.85±0.03 ^c | 1.97±0.01 ^{ab} | 1.91±0.05 ^{bc} | 2.05±0.00 ^a | 1.92±0.04 ^{bc} |
| Egg yield (%) | 91.33±0.33 | 91.00±0.00 | 92.00±0.58 | 90.67±0.33 | 90.67±0.33 |

^{abc}Row means with common superscript do not differ (p>0.05), FBW: Final Body Weight (g); FI: Feed Intake (g/bird/day); FCR: Feed Conversion Ratio (g feed/egg weight)

RESULTS AND DISCUSSION

The effects of dry tomato pulp on hen performance of laying hens are given in Table 2. As can be shown from Table 1 dry tomato pulp had a significant effect on the FBW, FI and FCR, whereas dry tomato pulp has no significant effect on the egg yield.

FCR and egg yield obtained in the current experiment is considerably lower than that obtained by Nobakht and Safamehr (2007) but consistent with finding of Jafari *et al.* (2006).

The effects of dry tomato pulp on external egg characteristics of laying hens are given in Table 3. As can be shown from Table 3 dry tomato pulp had a significant effect on the egg weight and egg shape index whereas dry tomato pulp had no significant effect on shell weight, shell thickness and shell strength.

The feed intake, egg weight and shell weight obtained in the current experiment is considerably higher than Jafari *et al.* (2006) but consistent with finding of Nobakht and Safamehr (2007). The shell thickness obtained in current experiment was comparable with findings of Jafari *et al.* (2006) and Nobakht and Safamehr (2007).

The effects of dry tomato pulp on internal egg characteristics of laying hens are given in Table 4. As can be shown from Table 4 dry tomato pulp had a significant effect on egg yolk index and roche color fan value whereas dry tomato pulp had no significant effect on the egg yolk weight, albumen index and haugh unite. The haugh unite obtained in the current experiment is considerably lower than that obtained by Jafari *et al.* (2006). The roche color fan value obtained in the current experiment was considerably higher than that obtained by Jafari *et al.* (2006).

Table 3: The effects of dry tomato pulp on external egg characteristics of laying hens

| Parameters | Diets | | | | |
|---------------------------------------|--------------------------|-------------------------|--------------------------|--------------------------|-------------------------|
| | I | II | III | IV | V |
| Egg weight (g) | 64.53±0.34 ^{ab} | 60.57±0.38 ^c | 64.63±1.56 ^{ab} | 62.70±0.26 ^{bc} | 65.97±1.32 ^a |
| Shell weight (g) | 7.84±0.10 | 7.80±0.20 | 8.16±0.06 | 7.67±0.22 | 7.71±0.14 |
| Shell thickness (mm) | 0.37±0.00 | 0.37±0.00 | 0.37±0.00 | 0.37±0.00 | 0.36±0.00 |
| Shell strength (kg cm ⁻²) | 1.13±0.15 | 0.95±0.08 | 1.25±0.08 | 1.35±0.19 | 1.20±0.05 |
| Egg shape index (%) | 77.84±0.15 ^a | 76.50±0.29 ^b | 77.74±0.28 ^a | 77.64±0.23 ^a | 78.18±0.54 ^a |

Table 4: The effects of dry tomato pulp on internal egg characteristics of laying hens

| Parameters | Diets | | | | |
|-----------------------|--------------------------|--------------------------|-------------------------|-------------------------|-------------------------|
| | I | II | III | IV | V |
| Egg yolk weight (g) | 16.49±0.20 | 15.94±0.37 | 16.52±0.07 | 16.63±0.26 | 16.79±0.43 |
| Albumen index (%) | 8.00±0.33 | 7.93±0.08 | 8.33±0.30 | 7.89±0.21 | 7.64±0.41 |
| Egg yolk index (%) | 43.46±0.20 ^{ab} | 42.65±0.12 ^{bc} | 43.97±0.26 ^a | 42.19±0.12 ^c | 43.09±0.46 ^b |
| Haugh unite | 79.75±1.24 | 79.19±1.97 | 80.06±0.99 | 78.57±0.93 | 76.67±2.01 |
| Roche color fan value | 9.00±0.00 ^f | 9.52±0.05 ^b | 8.90±0.05 ^c | 8.42±0.08 ^d | 9.85±0.08 ^a |

Table 5: The effects of dry tomato pulp on Likopen and β-caroten contents of egg yolk (mg/100 g)

| Parameters | Diets | | | | |
|------------|------------------------|-------------------------|-------------------------|-------------------------|------------------------|
| | I | II | III | IV | V |
| Likopen | 0.0 | 0.0 | 1.17±0.07 ^b | 1.29±0.01 ^{ab} | 1.53±0.21 ^a |
| β-caroten | 0.14±0.01 ^b | 0.16±0.04 ^{ab} | 0.17±0.03 ^{ab} | 0.20±0.05 ^{ab} | 0.22±0.03 ^a |

^{abc}Row means with common superscript do not differ (p>0.05)

The effects of dry tomato pulp on Likopen and β-caroten contents of egg yol were given in Table 5. As can be shown from dry tomato pulp had a significant effect on likopen and beta-caroten contents of egg yolk.

CONCLUSION

As a conclusion dry tomato pulp had a significant effect on the internal and external egg quality characteristics. Dry tomato pulp up to 20% can be used in laying hen diets without any adverse effects.

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