Plant Archives Volume 20 No. 2, 2020 pp. 7277-7281 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

THE EFFECT OF DIFFERENT SOURCES AND LEVEL OF NATURAL PIGMENTS IN THE LAYER DIET UPON SOME EXTERNAL AND INTERNAL QUALITY EGG TRAITS

Susan Adil Sadeq, Mohammed S. Baha Aldeen and Chrow A. Khurshid

College of Agriculture, University of Kirkuk, Kirkuk- Iraq.

Abstract

This study aimed to investigate the effect of different sources and level of natural pigments in the layer diet upon some external and internal quality parameters for the egg, 108 layers at 27 weeks old were fed with 60 days and the birds were house in the battery system. The nutritional treatements were basic diet free from any source of natural pigments (control treatment). T_2: basic diet supplemented with 1% dried carrot powder. T_3: basic diet supplemented with 2% dried carrot powder. T_4: basic diet supplemented with 0.40% Yellow turmeric powder. T_5: basic diet supplemented with 0.80% yellow turmeric powder. T_6: basic diet supplemented with 1% sweet red pepper powder. T_7: basic diet supplemented with 2% sweet red pepper powder. T_8: basic diet supplemented with 0.40% safflower powder and last treatment was (T_9): basic diet supplemented with 0.80% safflower powder. No significant differences recorded among egg treatements for the surface area, shape index, yolk height and yolk index, on other hand there were significant differences ($P<0.05$) among the treatements for specific gravity, percentage of shell, shell thickness, yolk diameter, yolk weight, yolk color, albumen height, albumen diameter, albumen index, albumen weight and haugh unit.

Key words : natural pigments, layer diet, egg traits.

Introduction

The main objective of poultry raising is to provide high-value food sources, as well as to benefit from poultry in converting many substances that are not suitable for human consumption into materials with high nutritional value (Shawi '2003). The degree of egg yolk color is an important criterion in the consumption of table eggs and also in the manufacture of food products that contain eggs (Rowghani et al. 2006). The color of the albumen yolk most preferred ranges between golden yellow and orange (Chowdhury *et al.,* 2008) by region of the world. European consumers like Germany, the Netherlands, Spain and Belgium seem to prefer dark orange, northern France, southern England, and Finland prefer the medium between golden yellow and orange (Alay and Karadas' 2017). There are more than 750 carotene dye known in the natural and that chickens use these Pigments to color the egg yolks and skin, as well as the fats deposited in the body, and these Pigments are found in abundant quantities in green fodder (Yassin and Abdel-Abbas '2010). Bartov and Bornsteins (1980) reported that chickens are unable to collect color Pigments and can only precipitate about 20 to 60% of the food Pigments eaten into egg yolk. Therefore, the intensity of the egg yolk color depends directly on the feed content of carotenoids (Hernandez et al. 2005). The use of natural Pigments has increased significantly due to consumer preference and legal restrictions in countries that prohibit the addition of artificial coloring sources in poultry feed which may have carcinogenic effects on consumers (Oktay *et al.,* 1972). And Fletcher (1981) indicated the need to provide pigments that generate yellow and red colors in a ratio of 1: 6 in the forage mixture of laying hens to obtain the appropriate color for the yolks. Carrot from the plant is considered rich in carotenoids. Studies have shown that the presence of beta and alpha A'B carotene in the blood has protective action against atherosclerosis (Nocoll *et*

Author for correspondence : E-mail: nazilgulum314@gmail.com

al., 2003). Municipal safflower contains two pigments that generate yellow (Crocin and Canthaxanthin) and one that generates orange (Zeaxanthin). Turmeric contains a colored substance and it gives the yellow color of turmeric (Eigner and Scholz '1999) and contains active compounds such as non-volatile coloring agent called Curcuminoi) which contains a yellow phenol dye called curcumin (Jayaprakasha *et al.,* 2005). Also, red pepper contains good coloring sources and is widely cultivated all over the world (AI-Kassie *et al.,* 2011). Red pepper contains small amounts of red pigments and relatively large amounts of yellow carotenoids that are easily transferred to egg yolks and thus enhance the intensity of the color yellow (Gonzalez *et al.,* 1999). Capsanthin is the main pigment in red pepper (Minguez-mosquera, 1993) and red pepper fruits have two types of tinctures: (Capsanthin) and Ketocarotenoid (Capsaicin). The two types are fat-soluble (Lipo soluble) and are represented in the liver (Gonzalez *et al.,* 1999) These compounds give the dark color to the egg yolk (Kirkpinar '1996). This study was conducted to show the effect of adding different sources and levels of natural Pigments in the diet on the specific characteristics of laying hens eggs.

Materials and Methods

This study was conducted in the poultry field of the Animal Production Department / agriculture College / Kirkuk University. For the period from 13/10/2019 to 13/ 12/2019. Randomly 108 ISA BROWN layers at 27 weeks old distributed to nine nutritional treatment which were T_1: basic diet (control) treatment. T_2: basic diet supplemented with 1% dried carrot powder. T_3: basic diet supplemented with 2% dried carrot powder. T_4: basic diet supplemented with 0.40% Yellow turmeric powder. T_5: basic diet supplemented with 0.80% yellow turmeric powder. T_6: basic diet supplemented with 1% sweet red pepper powder. T_7: basic diet supplemented with 2% sweet red pepper powder. T_8: basic diet supplemented with 0.40% safflower powder. T_9: basic diet supplemented with 0.80% safflower powder. The birds housed in cages with dimensions (40 x 45 x 48) in the battery system and two layers for each cage (replicate). The feed and water supply as free for the birds during the experiment period and the daily lighting system were 16 hours light with ingredients for the experimental diets were shown in the (Table 1). The traits were recorded each 15 days. The experiment was arranged in a completely randomized design. Statistical analyzed by

Table 1: Shows the composition of the feed for the experiment.

Ingredients	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
Yellow corn	52	52	52	52	52	52	52	52	52
Wheat	12.36	11.12	9.05	11.12	9.05	11.96	11.56	11.96	11.56
Soybean meal	20.63	20.86	21.34	20.87	21.34	20.63	20.63	20.63	20.63
Oil	2.70	2.70	3.30	2.70	3.30	2.70	2.70	2.70	2.70
Limestone	9.26	9.26	9.26	9.26	9.26	9.26	9.26	9.26	9.26
Salt	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Dicalcium phosphate	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Methionine	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Lysine	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Choline chloride	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vitamin mix	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Dried carrot powder		1	2						
Yellow turmeric powder				0.40	0.80				
Sweet Red Pepper Powder						1	2		
Safflower powder								0.40	0.80
Total	100	100	100	100	100	100	100	100	100
Chemical composition									
E.M, kcal kg- 1	2889.28	2817.66	2857.71	2856.6	2857.71	2876.88	2864.48	2876.88	2864.48
Crude protein (%)	16.1372	16.0864	16.0477	16.0912	16.0477	16.0852	16.0332	16.0852	16.0332
Methionine %	0.427462	0.42628	0.424913	0.42346	0.424913	0.426622	0.425782	0.426622	0.425782
Lysine %	0.915879	0.917478	0.922731	0.917747	0.922731	0.914399	0.912919	0.914399	0.912919
Calcium%	4.0468	4.0468	4.0468	4.0468	4.0468	4.0468	4.0468	4.0468	4.0468
Phosphorus%	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396

Table 2: The effect of different sources and level of natural pigments in the layer upon some external.

Transactions	Egg Surface Area	Shape Index	Specific gravity	Percentage of Shell	Shell thickness
T_1	93.68±1.01	80.80±2.13	1.103±0.03bc	±12.920.52bc	0.40±0.01ab
T_2	94.39±1.49	77.30±1.32	1.106±0.02b	±13.450.39b	0.39±0.05ab
T_3	93.73±0.83	77.04±0.69	1.104±0.01bc	0.32±13.10bc	0.38±0.09b
T_4	95.73±2.47	77.41±1.65	1.101±0.01bc	±12.650.23bc	0.41±0.05a
T_5	93.39±1.17	79.04±0.64	1.104±0.01bc	0.32±13.10bc	0.38±0.01ab
T_6	94.65±1.66	77.28±1.14	1.122±0.01a	0.62±16.01a	0.40±0.04ab
T_7	93.52±1.69	80.82±2.17	1.101±0.03bc	±12.580.54bc	0.39±0.07ab
T_8	96.55±1.94	78.30±0.68	1.097±0.01c	0.35±11.99c	0.40±0.01ab
T_9	93.08±2.09	78.24±1.43	1.105±0.01bc	±13.280.35bc	0.39±0.06ab

The different letters within one column indicate the presence of significant differences at the probability level (P <0.05).
T_1: (control) 'T_2: (1% powdered carrot powder)' T_3: (2% powdered carrot powder) T_4: (0.40% yellow turmeric) 'T_5: (0.80% yellow turmeric)' T_6: (1% sweet red pepper powder) 'T_7: (2% sweet red pepper powder)' T_8: (0.40% safflower powder) 'T_9: (0.80% safflower powder).

Table 3: The effect of different sources and levels of natural pigments in the internal characteristics.

Transactions	Yolk Height	Yolk Diameter	Yolk Weight	Yolk Index	Yolk color
T_1	±17.090.41	±38.840.61ab	±16.770.39ab	0.94±44.14	±6.040.29cde
T_2	±17.130.48	±39.040.33ab	±16.390.19ab	±44.101.39	0.30±6.12cde
T_3	0.48±16.61	0.54±38.40ab	±16.540.28ab	0.31±43.29	0.31±6.62cd
T_4	±16.230.28	±38.890.62ab	±16.690.49ab	±41.690.68	±6.370.22cd
T_5	±16.760.34	±38.760.53ab	±16.670.47ab	±43.350.99	±5.870.36de
T_6	0.31±17.34	0.74±39.10ab	±15.270.52b	44.53±0.10	±8.200.29b
T_7	±17.140.12	±37.260.83b	±17.120.54ab	±45.290.57	±12.290.19a
T_8	±16.750.30	±46.067.28a	±16.240.29b	2.02±41.93	±6.870.22c
T_9	±16.480.13	±37.650.27b	±18.161.28a	±43.800.47	±5.370.15e

The different letters within one column indicate the presence of significant differences at the probability level (P <0.05).
T_1: (control) 'T_2: (1% powdered carrot powder)' T_3: t (2% powdered carrot powder) T_4: (0.40% yellow turmeric) 'T_5: (0.80% yellow turmeric)' T_6: (1% sweet red pepper powder) 'T_7: (2% sweet red pepper powder)' T_8: (0.40% safflower powder) 'T_9: (0.80% safflower powder).

Table 4: The effect of different sources and levels of natural pigments in the internal characteristics.

Transactions	Albumen Height	Albumen Diameter	Albumen Index	Albumen Weight	Haugh Unit
T_1	±6.880.21a	±74.050.16b	9.34±0.38a	0.58±41.16ab	79.97±1.19a
T_2	0.27±5.36c	0.18±85.12a	6.34±0.38c	±41.81ab	67.49±2.87c
T_3	±5.820.26bc	±79.281.04ab	7.47±0.40bc	0.65±41.32ab	71.62±2.20bc
T_4	±5.620.29c	±80.971.97a	7.11±0.48bc	±43.231.79ab	69.09±3.33c
T_5	±5.420.39c	±84.511.91a	6.51±0.59c	±40.950.81ab	67.83±3.59c
T_6	0.41±6.03abc	±82.423.90a	7.86±0.96abc	±39.481.42b	72.09±3.30abc
T_7	±5.530.26c	±82.480.38a	6.94±0.53bc	±40.911.61ab	2.57±68.69±c
T_8	±6.700.14ab	±81.411.13a	8.34±0.23ab	1.70±44.80a	77.63±0.98ab
T_9	±6.300.43abc	±80.401.41a	7.95±0.61abc	±40.591.96ab	75.86±2.59abc

The different letters within one column indicate the presence of significant differences at the probability level (P <0.05).
T_1: (control) 'T_2: (1% powdered carrot powder)' T_3: (2% powdered carrot powder) T_4: (0.40% yellow turmeric) 'T_5: (0.80% yellow turmeric)' T_6: (1% sweet red pepper powder) 'T_7: (2% sweet red pepper powder)' T_8: (0.40% safflower powder) 'T_9: treatment(0.80% safflower powder).

using the General Linear Model procedure of SAS institute (2005). The Duncan·s Multiple Range Test at 5% probability(Steel and Torrie,1980).

Results and Discussion

No significant differences (P <0.05) founded in the table 2 for egg surface area and shape index among the treatments. While the value of specific gravity and shell percentage for the T_6 significantly (P <0.05) batter than the an there treatments and the average of the egg Shell thickness for the T_4 layers was significantly higher than T_3.

T_1: (control) 'T_2: (1% powdered carrot powder)' T_3: (2% powdered carrot powder) T_4: (0.40% yellow turmeric) 'T_5: (0.80% yellow turmeric)' T_6: (1% sweet red pepper powder) 'T_7: (2% sweet red pepper powder)' T_8: (0.40% safflower powder) 'T_9: (0.80% safflower powder).

Results in table 2 indicate that there were no significate differences (P <0.05) among treatment for the yolk height and yolk index, while the value of the yolk diameter (mm) for the egg of the T_8 layers significantly better than T_7 and T_9 and the yolk weight (gms) for the T_9 layers were significantly (P<0.05) higher then T_6 and T_8. The yolk color value for the egg of the layers fed diet contained 2% sweet red pepper powder (T_7) was significantly (P<0.05) better than another treatements table 3 and the reason on that due to high contains of the sweet red peppers form Beta-apo-8-carotenoid acid ester, which is causes the darkness of the yellow color in the egg yolk (Kirkpinar, 1996). Li *et al.,* (2012) clarify that fine grinding in the form of a powder leads to shattering the cell wall and increasing the surface area and increases the ability of laying hens to reach the red pigments present in red pepper powder, which facilitates their absorption and incorporation with egg yolk.

T_1: (control) 'T_2: (1% powdered carrot powder)' T_3: (2% powdered carrot powder) T_4: (0.40% yellow turmeric) 'T_5: (0.80% yellow turmeric)' T_6: (1% sweet red pepper powder) 'T_7: (2% sweet red pepper powder)' T_8: (0.40% safflower powder) 'T_9: (0.80% safflower powder).

The average of the albumen height (mm) was significantly (P<0.05) higher for the T_1 layers than T_2, T_3, T_4, T_5 and T_7 layers, while the albumen diameter (mm) for layers of T_2, T_4, T_5, T_6, T_7, T_8 and T_9 significantly (P<0.05) better than T_1 layers. The albumen index average for the layers control group (T_1) significantly (P<0.05) higher then T_2, T_3, T_4, T_5 and T_6. On other hand the value of the albumen weight (gms) for the T_8 birds was significantly (P<0.05) bigger the T_6 birds, haugh unit average for the T_1 egg was significantly (P<0.05) higher the T_2, T_3, T_4, T_5 and T_6.

T_1: (control) 'T_2: (1% powdered carrot powder)' T_3: (2% powdered carrot powder) T_4: (0.40% yellow turmeric) 'T_5: (0.80% yellow turmeric)' T_6: (1% sweet red pepper powder) 'T_7: (2% sweet red pepper powder)' T_8: (0.40% safflower powder) 'T_9: treatment (0.80% safflower powder).

Conclusions

The best value of the yolk color was produced by feeding the layers (ISA Brown) with basic diet supplemented with 2% sweet red pepper powder.

References

Al-Shawi, A.M.S. (2003). Age effect on qualitative and chemical composition in eggs of four strains of domesticated chicken. Master Thesis / College of Agriculture - University of Baghdad.

Al-Kassie, G.A.M., A.M.A. Mamdooh and J.A. Saba (2011). The effects of using hot red pepper as a diet supplement on some performance traits in broiler. *Pakistan J. Nutr*., **9:** 842-845.

Beevers, S. and S. Huang (2011). Pharmacological and clinical properties of curcumin. A review. Botanics: Targets Therapy, **1:** 5-18.

Bartov, I. and S. Bornsteins (1980). Studies on egg yolk pigmentation. Effect of ethoxiquin on xanthophyll within and among genetic sources poult. *Sci*., **59:**1460-1461.

Chowdhury, S.D., B.M. Hassin, S.C. Das, M.H. Ra-shid and A.J. Ferdaus (2008). Evaluation of marigold flower and orange skin as sources of xanthophyll pigment for the improvement of egg yolk color. *The Journal of Poultry Science*, **45(4):** 265-272.

Eigner, D. and D. Scholz (1999). Ferula asa-foetidaand Curcuma Longa in traditional medicinal treatment and diet in Nepal. *J. Ethhopharmacol.*, **67:** 1-6.

Fletcher, D.L. and R.H. Halloran (1981). An evaluation of a commercially available marigold concentrate and paprika oleoresin on egg yolk pigmentation poult. *Sci*., **60:** 1846-1854.

Gonzalez, M., E. Castano, E. Avila and E.G. Mejia (1989). Effect of capsaicin from red pepper (Capsicum sp) on the deposition of carotenoids in egg yolk. *J. Sci. Food Agric*., **79:** 1904-1908.

Hernandez, J.M., P.M. Beardswort and G. Weber (2005). Egg quality-meeting consumer expectations. *International Poultry Production*, **13(3):** 20–23.

Jayaprakash, G.K., L.J. Rao and K.K. Sakariah (2005). Antioxidant activities of curcumin, demethoxycurcumin and bisdemethoxycurcumin. *Food chem.*, **98:** 720-4.

Kirkpinar, F. and R. Erkek (1996). Beyaz misir ve bugday timeline dayali karma ilave edilen Bazi dogal ve sentetik Renk

maddelerinin yumurta sarirengi ve verim uzerine etkisi. *J. Vet. Anim. Sci*., **23:** 9-14.

Li, H., L. Jin, F. Wu, P. Thacker, X. Li, J. You, X. Wang, S. Liu, . Li5 and Y. Xu (2012). Effect of red pepper (Capsicum frutescens) Powder or Red Pepper Pigmenton the Performance and Egg Yolk Color of Laying Hens, **25(11):** 1605-1610.

Minguez-Mosquera, M.I. and D. Hornero-Mendez (1993). Separation and quantification of the carotenoid pigments in red peppers (*Capsicum Annuum* L.), paprika, and oleoresin by reversed-phase HPLC. *J. Agric. Food Chem*., **41(10):** 1616-1620.

Nocoll, C., N. Cardinault, O. Aprikian, J. Busserolles, P. Grolier, E. Rock, C. Demigne, A. Mazur, A. Scalbrt, P. Amouroux and C. Remesy (2003). Effect of carrot intake on cholesterol metabolism and antioxidant status in cholesterol fed rats. *Eur. J. Nutr.*, **42:** 254-261.

Oktay, E. and H. Olgun (1972). Klrmlzl biberin New-Hampshire tavuklarynda yu murta verimi, yumurta kalitesi ve kulucka verimine etkisi 4. Bilim kongresi. Lalahan, Ankara, 43-57.

Rowghani, E., A. Maddahian and M.A. Abousadi (2006). Effects of addition of marigold flower, safflower petals, and red pepper on egg-yolk color and egg production in laying hens. *Pakistan J. Biol. Sci*., **9:**1333-1337.

Yassin, A.A.K. and H.H.A. Mohamed (2010). Feed the domestic birds. First edition. Ministry of Higher Education and Scientific Research. Baghdad University. faculty of Agriculture.