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in

Brufau J. (ed.).
Feed manufacturing in the Mediterranean region. Improving safety: From feed to food

Zaragoza : CIHEAM
Cahiers Options Méditerranéennes; n. 54

2001
pages 173-175

Comparative bioefficacy of Lucantin® yellow in egg yolk pigmentation

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SUMMARY – An experiment was conducted in order to compare the bioefficacy of Lucantin® yellow and a Marigold-based yellow xanthophyll source for egg yolk pigmentation. One hundred and twenty hens of the Lohman LSL strain were used at 40 weeks of age. After a two-week adaptation period, they received two experimental diets: one contained 3.2 mg/kg apoester carotenoic acid provided in the form of Lucantin® yellow. The other contained 10 mg/kg of yellow xanthophylls provided by 500 mg/kg of a commercial product based on Marigold at 2%. The two diets contained 30 mg/kg Lucantin® red, which provided 3 mg/kg canthaxanthin, and no other xanthophyll source. Egg production was measured for 3 weeks and no differences between treatments were observed (P>0.1). At the end of the period, 12 eggs per replicate (48 eggs per treatment) were collected and egg yolk colour was determined by means of the BASF fan. No significant differences were observed (P>0.1) between the two xanthophyll sources as measured with the reference fan. These results suggest that a diet containing 30 mg/kg of Lucantin® red – with a content of active product of 3.2 mg/kg of apoester – results in an egg yolk pigmentation equivalent to that provided by 10 mg/kg of yellow xanthophylls supplied in the form of a Marigold-based product.

Key words: Chickens, abdominal fat, fatty acid profile, cholesterol.

RESUME – *"Bioefficacité comparative de Lucantin® jaune dans la pigmentation du jaune d'œuf". On a réalisé une expérience afin de comparer la bioefficacité de Lucantin® jaune et une source de xanthophylle jaune à base de Marigold pour la pigmentation du jaune d'œuf. 120 poules de race Lohman LSL et de 40 semaines d'âge ont été utilisées. Après une période d'adaptation de deux semaines, elles ont reçu deux rations expérimentales. Les rations contenaient 3,2 mg/kg d'apocarotène ester donné sous forme de Lucantin® jaune et 10 mg/kg de xanthophylles jaunes donnés en utilisant 500 mg/kg d'un produit commercial à base de Marigold à 2%. Les deux rations contenaient 30 mg/kg de Lucantin® rouge, qui apportait 3 mg/kg de canthaxanthine et aucune autre source de xanthophylle. La production d'œufs a été mesurée pendant trois semaines et on n'a observé aucune différence entre traitements (P>0,1). A la fin de la période, on a ramassé 12 œufs par répétition (48 œufs par traitement) et on a déterminé la couleur du jaune d'œuf en utilisant le ventilateur Basf. On n'a pas observé de différences significatives (P>0,1) entre les deux sources de xanthophylle mesurées avec le ventilateur de référence. Ces résultats suggèrent qu'une ration contenant 30 mg/kg de Lucantin® rouge – avec une teneur en produit actif de 3,2 mg/kg d'apoester – a pour résultat une pigmentation du jaune d'œuf équivalant à celle donnée par 10 mg/kg de xanthophylles jaunes donnés sous forme d'un produit à base de Marigold.*

Mots-clés : *Poulets, gras abdominal, profil des acides gras, cholestérol.*

Introduction

There are different sources of xanthophylls which can be used for egg yolk pigmentation. One is Marigold which is rich in yellow xanthophylls, mainly lutein and zeaxanthin (Karunajeewa *et al*., 1984). Another is the β-apo-8'-carotenoic acid ethyl ester (apoester) which has been isolated in maize (Baraud *et al*., 1959) and also synthesised (Isler *et al*., 1956). The objective of this experiment was to compare the bioefficacy of Lucantin® and a commercial pigment from Marigold in the pigmentation of egg yolks.

Materials and methods

Two hundred and forty laying hens of the Lohman LSL strain were used. They were 40 weeks old. They were housed in a battery room of the California type. The room had 80 cages distributed in two decks. One replicate was formed by 5 consecutive cages sharing a common feeder. There were 15 hens per replicate. They were fed a diet devoided of pigment for 2 weeks, followed by an experimental period of 3 weeks. There was a basal diet, based on barley and soybean meal and a level of xanthophylls of 10 mg/kg. The composition of the basal diet is shown in **¡Error!Argumento de modificador desconocido.**. Pigments were added to this diet according to the design shown in Table 2.

Table **¡Error!Argumento de modificador desconocido.**. Composition of the basal diet[†]

Ingredient (%)		Estimated nutrient content	
Wheat	12.894	Metabolizable energy (kcal/kg)	2750
Barley	34.432	Crude protein (%)	16.0
Sunflower oil	5.000	Methionine + cystine (%)	0.65
Manioc	15.000	Lysine (%)	0.84
Soybean meal, 47% protein	22.414	Calcium (%)	3.50
DL-methionine	0.156	Inorganic phosphorus (%)	0.34
Calcium carbonate	8.079	Total xanthophylls (mg/kg)	10
Dicalcium phosphate	1.296	Yellow xanthophylls (mg/kg)	10
Salt	0.329		
Mineral and vitamin premix	0.400		

[†]Per kg of feed: Vitamin A: 8000 UI; Vitamin D3: 1600 UI; Vitamin E: 5 mg; Vitamin K_3: 2 mg; Vitamin B_1: 1.5 mg; Vitamin B2: 4 mg; Vitamin B_6: 3 mg; Vitamin B12: 11.8 μg; Folic acid: 0.35 mg; Biotin: 150 μg; Calcium pantothenate: 10 mg; Nicotinic acid: 20 mg; Mn: 30 mg; Zn: 50 mg; I: 0.3 mg; Fe: 50 mg; Cu: 6 mg; Se: 0,1 mg; Ethoxyquin: 125 mg.

Table 2. Design for pigments added to the diet

Treatment	Aimed level of total yellow xanthophylls (mg/kg)	Lucantin® yellow (mg/kg)	Marigold pigment (mg/kg)	Lucantin® red (mg/kg)
T-1	10	*32*		30
T-2	10		500	30

Feed consumption, egg production and feed to gain were measured during the pre-experimental and experimental periods. At the end of the experimental period, three weeks after feeding the experimental diets, six eggs per replicate were collected on two consecutive days (total of 12 eggs per replicate, and 48 eggs per treatment) for colour evaluation with the BASF fan. Results were analysed as a randomised complete block design. Data were collected on two consecutive days, but a preliminary analysis of variance revealed that there were no effects of days. Consequently, data from each pen were pooled. The interaction block * treatment was used as the experimental error, because the pen was considered the experimental unit.

Results

Performance and egg yolk pigmentation is shown in Table 3. As expected, there were no significant differences between treatments for any of the parameters studied (P>0.10). **¡Error!Argumento de modificador desconocido.** is shown in Table 3. In addition, range of

pigmentation for each treatment, and frequency of each score is presented. There were no effects of source on pigmentation scores.

Table 3. Performance and egg yolk pigmentation

Treatment	Source	Level of xanthophylls	Rate of lay (eggs/d/100 hens)	Egg weight (g)	Feed conversion (g/g)	Pigmentation (Basf units)		
						Mean	Score	Freq.
T-1	Lucantin yellow	10	87.1	64.7	2.05	14.15	13 14 15	4 33 11
T-2	Marigold pigment	10	90.2	63.7	1.99	14.02	13 14 15	3 41 4
Pooled SEM†			*2.66*	*0.46*	*0.066*	*0.104*		
Source††			NS	NS	NS	0.343		

†Mean of four replicates of 12 eggs.
††NS = Not significant P>0.10

Conclusion

Results of this experiment suggest that yellow xanthophylls from Lucantin yellow and Marigold give the same level of pigmentation in a basal diet containing 30 ppm of Lucantin red. When used at the 10 mg/kg level, the two sources give almost identical scores.

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