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EFFECT OF ARTIFICIAL MOLTED BROWN LAYING HENS ON PRODUCTION OF DHA ENRICHED EGGS

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Abstract

The aim of the experiment was to investigate the possibility of production docosahexaenoic acid (C22:6n-3 − DHA) enriched eggs using very old molted hens. Two groups Hisex Brown molted laying hens, 60 wks and 80 wks old, were assigned in 2 subgroups and fed diets enriched with omega 3 fatty acid (especially DHA).The source of DHA was fish oil and fish meal. The amount of omega 3 in feed offered to the experimental hens was 792 mg and 1180 mg C22:6n-3 in kg feed. Feed consumption was restricted on 120 g feed/day/hen. The intensity of egg production at 60 wks and 80 wks old molted hens was similar, 77.93% and 77.86% in subgroups fed lower amount of DHA and 79.28% and 89.16% n subgroups fed with higher amount of DHA. Younger molted hens, 60 wks old, have better egg production then older. Lower level of DHA in feed induced egg production 136,61 and 140.73 mg/egg, and higher amount of DHA in feed induced egg production richer with DHA, from 159.41 to 170.49 mg/egg. Molted older laying hens can produced richer eggs with DHA long chain polyunsaturated fatty acid.

Key words: *DHA, eggs, laying hens, molting.*

INTRODUCTION

Polyunsaturated n-3 fatty acids (PUFA n-3) have significant and various health benefits as treatment of arthtritis (Rennie et al., 2003) coronary disease (Simopoulos, 2000), blood pressure control (Holm et al, 2001), lowering triglycerides (Covington, 2004) and enhancement of immunity (Simopoulos, 2002). Consumption of enriched eggs with omega 3 fatty acids demonstrates positive effects and no negative effects on human health (Lewis et al., 2000). Enricihing the eggs with omega-3 fatty acids is the well known procedure which are related with modified laying hens diets. This procedure is challange for the scientists because using of the enriched diets with PUFA n--3 may have an undesirable effects on productive performance of laying hens, egg weight and yolk weight (Sari et al., 2002),. Laying hens strain does not have any influence on fatty acid composition of eggs yolk (Ahn et al., 1995; Grobas et al., 2001), but the hens age has an important role in deposition of n-3 PUFA in egg yolk (Nielsen, 1998; Yannakopouols et al., 2005).

The aim of this research was to evaluate the influence of the age of the molted laying hens on the production performances and content of DHA in egg yolk.

MATERIALS AND METHODS

Forty molted Hisex Brown hens (60 wks old and 80 wks old molted hens) were housed in laying cages (2 birds per cage) in standard poultry house with a light regime of 16H and 8H darkness. The hens were assigned in four experimental groups (10 birds per group). The experiment was lasting 30 days. The body weight of hens was measured at the beginning and at the end of the experiment. The egg production was controlled daily and the egg mass was controlled weekly. The feed consumption of hens was restricted to 120 g/day, but water consumption was provided ad libitum by 2 nipple waterers in every cage. The ingredients and nutrient composition of the experimental diets was presented in Table 1.

Egg samples were collected every 10th day, 6 eggs per group. The eggs were measured, cracked, the shells were discharged, the separation of the yolk from the albumen were performed manually.

Table 1. Ingredients and nutrient composition of experimental diets

Ingredients (%)	Experimental diet	
	1	2
Ground yellow corn	51.96	50.34
Wheat middlings	10.00	10.00
Sunflower meal	13.00	13.00
Soybean meal	10.18	10.86
Fish oil	1.93	2.90
Fish meal	1.71	1.69
DL methionine	0.08	0.08
L lysine	0.06	0.04
Choline chloride	0.05	0.05
Salt	0.23	0.24
Limestone	9.00	9.00
Dicalcium phosphate	1.30	1.30
Microtracer	0.50	0.50
Total	100.0	100.0
Calculated nutrient composition		
ME, Kcal/kg	2700	2722
Crude proteins,%	15.00	15.00
Crude fibre,%	4.05	4.08
Fat,%	5.48	5.40
Ash,%	12.47	13.00
Lys,%	0.80	0.80
Met,%	0.40	0.40
DHA, g/kg	0.792	1.18
Ca,%	3.80	3.89
Nonphytate P,%	0.38	0.38

The albumen residuals were eliminated from the yolk using blotting paper, viteline membrane was removed using tweezers, then mixed manually with a spatula and stored frozen and analyzed up to 7 days.

Concentrations of docosahexaenoic (DHA, C22:6n-3) fatty acid was measured in egg yolk. Six yolks were mixed, then dried with sodium sulphate, mixed with DI (deionized) water and hexane and centrifuged 2-3 minutes at 2500 rpm. Fatty acid was determined by gas chromatography (AOCS −Ce 1f − 96) adapted by Abril and Barclay (1999), with identification of fatty acids by comparing of their retention times and quantified by areas standardization.

Obtain results were analysed running f-tests on two significance level (5% $P< 0.05$ and 1% $P< 0.01$) according to Snedecor and Cochran (1989).

RESULTS AND DISCUSSIONS

Production parameters of hens were presented in Table 2.

Table 2. Production parameters

Parameter	60 wks old hens		80 wks old molted hens	
	Group 1 BF + 792 mg DHA kg^{-1}	Group 2 BF + 1180 mg DHA kg^{-1}	Group 3 BF + 792 mg DHA kg^{-1}	Group 4 BF + 1180 mg DHA kg^{-1}
Number of hens	10	10	10	10
Hen′s weight, g				
at the beginning	1910	1960	2179	2167
at the end	1900	2025	2104	2216
change in body weight	-10	65	-75	-49
Egg production				
laying intensity,%	77.93	89.16	77.86	79.28
average egg weight, g	64.74[a]	65.43[a]	70.03[b]	67.36[b]
Feed consumption				
daily consumption, g	120	120	120	120
per egg, g	154	134	145	151
per gram egg mass, g	2.38	2.05	2.07	2.24
DHA consumption				
per hen, mg/day	95	142	95	142
per egg, mg	122	158	115	179

[a.b] – Values in the same row with no common superscript differ significantly ($p< 0.05$)

During the experiment there were no health disorders, and mortality was ranged in the technological norms, while differences between groups were not significant. The hens at the beginning and the end of the experiment had similar body weight for the hybrid, and differences in body weight between groups at the beginning and the end of the experiment were not statistically significant ($p > 0.05$). The intensity of egg production at 60 wks old hens and 80 wks old molted hens was similar, 77.86% and 77.93% in groups fed with lower amount of DHA and 79.28% and 89.16% with higher amount of DHA in old molted hens and in younger 60 wks old hens, respectively. The average egg weight throughout the experiment was greater in the experimental groups 3 and 4 80 wks old molted hens (70.03 g and 67.36 g) and in group 1 and 2 60 wks old hens was 64.74 g and 65.43 g. The feed consumption was restricted (120 g feed/day), but the feed

consumption per egg was the lowest in group 2, 134 g, then in group 3, 145 g, and group 4 and 3 151 g and 154 g per egg, respectively.
The feed conversion efficiency was the lowest in group 2, (2.05 g/g egg mass), the highest was in group 1, (2.38 g/g egg), and in group 3 and 4 was 2.07 g and 2.24 g/g egg mass.
The daily consumption of DHA was 95 mg for experimental groups fed with 0.792 g DHA/kg supplemented feed and for experimental groups fed with 1.18 g DHA/ kg supplemented feed the daily consumption of DHA was 142 mg.
The highest DHA consumption per egg was recorded in groups 4 and 2 (179 mg and 158 mg) and in groups 1 and 3 was 122 and 115 mg, respectively.
The content of DHA, in gram yolk in the 60 wks old laying hens was 8.23 mg and 9.72 mg in group 1 and 2, and in gram yolk produced from 80 wks old molted laying hens was 8.13 mg and 9.77 mg in group 3 and 4, respectively.
The content of DHA, in average, was the highest in the groups 4 and 2 fed with 0.792 g DHA/kg supplemented feed (170.49 mg and 159.41 mg) and lowest in groups 3 and 1 fed with 1.18 g DHA/ kg supplemented feed (140.73 mg and 136.61 mg). The results are presented in Table 3.

Table 3. Content of DHA in egg yolk

	60 wks old hens		80 wks old molted hens	
	Group 1 BF + 792 mg DHA kg^{-1}	Group 2 BF + 1180 mg DHA kg^{-1}	Group 3 BF + 792 mg DHA kg^{-1}	Group 4 BF + 1180 mg DHA kg^{-1}
DHA in gram yolk, mg	8.23	9.72	8.13	9.77
DHA in 100 g yolk, mg	823	972	813	977
DHA in one average egg, mg	136.61	159.41	140.73	170.49

Nielsen (1998) reported that the age of laying hens had an effect on the composition of fatty acids in egg yolk. Eggs produced by white Lohmann hens were collected at the ages 21 and 51 weeks. The content of arachidonic acid (20:4 ?-6) and DHA (22:6 ?-3) was higher in egg yolk from young hens compared with older hens. An opposite conclusion was reported by Scheideler et al. (1998) who found that eggs laid by the genotypes Babcock B300, DeKalb Delta and HyLine W-36 hens at the age of 36 weeks had less DHA than at 58 weeks.
The content of DHA, in one average egg are presented in Figure 1.

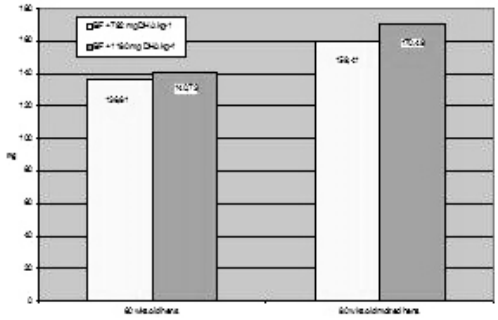

Figure 1. DHA in one average egg, mg

Younger molted hens, 60 wks old, have better egg production then older. Lower level of DHA in feed induced egg production 136,61 and 140.73 mg/egg, and higher amount of DHA in feed induced egg production richer with DHA, from 159.41 to 170.49 mg/egg. Molted older laying hens can produced richer eggs with DHA long chain polyunsaturated fatty acid.

CONCLUSIONS

There are no significant differences among investigated parameters (P> 0.05), except on the obtain results about average egg weight (p< 0.05). However, the results obtained form this investigation indicate that molted older laying hens fed with supplemented diet with fish meal and fish oil can produced richer eggs with DHA long chain polyunsaturated fatty acid.

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