Modifying egg fatty acid content by supplementation of laying hen diets with palm olein oil (POO)

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Introduction Palm oil is the most abundant of all oils produced globally. It is very high in saturated fatty acids specifically palmitic acid, but other fatty acids (monounsaturated (MUFA) and polyunsaturated) are presented at low concentrations. In the processing plant some high amount of oleic acid with some other unsaturated fatty acids are extracted and marketed as Palm olein oil, and used to reduce blood or egg cholesterol (Rievelles *et al*., 1994). The objective of this study was to determine the optimum level of dietary palm olein oil required to enrich the mono-unsaturated fatty acid content of yolk, egg cholesterol and antibody titre.

Materials and methods Eighty four 26-wk-old white Hy-line W-36 laying hens were randomly assigned to 4 diets, with 3 replicates of 8 layers each. The experiment was conducted over a period of 12 wks. The mash diets were provided iso-caloric and iso-nitrogenous (ME= 2820kcal/kg, Cp= 16.2%, Lys=0.84% Na=0.18%, Ca=3.70% and AP=0.39%) and contained 0, 1.5, 3, and 4.5% of Palm olein oil (POO). At the end of experimental period, 2 hens per replicate were randomly selected, weighed, and blood was withdrawn from wing vein.. Blood cholesterol and antibody titre against Newcastle disease (ND), Infectious bronchitis disease (IBD) were measured. One egg was randomly selected from each replicate hens, yolk was separated and stored in -20 C for later analyses. The yolk fatty acid contents were determined via the Folch method by GC apparatus. The data were analysed with SAS version 6.12.

Results The results of yolk and blood cholesterol and antibody titres, are presented in Table 1. The results of egg yolk fatty acid content and ratios of SFA/PUFA and omeg-6/omega-3 are shown in Table 2.

Table 1 The effect of dietary palm olien oil on antibody titter, yolk and blood cholesterol of hens.

Performance	Dietary palm olein oil content (%)				SEM
	0.0	1.5	3.0	4.5	
Yolk cholesterol(mg/g)	12.95	13.20	13.55	13.75	0.65
Blood cholesterol(mg/dl)	143.00[b]	157.67[ab]	161.00[a]	162.33[a]	9.96
IBD titre	6812	6075	5590	5520	742.78
ND titre	8.67	8.33	8.33	8.67	0.67

[a-b] Values within a row with no common superscripts differ significantly($P<0.05$).

Table 2 The effect of dietary palm olien oil on yolk fatty acid contents and the ratio of SFA/PUFA and ω -6/ω -3 fatty acids.

Fat content (%)	Dietary palm olein oil content (%)				SEM
Fatty acid	0.0	1.5	3.0	4.5	
Palimitic acid	34.92	34.13	32.78	29.99	1.65
Stearic acid	8.89	8.48	8.50	8.66	0.32
Oleic acid, n-9	39.96[c]	40.06[c]	43.13[b]	46.00[a]	0.707
Linoleic acid, n-6	10.24	10.49	10.51	10.39	0.42
Linolenic acid, n-3	0.50	0.56	0.47	0.46	0.154
Arachidonic acid, n-6	1.34	1.46	1.36	1.23	0.127
Eicosapentanoic acid, n-3	0.157	0.123	0.107	0.102	0.06
Docosahexaenoic acid, n-3	0.031	0.024	0.023	0.029	0.002
∑ n-3 fatty acids	0.69	0.62	0.60	0.58	0.005
∑SFA[1]	43.24	41.35	41.14	38.95	2.28
SFA/PUFA[2]	0.81	0.79	0.78	0.77	0.08
ω -6 / ω -3	18.01[b]	19.43[a]	19.63[a]	19.75[a]	0.28

a-c Values within a row with no common superscripts differ significantly($P<0.05$).
1- SFA: saturated fatty acid, 2- PUFA: polyunsaturated fatty acid

Conclusion The different levels of dietary POO did not ($P> 0.05$) affect the saturated fatty acid (meristic, palemitic and stearic acid), ω-7 (palemitoleat), ω -6 (linoleate and arachidonate) and ω -3 (Linolenate, eicosapentenoate and Docosahexaenoate) content of egg yolk. The oleic acid (major fatty acid in the omega-9 family) was increased ($P<0.05$) as the level of POO increased in the diet. The SFA and SFA/PUFA ratio did not change with the level of dietary palm olein oil. The increase in dietary POO caused an increase in the ratio of ω -6/ ω -3 fatty acid and blood cholesterol ($P<0.05$). The yolk cholesterol, ND and IBD titre was not affected by dietary POO ($P>0.05$). It is concluded that the dietary POO level may affect the omega-9 fatty acid and the ratio of n-6/n-3 fatty acids of egg yolk.

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