

Effect of linseed on lipidic release and on liver phospholipids fatty acids content of overfed ducks

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Introduction :

Lipidic release of fatty liver (called “foie gras” in french) reflects the loss of fat that occurs during heat treatment (pasteurization or sterilization). Previous studies (Rondia et al, 2004 and 2006) have shown a downward trend of lipidic release following the addition of 2% extruded linseed (GLE - omega-3 provider) in the diet of overfed ducks. We supposed that lipidic release, which is prejudicial to the quality of fatty liver, would be reduced through better elasticity of the hepatic cell membranes consecutive to n-3 PUFA enrichment. The experiment was studying the impact of extruded linseed supplementation during the pre-force-feeding period (PFP, 21 days) and/or during the force-feeding period (FP, 13 days) on lipidic release (LR) and fatty acids (FA) content of liver phospholipids of overfed ducks.

Materials and methods:

572 Mule ducks were arranged in 4 groups. The control group (CG) received corn grain alone (L0/0) and the experimental groups (EGs) corn grain with : 2% linseed added only during PFP (L2/0), 3% linseed added only during FP (L0/3) or linseed added during PFP and FP (L2/3). The analyses were made on liver of 15 individuals per diet. The phospholipids FA pattern was determined by using HPLC coupled to a light-scattering detector. The LR index was measured using the FIL-IDF method for determination of butter non-fat solid content. Analysis of variance (one-way ANOVA) was used to compare diets using MINITAB software.

Results :

Lipidic release decreases (-24%) with incorporation rate of 2 or 3% GLE in diets during FP but liver weight was significantly lower (table 1). There was no difference of LR value between CG and EGs but differences emerged within EGs: L2/3 had a twice higher LR value compared with L2/0 and L0/3. This observation may result from a lipoproteins stimulation who can be responsible for the transfer of lipids to peripheral tissues. Changes occurred in the phospholipids FA pattern, especially between L2/3 and the others groups : reduction of saturated fatty acids (stearic acid) and polyunsaturated (linoleic acid and its derivatives) and increased monounsaturated fatty acids (oleic acid). No n-3 ALA was observed with L0/3 or L2/3 but its derivatives were increased. The assumption was not verified because no correlations between LR and n-3 PUFA were found.

Table 1 : Fatty acids composition of thigh samples of chickens assigned to three different feeding programs

	L 0/0	L 2/0	L 0/3	L2/3	P value
Lipidic release (%)	8,0 ^{ab}	6,1 ^a	6,3 ^a	12,4 ^b	0,002
Liver weight (g)	625 ^a	591 ^a	472 ^b	486 ^b	0,000
Phopholipid content (g/kg)	17,7	20,0	16,7	18,2	0,352
Fatty acid					
(g/100g FA)					
C14 :0	0,3 ^a	0,3 ^a	0,3 ^a	0,5 ^b	0,000
C16 :0	21	19,9	20,5	21	0,449
C18 :0	22,3 ^a	24,7 ^{ab}	24,9 ^b	17,7 ^c	0,000
C18 :1 n-9	28,2 ^a	25,8 ^a	25,2 ^b	41,2 ^c	0,000
C18 :2 n-6	9,3 ^a	9,4 ^a	9,5 ^a	5,7 ^b	0,000
C20 :3 n-6	2,6 ^a	2,9 ^a	2,6 ^a	1,5 ^b	0,000
C20 :4 n-6	10,3 ^a	11,3 ^a	10,0 ^a	6,2 ^b	0,000
C20 :5 n-3					
EPA	0,44 ^a	0,52 ^a	1,62 ^c	1,3 ^c	0,000
C22 :4 n-3	0,3	0,26	0,32	0,37	0,598
C22 :4 n-6	0,50 ^a	0,51 ^a	0,46 ^a	0,27 ^b	0,000
C22 :6 n-3	0,26 ^a	0,35 ^{ab}	0,49 ^b	0,38 ^{ab}	0,000
C22 :5 n-3					
DPA	0,19 ^a	0,17 ^a	0,38 ^b	0,41 ^b	0,000
S SFA	44,0 ^a	45,1 ^a	45,9 ^a	39,3 ^b	0,000
S MUFA	29,4 ^a	26,8 ^{ab}	26,1 ^b	43,3 ^c	0,000
S PUFA	26,6 ^a	28,1 ^a	27,9 ^a	17,4 ^b	0,000

^{a,b,c}Values in the same row with no common superscript are significantly different
SFA = saturated fatty acids ; MUFA = monounsaturated FA ; PUFA = polyunsaturated FA

Conclusions :

The L2/0 showed a tendency to a lower LR and had no adverse effect on other criteria. The 3% linseed inclusion during FP was not recommended because of its negative effect on liver weight. Moreover, linseed added during PFP and FP tended to increase the LR.

Literature cited :

Rondia, P., Delmotte, Ch., Raes, K., De Smet, S., Fameree, J. et Bartiaux-Thill, N. (2004). Effect of dietary linseed on n-3 fatty acids content in liver and intramuscular fat of overfed ducks. In-between congress of the International Society for Animal Hygiene (St-Malo) : p.265.

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