# EFFECT OF DIETARY LINSEED ON n-3 FATTY ACIDS CONTENT IN LIVER AND INTRAMUSCULAR FAT OF OVERFED DUCKS

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## Introduction

An experiment was conducted on thirty mule ducks to study the impact of extruded linseed supplementation during the force-feeding period on fatty acids (FA) composition of liver and intramuscular fat.

## Material and methods

Ducks were manually force-fed with boiled corn over all the duration of the experiment (13 days). During this overfeeding period, three treatment groups (10 animals per group) were established according to the feeding program : corn grains alone (Control diet -C-), corn grains with 2% of extruded linseed (L2%) and corn grains with 4% of extruded linseed (L4%). Live weight, carcass, breast, thigh and liver weights were recorded on all birds of each diet. The fatty acid profile were determined on liver (small lobe) and intramuscular fat (breast and thigh) of five individuals per diet by using gas chromatography.
Moreover, a sensory test was realized on reconstituted blocks of "foie gras" using a neighbour-designs with border plots (Azaïs and al., 1993). The panel evaluated color, flavor, juiciness, texture, granular and visual appearance of the "foie gras".
Analysis of variance (one-way ANOVA) was used to compare the three diets using the GLM procedure of MINITAB.

## esults and discussion

There were no significant difference in weight parameters among diets. The sensory test showed that the L2% diet had a positive effect on the visual appearance of the "foie gras". The L4% diet gave a higher juiciness and a more granular appearance. These latter criteria are generally not appreciated by the consumer. The visual appearance was strongly correlated with color (r=0.77) and flavor was negatively correlated with granular appearance (r=-0,42). The total FA content of the different tissues was not influenced by the diet (data not shown). The linseed supplement improved the fatty acid profile by an increase in n-3 PUFA in liver and intramuscular fat and a decrease in n-6/n-3 ratio, which becomes more in line with human health recommendations. Despite a higher linolenic acid level in the linseed diets, the proportion of this fatty acid remained relatively low in liver of overfeeding ducks. We also observed that the dietary fat largely influence the n-3 PUFA (linolenic and ecosapentaenoic acids) proportion of intramuscular fats of birds receiving control or linseed diets (Table 1). The other FA proportions showed no or minor changes between the different dietary groups.This is due to the fact that *de novo* hepatic lipogenesis prevailed over dietary lipid intake to modulate lipid composition of tissues in overfed waterfowl (Chartrin and al., 2003). However, some differences in FA profile appeared between fat location (Table 1).

*Table 1 : Fatty acid profile of samples of ducks assigned to three different diets*

| FA (g/100g) | C diet | L2% diet | L4% diet | SEM |
|---|---|---|---|---|
| **Foie gras** | | | | |
| C18:3 n-3 | 0.090$^{a}$ | 0.228$^{b}$ | 0.354$^{c}$ | 0.025 |
| C20:5 n-3 | 0.026$^{a}$ | 0.074$^{b}$ | 0.090$^{b}$ | 0.005 |
| C22:5 n-3 | 0.022$^{a}$ | 0.070$^{b}$ | 0.078$^{b}$ | 0.012 |
| C22:6 n-3 | 0.022 | 0.024 | 0.036 | 0.013 |
| n-3 PUFA | 0.158$^{a}$ | 0.396$^{b}$ | 0.558$^{c}$ | 0.036 |
| n-6/n-3 | 23.4$^{a}$ | 6.7$^{b}$ | 4.5$^{b}$ | 3.01 |
| SFA | 37.8 | 37.6 | 39.3 | 0.59 |
| MUFA | 58.4 | 58.6 | 56.5 | 0.59 |
| PUFA | 3.05 | 3.10 | 3.08 | 0.34 |
| **Intramuscular thigh fat** | | | | |
| C18:3 n-3 | 0.654$^{a}$ | 1.788$^{b}$ | 2.548$^{b}$ | 0.073 |
| C20:5 n-3 | 0.046$^{a}$ | 0.086$^{ab}$ | 0.126$^{b}$ | 0.017 |
| C22:5 n-3 | 0.228 | 0.272 | 0.302 | 0.066 |
| C22:6 n-3 | 0.282 | 0.256 | 0.258 | 0.050 |
| n-3 PUFA | 1.214$^{a}$ | 2.400$^{b}$ | 3.234$^{c}$ | 0.118 |
| n-6/n-3 | 18.5$^{a}$ | 7.2$^{b}$ | 4.9$^{b}$ | 0.65 |
| SFA | 31.7 | 30.5 | 31.0 | 0.36 |
| MUFA | 48.1 | 49.0 | 47.7 | 1.40 |
| PUFA | 17.3 | 18.3 | 19.0 | 0.85 |
| **Intramuscular breast fat** | | | | |
| C18:3 n-3 | 0.526$^{a}$ | 1.448$^{b}$ | 1.912$^{c}$ | 0.061 |
| C20:5 n-3 | 0.124$^{a}$ | 0.280$^{b}$ | 0.298$^{b}$ | 0.025 |
| C22:5 n-3 | 0.278 | 0.426 | 0.434 | 0.053 |
| C22:6 n-3 | 0.324 | 0.432 | 0.444 | 0.035 |
| n-3 PUFA | 1.252$^{a}$ | 2.586$^{b}$ | 3.086$^{c}$ | 0.126 |
| n-6/n-3 | 23.6$^{a}$ | 9.4$^{b}$ | 7.0$^{b}$ | 1.03 |
| SFA | 34.7 | 33.4 | 33.0 | 0.45 |
| MUFA | 42.2 | 40.3 | 39.6 | 0.95 |
| PUFA | 19.4$^{a}$ | 22.4$^{b}$ | 23.5$^{b}$ | 0.70 |

$^{a,b,c}$Values in the same row with no common superscript are significantly different. SFA = saturated FA ; MUFA = monounsaturated FA ; PUFA = polyunsaturated FA SEM = standard error of the mean.

The "lipidic wasting" (called "fonte lipidique" in french) is a important indicator of the technological quality of the "foie gras". We supposed that the higher n-3 PUFA content in liver with linseed diets would give more elasticity to the cellular membrane and, by this fact, would reduce the lipidic wasting who is prejudicial to the "foie gras" quality. More studies should be performed to confirm this assumption.

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