

Dietary Enrichment of Fish-Oils Attenuates Diet-Induced Obesity and Hepatic Steatosis

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ABSTRACT

Non-alcoholic fatty liver disease (NAFLD) is characterized by the accumulation of excess hepatic fat, exceeding 5% of total liver mass. NAFLD is present in one-third of Americans and up to 90% in those who are obese. NAFLD develops largely in part to consumption of a Western diet, defined as 40-60% kcal from saturated fats; however, a diet rich in fish-oils may prevent and reverse the development of steatosis.

PURPOSE: To determine the effects of fish oils on the development of NAFLD. **METHODS:** C57BL/6 (n=91) mice were randomly assigned to four dietary groups for 32-weeks: 10% lard (LFL), 10% fish-oil (LFFO), 41% lard (HFL), or 41% fish-oil (HFFO) diet. Significant differences ($p<0.05$) between groups were identified by a one-way ANOVA. **RESULTS:** When compared to HFFO, mice in the HFL group saw an greater (Table 1) body mass and net glucose AUC by 13% ($p<0.001$) and 24% ($p=0.08$), respectively. No significant difference was observed between LFL and LFFO for body mass, net glucose AUC or HOMA-IR. This is interesting given no significant difference was observed between groups for the mean weekly caloric intake. HFFO mice showed an 86% lower ($p<0.001$) total hepatic lipid and 4.8-fold lower ($p<0.001$) hepatic triglyceride concentration when compared to HFL. HFFO mice also saw a 32% lower ($p<0.001$) total hepatic cholesterol when compared to HFL. There was no significant difference in total hepatic lipids between LFL and LFFO. **CONCLUSION:** Despite for no significant difference in caloric intake between high-fat diet groups, consumption of a high-fat diet rich in fish-oils prevented dietary induced obesity, insulin resistance and hepatic steatosis. These results suggest that a diet rich in fish-oils have preventative effects on the development of NAFLD.

Table 1. Physiological Characteristics Following 32-Week Diet Intervention

Variables	LFL (n=24)	LFFO (n=22)	HFL (n=21)	HFFO (n=24)
Body mass (g)	35.6 ± 0.7	35.3 ± 0.7	42.9 ± 1.4 ^{a,b}	37.5 ± 0.6 ^c
Kcal/mouse/wk	70.0 ± 5.3	70.8 ± 5.9	76.1 ± 6.3	78.2 ± 9.6
HOMA-IR	5.2 ± 0.5	5.0 ± 0.7	23.8 ± 3.9 ^{a,b}	5.5 ± 0.9 ^c
Net Glucose AUC	4827.4 ± 445.0	4923.1 ± 353.7	7807.3 ± 732.5 ^{a,b}	5975.0 ± 552.6
Liver Total Lipid (%)	7.9 ± 0.6	6.9 ± 0.3	13.4 ± 0.9 ^{a,b}	7.2 ± 0.3 ^c
Liver Tg (µg/mg)	16.3 ± 1.9	10.0 ± 1.0	34.3 ± 4.0 ^{a,b}	5.9 ± 0.9 ^{a,c}
Liver Chol (µg/mg)	3.4 ± 0.2	3.4 ± 0.2	5.4 ± 0.3 ^{a,b}	3.7 ± 0.2 ^c

Data are mean \pm SD. ^aSignificantly ($p < 0.05$) different than LFL, ^bsignificantly ($p < 0.05$) different than LFFO, ^csignificantly ($p < 0.05$) different than HFL.

