TACSM Abstract

The Effects of Physical Activity on Hepatic Lipid Metabolism During Weight-Loss

Poole KE, Seija A, Eck K, Harris M, Nick TN, and Wooten JS

Exercise Biochemistry and Physiology Laboratory; Department of Kinesiology and Health Education; Southern Illinois University Edwardsville; Edwardsville, IL

Category: Undergraduate

Advisor / Mentor: Wooten JS (jwooten@siue.edu)

ABSTRACT

Non-alcoholic fatty liver disease (NAFLD) develops as a result of physical inactivity and overnutrition. Changing dietary behaviors and increasing physical activity are common strategies used for weight-loss; however, it remains unclear what additional benefits are provided by incorporating physical activity in a weight-loss program for the treatment of NAFLD. The purpose of this study was to determine how physical activity reduces hepatic steatosis and changes the expression of hepatic lipogenic genes during weight-loss. Male C57BL/6 mice were fed either a low-fat (LFD; 10% kcal fat) or high-fat (HFD; 60% kcal fat) diet for 10-weeks. Following 10-weeks, the HFD group was randomly assigned to either a LFD (Diet) or LFD with physical activity (Diet+PA) to induce weight-loss for 8-weeks. After 8-weeks of weight-loss, reductions in body and liver mass were observed in both Diet and Diet+PA groups (see Table 1.). Interestingly, the Diet+PA group lost significantly ($P<0.05$) more body mass than the Diet group. Reductions in body mass and HOMA-IR in the Diet and Diet+PA groups were matched by reductions in hepatic triglyceride levels. In the Diet+PA group, liver triglyceride and cholesterol levels were significantly ($P<0.05$) lower than all other groups. The greater reduction in hepatic triglyceride levels from physical activity was due to significant ($P<0.05$) reductions in the expression of lipogenic FASN and SCD-1 mRNA. Interestingly, physical activity did not alter fatty acid uptake or fatty acid oxidation as observed with CD36 and CPT-1a mRNA levels, respectively. Based on these findings, the addition of physical activity to a diet-induced weight-loss intervention provides a more effective approach for the treatment of NAFLD than dieting alone.

Table 1. Whole body and hepatic metabolic characteristics following weight-loss.

Variables	LFD (n=12)	HFD (n=12)	Diet (n=12)	Diet+PA (n=12)
Body mass (g)	30.2 ± 1.1	48.8 ± 0.5*	30.3 ± 0.7†	26.1 ± 0.3*,†,‡
Liver mass (g)	1.2 ± 0.1	2.9 ± 0.2*	1.2 ± 0.1†	1.2 ± 0.1†
Triglyceride (mg/dL)	99.4 ± 8.7	96.7 ± 5.5	88.3 ± 6.1	88.4 ± 4.8
Cholesterol (mg/dL)	153.5 ± 10.1	246.0 ± 8.7*	148.2 ± 15.5†	127.6 ± 4.7*,†
HOMA-IR	22.9 ± 1.2	187.3 ± 7.5*	19.4 ± 8.8†	25.3 ± 10.5†
Liver Tg (mg/mg tissue)	1.18 ± 0.14	2.53 ± 0.05*	0.96 ± 0.15†	0.58 ± 0.07*,†,‡
Liver Chol (µg/mg tissue)	437.0 ± 43.0	585.2 ± 54.4*	527.0 ± 56.5	324.0 ± 27.3*,†,‡
FASN mRNA	1.00 ± 0.20	1.90 ± 0.34*	2.10 ± 0.54*	0.46 ± 0.11*,†,‡
CD36/FAT mRNA	1.00 ± 0.22	0.19 ± 0.20*	0.97 ± 0.10†	0.80 ± 0.04†
SCD-1 mRNA	1.00 ± 0.28	1.94 ± 0.83*	0.76 ± 0.13†	0.44 ± 0.05*,†,‡
CPT-1a mRNA	1.00 ± 0.18	0.74 ± 0.04*	0.62 ± 0.08*	0.73 ± 0.05*

Note. Data are presented as mean ± SEM.*Significantly (P<0.05) different than LFD; †significantly (P<0.05) different than HFD; ‡significantly (P<0.05) different than Diet.