

Effects of Fatty Acid Composition in a High Fat Diet on Skeletal Muscle Mitochondrial Content

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ABSTRACT

High fat diets (HFD) have been shown to impair skeletal muscle mitochondrial content and function, resulting in impaired lipid oxidation and insulin resistance. However, it is not well understood how the type of fatty acid (mixed fats, monounsaturated fatty acids (MUFA; predominately oleic acid) and polyunsaturated fatty acids (PUFA; primarily linoleic acid)) affects mitochondrial content. **PURPOSE:** The purpose of this study was to determine the effects of HFD, differing in the major type of fatty acids, on skeletal muscle mitochondrial content. **METHODS:** Male Sprague Dawley rats were fed a Western-style (21% by weight; 41% total energy) HFD for nine weeks to induce obesity. They were then divided into three dietary groups and a control chow group for the following six weeks. The dietary groups consisted of 1) a mixed fat Western diet (WD) (9.8% saturated fat, 7.7% monounsaturated fat; 3.5% polyunsaturated fat; n=10), 2) a HFD consisting of high MUFA (2.8% saturated, 15.8% mono; 2.2% poly; n=10), and 3) a HFD consisting of high PUFA (3.0% saturated; 2.9% mono; 15.7% poly; n=10). The control chow diet consisted of 4.8% fat (n=10). At the end of the dietary intervention, soleus muscle was extracted from the rats. Mitochondrial content was measured by quantifying oxidative phosphorylation (OXPHOS) complex I-V proteins by western immunoblotting using Odyssey CLx imaging. **RESULTS:** After the six-week intervention, there was no significant differences (One-way ANOVA $p > 0.05$) in OXPHOS protein content among different diet groups. Specifically, protein content of Complex I (Chow: 1.33 ± 0.83 n=9; WD: 1.23 ± 0.52 ; MUFA: 0.81 ± 0.26 ; PUFA: 0.66 ± 0.16), Complex II (Chow: 1.02 ± 0.45 n=9; WD: 0.51 ± 0.21 ; MUFA: 0.33 ± 0.18 ; PUFA: 0.56 ± 0.23), Complex III (Chow: 11.63 ± 8.216 n=9; WD: 6.52 ± 3.16 ; MUFA: 5.05 ± 1.90 ; PUFA: 3.44 ± 1.23), Complex IV (Chow: 3.95 ± 1.98 n=9; WD: 2.60 ± 0.86 ; MUFA: 2.20 ± 0.69 ; PUFA: 1.65 ± 0.55), and Complex V (Chow: 13.00 ± 9.87 n=9; WD: 6.52 ± 3.45 ; MUFA: 4.12 ± 1.57 ; PUFA: 3.26 ± 1.22) were not different among different diet groups. **CONCLUSION:** Our data suggests that skeletal muscle mitochondrial content is not affected by a HFD or dietary fatty acid composition (saturated, monounsaturated, and polyunsaturated) in rodents.