TACSM Abstract

Lower Skeletal Muscle Mitochondrial Content After a High Fat Diet Rich in Polyunsaturated Fatty Acids Compared to a High Fat Diet Rich in Monounsaturated Fatty Acids

CATALINA DE LA PENA, CESAR MEZA, CYNTHIA MONTENEGRO, ANNA SIMCOCKS, SHAAN NAUGHTON, LANNIE O'KEEFE, DEANNE HRYCIW, MICHAEL MATHAI, ANDREW MCAINCH, SUDIP BAJPEYI

Metabolism, Nutrition, and Exercise Research (MiNER) laboratory; Department of Kinesiology; University of Texas at El Paso; El Paso, TX

Category: Undergraduate

Advisor / Mentor: Bajpeyi, Sudip (sbajpeyi@utep.edu)

ABSTRACT

High fat diet (HFD) has been associated with weight gain, insulin resistance, and type 2 diabetes. The composition of fatty acids in various diets (monounsaturated, polyunsaturated, saturated) influence levels of blood insulin, glucose, and the onset of metabolic and cardiovascular diseases. **PURPOSE**: Determine the effects of high fat diets with alterations in the major dietary fatty acid content (a mixed fat western diet, a polyunsaturated fatty acid diet or a monounsaturated fatty acid diet) on skeletal muscle glycogen, lipid, glucose transporter 4 (GLUT4), and mitochondrial content. **METHODS**: Male Sprague Dawley rats were fed a 21% (by weight; 41% total energy) high fat western-style diet for 9 weeks to induce obesity. They were then divided into 3 dietary groups that continued on a HFD for the next 6 weeks of 1) mixed fat western diet (WD) (9.8% saturated, 7.7% mono; 3.5% poly; n=9); 2) monounsaturated fat (MUFA) (2.8% saturated, 15.8% mono; 2.2% poly; n=9); or 3) polyunsaturated fat (PUFA) (3.0% saturated; 2.9%mono; 15.7% poly; n=8). A control group followed a 15-week low fat Chow diet (CD) (4.8% fat; 0.74% saturated fat; 2% mono; 1.77% poly; n=9). At the end of the dietary intervention, glycogen content was measured in extensor digitorum longus (EDL) with periodic acid-schiff staining. GLUT4 protein content was measured using rabbit polyclonal antibody against GLUT4 (ab654), mitochondrial content was measured using mouse polyclonal antibody against COX4 protein (ab14744), and lipid content was measured using BODIPY 493/503, using immunohistochemistry techniques. Images were captured by ZEN imaging software by ZEIS and data was analyzed with ImageJ. **RESULTS**: There were no significant differences in glycogen content after 6 weeks of HFD with different dietary fatty acid composition, compared to control chow diet. (AU± SEM; CD: 4.41±0.04, WD: 4.74± 0.13, MUFA: 4.54± 0.08, PUFA: 4.54± 0.11, one-way ANOVA p= 0.11). There were also no significant differences in GLUT4 protein content (AU± SEM; CD: 74.68± 5.91, WD: 64.42 ± 2.88, MUFA: 76.12± 6.51, PUFA: 62.83± 4.12; one-way ANOVA p= 0.17) and lipid content after a HFD differing in dietary fatty acids compared to a control chow diet. (AU± SEM; CD: 168± 19.28, WD: 141.3 ± 15.5, MUFA: 193.7 ± 15.3, PUFA: 152.1± 16,69; one-way ANOVA p=0.18). Mitochondria content was less in HFD rich in PUFA when compared to HFD rich in MUFA (CD; WD; AU± SEM; MUFA 60.33±7.31 vs. PUFA 37.42±5.53; MUFA vs. PUFA p= 0.03). **CONCLUSION**: Our data suggest that six weeks of high fat diet does not affect skeletal muscle glycogen content, lipid content and GLUT4 content regardless of dietary fatty acid composition. Six weeks of high fat diet rich in polyunsaturated fatty acids results in lower mitochondrial content compared to high fat diet rich in monounsaturated fatty acid. Our data suggest that high fat diet rich in polyunsaturated fatty acids may negatively impact skeletal muscle oxidative capacity compared to a diet rich in monounsaturated fatty acids.