OXIDATIVE CAPACITY IN SKELETAL MUSCLE OF OBESITY PRONE AND OBESITY RESISTANT RATS FED A HIGH FAT AND LOW FAT DIET

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Percentage of individuals that are considered overweight or obese.

Louisiana: 1990 (10-14%) 1999 (20-24%) 2009 (> 30%)
Health Consequences of Obesity

- Coronary heart disease
- Type 2 Diabetes
- Cancer (endometrial, breast, colon)
- Hypertension
- Dyslipidemia
- Stroke
- Liver & gallbladder disease
- Sleep apnea & respiratory problems
- Gynecological problems
  - (abnormal menses, infertility)
Disorders in fatty acid metabolism within the muscle have been strongly correlated with obesity.

Skeletal Muscle Fibers are differentiated between Oxidative (Type I) and Glycolytic (Type II) with various intermediate types in between.

Oxidative fibers are the main site of fatty acid metabolism in muscle tissue. How do fatty acids gain entry into the muscle cell?
Role of CD36

- Fatty acid transporter in the skeletal muscle.
- Deficiencies in CD36 have been linked to faulty fatty acid transportation, insulin resistance, and intramuscular lipid accumulation.

CD36 translocates during contraction or insulin stimulation from endosomal pools to the plasma membrane (Sarcolemma) to facilitate fatty acid uptake.
Does the consumption of a high fat diet alter the uptake and oxidation of fatty acids in the skeletal muscle of individuals prone or resistant to obesity?
On a High Fat Diet, Osborne-Mendel (OM) rats weigh more and have more body fat than S5B rats.

Figure 1: When fed a high fat diet over 20 weeks, OM rats weigh more and have more body fat than S5B rats. OM rats are more susceptible to diet-induced obesity than S5B rats. (Schemmel et al., 1970)
Hypothesis

1. In our animal models, high fat diet will increase the expression of CD36 in skeletal muscle.

2. Oxidative muscle fibers will be more prevalent in obesity-prone rats.

3. Skeletal muscle with the highest percentage of oxidative fibers will demonstrate the highest expression of CD36.
Experimental Methods

60% High Fat Diet or 10% Low Fat Diet

Assays:
1. Real Time PCR (mRNA)
2. Western Blot (protein)
3. Succinic Dehydrogenase (SDH) Staining
Consumption of a High Fat Diet increased CD36 mRNA levels in obesity-prone and obesity-resistant rats.
Obesity prone rats consuming a high fat diet expressed greater levels of CD36 than obesity resistant rats.

![Graph showing CD36 expression in gastroc muscle between LFD and HFD groups.](image-url)
Obesity Prone rats had the highest percentage of oxidative muscle fibers when compared to obesity resistant rats.

- Obesity Prone LFD
- Obesity Resistant LFD
- Obesity Prone HFD
- Obesity Resistant HFD

![Graph showing fiber type distribution](image)

- Fibers are categorized as Type II (Glycolytic) and Type I (Oxidative).
- The graph compares the distribution of fiber types among different conditions and diets.
Summary and Conclusions

• There is a strain specific difference in CD36 protein expression in animals consuming a high fat diet.

• Obesity-prone rats have a larger pool of oxidative muscle fibers as evident by the succinic dehydrogenase activity.

• Interestingly the consumption of a high fat diet did not increase the oxidative capacity in the skeletal muscle of either animal model.

• CD36 is altered by a high fat diet, but may not be the primary modulator of fatty acid metabolism in the skeletal muscle of either animal model.
Future Directions

- Levels of Malonyl-COA (possible inhibition of CPT-1, blocking β-Oxidation)
- Lipid deposits within the muscle tissue
- Insulin signaling and CD36 in our animal models.
- Track fat oxidation (Metabolic chambers)
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