

PATRICK-MELIN, AMY J., PH.D., August, 2011

Exercise Physiology

EFFECT OF 7 DAYS AEROBIC EXERCISE ON INSULIN SENSITIVITY,
OXIDATIVE STRESS, TLR2/TLR4 CELL SURFACE EXPRESSION
AND CYTOKINE SECRETION IN SEDENTARY OBESE ADULTS (218 pp.)

Director of Dissertation: Michael I. Kalinski, Ph.D.

Aerobic exercise training (AEX) has been well documented to improve glucose tolerance and insulin action in patients who are obese (Goodpaster & Kelley, 2003), insulin resistant (Rodgers, M.A., 1988) and in patients with T2DM (Bruce, 2004; Kirwan et al., 1990; Kirwan, Solomon, Wojta, Staten, Holloszy, 2009; Kirwan, Kohrt et al., 2002; Kirwan, et al., 1990) in the absence of weight loss. Mononuclear cells (MNC) are immune mediators of inflammation that are known to be elevated in diseases such as obesity and insulin resistance. Toll like receptors 2 and 4 (TLR2, TLR4) are predominantly found on the plasma membrane of MNCs and play a key role in the innate immune response. However, it is not known whether improvements in glucose tolerance resulting from short term AEX is due to reductions in proinflammatory mediators.

Thirteen sedentary obese ($34.38 \pm 1.13 \text{ kg/m}^2$) adults, age $58.71 \pm 3.21 \text{ yr}$, underwent Oral Glucose Tolerance Tests (OGTT's), before and after 7 days of supervised AEX at $\sim 70\% \text{ VO}_{2 \text{ max}}$. Insulin sensitivity was assessed via the OGTT, TLR2/TLR4 cell surface expression by flow cytometry, ROS production by chemiluminescence, and MNC derived cytokine (TNF- α , IL-6) secretion by ELISA.

Seven days of AEX resulted in improvements in Matsuda insulin sensitivity ($p=0.04$) in the absence of weight loss and increased VO_{2max} , ($p = 0.004$). Metabolic improvements were also noted in CHO_{OX} and Fat_{OX} ($p = 0.02, 0.03$), $Gluc_{120}$ and Ins_{120} responses ($p = 0.002, 0.007$) and tAUC for $Gluc_{120}$ and Ins_{120} ($p = 0.04, 0.01$). ROS ($p=0.05$) and IL-6 production at $Gluc_{120}$ ($p= 0.05$) were also significantly reduced. No changes were observed in either CD14 or CD14 CD16 TLR2 or TLR4 response for any time points.

Seven days of aerobic exercise training is sufficient to produce changes in insulin sensitivity in obese adults and these changes are associated with reductions in ROS and improvements in insulin sensitivity of peripheral tissues. However, because there were no changes in innate response, it is likely that a longer training duration greater than seven days may be required to reduce chronic inflammation in obese sedentary humans.