EFFECT OF ELEVATED FATTY ACIDS AVAILABILITY ON METABOLISM AND FORCE OF RAT SKELETAL MUSCLES DURING INTENSE CONTRACTIONS
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During intense muscle contraction induced by electrical stimulation, long chain fatty acids (LCFA) might reduce mitochondrial ATP/ADP ratio, raising the contribution of glycolysis for ATP production. To examine this hypothesis we examined the effect of a lipid infusion (Lipovenus emulsion) on UCP-3 mRNA level, lactate, glucose-6-phosphate (G-6P) and glycogen content in soleus (SO), red gastrocnemius (RG) and white gastrocnemius (WG) muscles. Blood samples for determination of free fatty acids and lactate were collected at 0, 30 and 60 min during rest and at 0, 10 and 20 min during muscle contraction. In addition, the force level was determined during muscle contractions. The effect of Lipovenus emulsion on respiration of mitochondria isolated from rat skeletal muscle, and content of UCP-3 and lactate in cultured skeletal muscle cells was also determined. The in vivo experiments showed that Lipovenus induced a significant increase of UCP-3 mRNA levels (P < 0.05). After Lipovenus infusion, lactate level was increased in RG muscle only (P < 0.05), whereas the contents of glycogen and G-6P were decreased in both RG and WG muscles (P < 0.05). Lipovenus infusion failed to exert any effect on muscle force performance (P > 0.05). The in vitro experiments showed that Lipovenus infusion induced a significant increase in mitochondrial respiration (P < 0.05), but had no effect on UCP-3 content (P > 0.05). Lactate concentration was significantly increased in the culture medium of stimulated cells in the control and Lipovenus groups compared with the respective not-stimulated cells (P< 0.05). We concluded that as mitochondrial function becomes limited by the FFA-uncoupling effect, the ATP demand is mainly supplied by anaerobic glucose metabolism preventing an expected decrease in muscle contraction performance.

Keywords: Fat Metabolism, Muscle Metabolism, Glucose