SOME METHODS TO PROMOTE MITOCHONDRIAL ADAPTATION WITH EXERCISE TRAINING

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Abstract

Mitochondria are one of the key players for physical fitness. Recent many studies have found that not only endurance training but also high intensity interval training can be a good method to promote mitochondrial biogenesis in a short duration. We have done several in vivo studies investigating methods to promote mitochondrial biogenesis with endurance or high intensity training. Recently, lactate has been reported as a signal to induce several adaptations such as mitochondrial biogenesis, angiogenesis and wound healing. We injected lactate into ICR mice (1 mg/g) in order to increase blood lactate concentration. After 3 hours of the injection PGC-1 alpha mRNA, which is known as a master regulator for mitochondrial biogenesis, significantly increased in skeletal muscle. Dichloroacetate (DCA) activates pyruvate dehydrogenase and therefore increases oxidation of carbohydrate and lactate leading to decreased blood and muscle lactate concentrations during exercise. High intensity training with DCA injection resulted in decrease in the training effects related to mitochondrial adaptation by the training. Therefore, we have confirmed that lactate is a signal for mitochondrial adaptation by exercise training. We have investigated the effects of casein peptide ingestion before endurance training in high fat diet mice. Endurance training (25 m/min, 30 min) with ingestion of casein peptide resulted in increase in maximal mitochondrial activities in soleus and heart. So, casein peptide can promote mitochondrial biogenesis in slow type muscles and heart by the endurance training. Finally, we investigated whether heat stress in a hot environment chamber can change mitochondrial adaptation after endurance training. Endurance training (25 m/min, 30 min) and heat stress (40C, 30 min) immediately after the training increased mitochondrial activities and proteins. The heat stress can also partly inhibit decrease in mitochondrial proteins after denervation of lower limb. These results showed heat stress promotes mitochondrial biogenesis with exercise training.

Key Words: mitochondria, training, lactate, casein peptide, heat

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