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Impact of Exercise on Skeletal Muscle in Health and Metabolic Diseases

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Aerobic training (endurance training) has two major goals. First of all, aerobic training induces adaptation in cardiovascular function increasing oxygen delivery to active skeletal muscle. Secondly, aerobic training induces significant adaptations in muscle metabolism. This beneficial adaptation to training in skeletal muscle is accompanied by structural and biochemical change including muscle fiber type, mitochondrial number, oxidative enzymes, and energy stores and substrate availability. However, adaptations can be quickly lost with detraining. One of the impacts of exercise on skeletal muscle is an increase of resting (basal) metabolic rate. Resting metabolic rate is highly correlated with free-fat mass and significantly decreased with aging. Many studies have indicated that regular resistance exercise offsets the decrease in resting metabolism that usually accompanies aging. This is a reason why resistance exercise is important for obesity interventions, because resting metabolic rate accounts for 60-75% of total daily energy expenditure.

The prevalence of type 2 diabetes mellitus (DM) is dramatically increasing in recent 20 years. Type 2 DM is becoming one of the leading causes of death in Korea and is considered to result from a gradual development of insulin resistance and deterioration of the ability to transport glucose from circulating blood to primarily muscle, liver, or other tissue cells. Growing scientific evidences suggest that the major driver in the pathogenesis of type 2 DM is inactivity of the skeletal muscle. However, it is well known that skeletal muscle increases its insulin sensitivity for glucose uptake from the blood during exercise (contraction) and even during post-exercise just long enough to replenish the stores of intramuscular glycogen consumed by exercise. In collaboration with veterinary medicine research group, we've been able to use type 2 DM animal models to investigate effects of aerobic and resistance training on this metabolic disease. In this presentation, previous and current studies in our laboratory with respect to exercise and type 2 DM using animal models including Otsuka Long-Evans Tokuhsima Fatty (OLETF) rats and Zucker Diabetic Fatty (ZDF) rats will be introduced and discussed briefly.