The Effects of Overload Stimulation on Satellite Cells Differentiation

Shin FUJIMAKI¹,², Masanao MACHIDA³,
Ryo HIDAKA², Tomoko KUWABARA²,
Tohru TAKEMASA¹

¹Comprehensive Human Sciences, University of Tsukuba, ²Research Center for Stem Cell Engineering, AIST; ³Organization for General Education, Saga University

Purpose: It was well-known that the number of satellite cells increases after exercise. However, the effects of the exercise on the function of satellite cells and the regulatory mechanism remain unclear. We investigate that the effect of the overload stimulation, mimicking weight training and causing skeletal muscle hypertrophy, on the differentiation ability of satellite cells.

Methods: Functional overload was induced by ablation of the synergistic muscles of 11 to 12 week-old Fischer344 rats. Satellite cells were isolated from overloaded skeletal muscles of exercise group rats, and the property for myogenic differentiation was compared with that from control skeletal muscle (no exercise group).

Results and Discussion: Although established satellite cells for in vitro culture from both groups could form myotubes, differences were observed in their sizes of myotubes and the contents of myonucleus. Expression levels of several transcription factors, specific for early stage during myogenesis, significantly changes between control and overloaded groups. Furthermore, several niches-delivering signaling factors are identified as candidates to determine the function of satellite cells under the overload stimulation.

Evaluation of antioxidant enzyme polymorphism in oxidative stress during intense short time exercise.

Yukihiro HAYAKAWA
Shigakkan University, Graduate School of Health and Sports Science

Purpose: It is well established that contracting skeletal muscles produce reactive oxygen species (ROS), however, the contribution of MnSOD (a representative antioxidant enzyme) polymorphism (SNP) for eliminating ROS during intense short time exercise is not well understood. Therefore, we investigated the influence of MnSOD SNP for oxidative stress during intense short time exercise.

Methods: Twenty eight track and field athletes were enrolled to this study. MnSOD SNP (Val16Ala) was determined by real time PCR using quenching probe method. The individuals were asked to do all-out intense exercise using a bicycle ergometer. Urine samples were collected before exercise, at 1hr and 2 hrs after exercise. Oxidative stress was evaluated using urine 8-OHdG (a marker of oxidative DNA damage) divided by urine creatinine, as 8-OHdG/creatinine, for standardization.

Results: Urine 8-OHdG/creatinine was elevated significantly at 1 hr after exercise compared to baseline and returned to initial level at 2 hrs after exercise. However, the values of urine 8-OHdG/creatinine were not significantly different between SNP types of MnSOD.

Conclusion: These results suggested that intense short time exercise induced the transient increase of oxidative stress, however, MnSOD SNP did not affect these conditions.

Key words: exercise, oxidative stress, MnSOD, SNP