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ANALYSIS OF THE PLASTIC CHANGES INDUCED IN THE SOLEUS MUSCLE UNDER A MICROGRAVITY CONDITION

Abstract

A microgravity condition induces physiological changes in various organs, and it is essential to comprehend the adaptation to different gravitational conditions for future space explorations and the managements of astronaut health. The soleus muscle, which is recognized as the anti-gravity muscle among the skeletal muscles in hindlimb, is particularly vulnerable to the effects of microgravity. A previous study has shown that microgravity induces muscle atrophy and fast-twitching in the soleus muscle. Oxidative stress is one of the factors for muscle atrophy and muscle fiber type transition. We hypothesized that the antioxidant master regulator nuclear factor E2-related factor 2 (Nrf2) may be effective against space stress, and we launched C57BL/6J wild-type (WT) and Nrf2 knockout (KO) C57BL/6J mice into space to analyze its effects on the whole body. In result, Nrf2 protects the white adipose tissue from space stress and suppresses ageing-like symptoms. In this study, we investigated the role of Nrf2 in the soleus muscle under a microgravity condition using WT and Nrf2 KO mice, which were housed in a microgravity condition for approximately one month at the Kibo module in the International Space Station. We found that the soleus muscle of Nrf2 KO mice exhibited the same level of muscle atrophy as those of WT mice, but the Nrf2 KO mice exhibited accelerated fast-twitching compared to those of WT mice under a microgravity condition. As a result, it is indicated that Nrf2 involves in muscle fiber type transition but not in muscle atrophy under a microgravity condition.