

TAURINE PREVENTS THE DISUSE-ASSOCIATED ALTERATION OF SOLEUS MUSCLE CALCIUM HOMEOSTASIS IN THE HINDLIMB-UNLOADED RATS

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It is well known that microgravity, a condition of muscle disuse, induces the atrophy of postural slow-twitch muscles which acquire functional properties typical of fast-twitch ones. We previously demonstrated that soleus muscle of Hindlimb Unloading (HU) rat, which mimics the condition of microgravity as occurring during space flight, undergoes changes in membrane excitability, contractile properties, ion conductances, calcium homeostasis and expression of isoforms of myosin heavy chain (MHC) (1). All these parameters were found shifted toward those of fast-twitch muscle. In particular, we showed that in soleus muscle the intracellular calcium concentration ($[Ca^{2+}]_i$), the sarcolemmal permeability to divalent cations (SpCa) through stretch-activated channels, the sensitivity and responsiveness to caffeine decreased during hindlimb suspension. Here, we evaluated the effect of 2 weeks-treatment of taurine (1 gr/Kg body weight), a sulphonic amino acid widely present in many mammalian tissues, on calcium homeostasis of skeletal muscle fibers in control and HU rats. Taurine is involved in biological activities as osmoregulation and stabilization of membrane excitability. Moreover, it carries out a protective role against damaged tissues and modulates calcium homeostasis. In fact, this aminoacid was found to ameliorate the electrical and contractile functions of skeletal muscle both in aged rats and in dystrophic mice (2). So, we tested the hypothesis that taurine may contribute to counteract the calcium-dependent alterations of slow-twitch muscles due to 14 days HU. Using fura-2 calcium probe, we showed that the administration of taurine 1gr/Kg, prevented the phenotype change in soleus HU: $[Ca^{2+}]_i$, and SpCa values remained similar to those of soleus control rats. Differently, taurine had no effect on calcium homeostasis of control rats soleus muscle both in vivo and in vitro. Moreover calcium transient induced by caffeine or by depolarizing solution was not modified by pre-incubation with taurine. These results confirmed the capability of taurine to protect tissues from impairment by modulating the intracellular free calcium, and make taurine a useful therapeutic agent in the treatment of muscular disorders. (Italian Space Agency, Project OSMA)

(1) Fraysse B., Desaphy JF., Pierno S., De Luca A., Liantonio A., Mitolo CI., Conte Camerino D. 2003 FASEB J. 17:1916-1918.

(2) Conte Camerino D., Tricarico D., Pierno S., Desaphy JF., Liantonio A., Pusch M., Burdi R., Camerino C., Fraysse B., De Luca A. (2004) Neurochem Res. 29:135-142.