Exposure of mammalian skeletal muscle to sub-physiological temperatures reduces its ability to function at physiological temperatures

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Most studies using isolated mammalian skeletal muscle preparations are conducted at temperatures well below physiological temperatures (17-25°C) because the performance of isolated mammalian skeletal muscle preparations dramatically and irreversibly drops when preparations are re-exposed to normal body core temperatures around 37°C (Lännergren & Westerblad 1987; Ranatunga 1998; Coupland & Ranatunga 2003). This loss in force may be the result of re-heating the preparation during experimental procedures.

In order to test the hypothesis that re-heating isolated skeletal muscle fibre preparations to physiological temperature causes damage to the muscle, rat EDL fibre bundles were excised (30-50 fibres) either at 22°C or in a temperature-controlled room at 37°C from Long Evans (Hooded) rats killed by halothane overdose in accordance with the LTU Animal Ethics Committee. The muscles were then attached to a force transducer, stretched to optimum length and tetanically stimulated every 10 min until force could not be measured whilst immersed in a Krebs-Ringer solution (KRS) maintained at 37°C. KRS contained (mM); NaCl 122, KCl 2.8, $CaCl_2$ 1.3, $MgSO_4$ 1.2, KH_2PO_4 1.2, $NaHCO_3$ 25 and D-glucose 5, (constantly bubbled with carbogen: 95% oxygen, 5% carbon dioxide).

The results show that after 30 min of exposure to solution maintained at 37°C, tetanic force dropped dramatically to 3.4 ± 0.1% of initial tetanic force in muscle preparations that were dissected at 22°C and then re-heated, whereas after the same length of time, tetanic force dropped to only 68.0 ± 7.8% of initial tetanic force in muscle preparations dissected and kept throughout at 37°C. This marked decrease in tetanic force appears to be associated with an increase in free radical $O_2^{\bullet -}$ production when preparations are re-heated. These results show that preventing isolated mammalian skeletal muscle from dropping below core body temperature during dissection helps maintain its function when working at 37°C.

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