Mol Cell Biochem 1999 May;195(1-2):37-46

Post mortem changes in Ca2+ transporting proteins of sarcoplasmic reticulum in dependence on malignant hyperthermia status in pigs.

Kuchenmeister U, Kuhn G, Wegner J, Nurnberg G, Ender K

Research Institute for Biology of Farm Animals, Division of Muscle Biology and Growth, Dummerstorf, Germany.

Meat quality of pigs is dependent on biochemical and biophysical processes in the time course post mortem (p.m.) and is associated with the intracellular Ca2+ homeostasis. However, there is little known about changes in the Ca2+ transporting proteins controlling the Ca2+ uptake of sarcoplasmic reticulum (SR) in the time course p.m. In this study changes in the Ca2+ transporting proteins were investigated in homogenates of longissimus muscles of 4 malignant hyperthermia susceptible (MHS) and 6 malignant hyperthermia resistant (MHR) Pietrain pigs. Muscle samples were obtained at different time intervals: biopsy 2 h prior slaughtering and from the carcass immediately after exsanguination (0 h), 45 min, 4 h, and 22 h p.m. The SR Ca2+ uptake rate was measured immediately after homogenization with closed calcium release channel (CRC), with opened CRC and without manipulation of CRC. Additionally the SR Ca2+ ATPase activity was determined. The results show: (i) The ability of SR to sequester Ca2+ declined to about 60% in the first 45 min p.m. in MHS samples irrespective of CRC state, whereas in MHR samples this decline was about 5%; (ii) Ca2+ uptake and Ca2+ ATPase activity were not different between the biopsy and 0 h samples, i.e. the stress of slaughter was of no immediate influence; (iii) The Ca2+ ATPase activity of the SR declined at about the same rate as the Ca2+ uptake in both MHS and MHR pig samples in the course of time p.m.; (iv) In samples, taken immediately after exsanguination, the Ca2+ ATPase activity of MHS pigs was higher than that of MHR pigs. However, in samples taken 4 h p.m. Ca2+ ATPase activity of MHS pigs has declined to about 30% of the value at 0 h; (v) The CRC can be closed and opened in all samples up to 22 h p.m. and seems to be fully functional at all sampling times; (vi) The CRC of MHS pigs is almost fully open, whereas the CRC of MHR pigs is only partially open at all sampling times; (vii) The permeability of the SR membrane to Ca2+ (determined as the ratio of SR Ca2+ ATPase with and without ionophore A23187) is the same in both MHS and MHR and did not change with ongoing time; (viii) No uncoupling of uptake from ATP hydrolysis occurred up to 4 h p.m., but the coupling differed between MHS and MHR for all time intervals with lower values for MHS pigs. The results suggest that the decreasing Ca2+ uptake rate of homogenates, sampled at different times p.m., is essentially caused by changes in the Ca2+ pump and not by changes in the CRC or an increased phospholipid membrane permeability to Ca2+.