EFFECT OF SALT CONCENTRATION ON THE ENERGY TRASDUCTION MECHANISM OF A MOTOR PROTEIN

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Summary

It is known that elevated salt concentration decreases isometric tension. To elucidate the mechanism by which salt concentration influences the chemo-mechanical energy transduction in muscle, we examined the contractile kinetics of skinned rabbit psoas muscle fibers activated either by the photolysis of caged calcium (nitrophenyl EGTA) or by conventional solution exchange at various salt concentration.

Increasing the salt concentration from 200 mM to 520 mM (in terms of ionic strength) decreased the rate constant for the rise of tension by 43% (from 6.8 to 3.9 s^{-1} at 5°C), a decrease much smaller than that of steady-state isometric tension level (73%). To test whether the relative population of the low force A·M·ADP·Pi intermediate (Iwamoto, 1995) is affected by ionic strength, ramp stretches of various amplitudes were applied in the rising phase or at the plateau of isometric tension at salt concentrations of 200 and 360 mM. In the rising phase, the stretch amplitude-response curve showed a nonlinear feature characteristic of the low force A·M·ADP·Pi intermediate at both salt concentrations. At the plateau, however, the nonlinearity was not observed in either of the salt concentrations, suggesting that a relatively small amount of the low force A·M·ADP·Pi intermediate exists during steady state contraction. The nonlinearity was also observed in the presence of 20 mM Pi, which is known to increase preferentially the low force A·M·ADP·Pi intermediate. These results suggest that elevated salt concentration does not reduce isometric tension by affecting the transition between low force and force producing actomyosin intermediates. The results are best explained if there are two force producing A·M·ADP intermediates and the balance between them is affected strongly by salt concentration.