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Effect of Extracellular pH on Osmoadaptation in *Saccharomyces cerevisiae* Yeast Cells

Angela Primavera*, Ohiemi Benjamin Ocheja, Maria Antonietta Di Noia, Nicoletta Guaragnella

Department of Biosciences, Biotechnologies and Environment, University of Bari "Aldo Moro", Italy

ABSTRACT

Maintenance of ion concentrations across cellular membranes is crucial for proper physiological functions. Disruptions of ionic gradients can significantly affect membrane electrochemical potential and the ion balance, particularly under stressful conditions. Here we studied the effect of extracellular pH on adaptation to NaCl treatment in *Saccharomyces cerevisiae* yeast cells. BY4741 wild type cells grown in rich medium at pH 4.5 and pH 6.8 have been compared for their sensitivity to NaCl and it was found that an higher extracellular pH ameliorates the kinetics of stress response. To gain insight into the molecular mechanisms of this adaptive response, three mutant strains, lacking *NHA1*, *VMA1* and with a mutation in *PMA1* were analysed in both liquid and solid media with and without stress. NHA1 encodes the Na^+/H^+ antiporter involved in sodium efflux through the plasma membrane; *VMA1* encodes a subunit of the Vacuolar-ATPase and *PMA1* is a plasma membrane H^+-ATPase whose role is exporting protons out of the cell. The adaptation to NaCl was improved at higher pH in liquid media also for the mutants. In addition, the mutation in *PMA1* had a specific positive effect on cell viability in the presence of stress when compared to WT and to the other mutants. On the other hand, the absence of VMA1 becomes detrimental on cell viability with NaCl at both pH. The lack of *NHA1* has a negative effect on cell viability especially at pH 6.8 in the presence of NaCl. Overall, these results indicate that pH homeostasis plays a determinant role during adaptation to NaCl stress and highlight the interplay among plasma membrane and vacuolar pumps in the mechanism of adaptation. The cooperation between *NHA1* and *VMA1* seems to be reinforced by the absence of PMA1 activity.

Keywords: yeast, *Saccharomyces cerevisiae*, osmostress, pH

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*Corresponding Author:

Angela Primavera, Biosciences and Biotechnologies, Department of Biosciences, Biotechnologies and Environment, University of Bari "Aldo Moro", Italy, Via Orabona 4, Bari, 70124, Italy.
Email: a.primavera1@phd.uniba.it