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Implication of Phosphorylation/Dephosphorylation in the Adaptive Heat Shock Response

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INTRODUCTION-AIM

Phosphorylation/dephosphorylation is a ubiquitous cellular regulatory mechanism involved in the reversible functional modification of proteins through addition/removal of phosphate groups by kinases and phosphatases respectively. The aim of this study was to evaluate the role of phosphorylation/dephosphorylation on yeast survival during the mild and severe stress adaptive cellular response.

METHODS

The stress response was evaluated in post-log phase growing cultures (27 °C, 22 h) of *S. cerevisiae* ATCC 2366, by determining microscopically the percentage of viable cells, after staining with the vital exclusion dye methylene blue (viability), in non-pretreated (27 °C, 2 h) or pretreated (37 °C, 2 h) cultures, which were exposed to heat shock (HS, 53 °C, 30 min). The effects of 0.035-1.12 mM suramine, a topoisomerase II and non-selective kinase inhibitor and of 0.0025-0.025 mM okadaic acid, a selective phosphatase PP2A inhibitor, were investigated following addition of the agents to non-pretreated and pretreated cultures. Statistical analyses were performed by Anova followed by Scheffe or Dunnett test.

RESULTS

Upon addition to non-pretreated cultures, suramine resulted in acquisition of thermotolerance during the subsequent HS ($P<0.05$, n=5-14), while okadaic acid reduced yeast viability at low concentrations ($P<0.01$, n=2-5). Both agents were unable to significantly modify the pretreatment-induced thermotolerance ($P>0.05$, n=3-7) when added during the mild thermal pretreatment.

CONCLUSIONS

These data provided evidence for the regulatory role of both phosphorylation and dephosphorylation processes in the cellular adaptive processes under normal growth conditions, while their role in the mild thermal stress-induced thermotolerance remains elusive. Moreover, the vital biphasic functional implication of the phosphatases PP2A in the acquisition of thermotolerance deserves further consideration.