Oxidative Stress-Induced Protein Aggregation in Saccharomyces cerevisiae BY4741 Exhibits Potential Pattern Relevant in Early Alzheimer's Disease

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The accumulation of amyloid-beta (AB) plaques and tau protein tangles are defining pathological features of Alzheimer’s disease (AD). In previous studies, AB plaques and tau tangles have been reported to contribute to neurotoxicity, synaptic dysfunction and neuronal death. Therapeutic interventions targeting amyloid and tau pathology are time-sensitive, requiring administration before irreversible neuronal damage occurs. Identifying a reliable biomarker that signals when protein aggregation will occur could enhance early detection and intervention. In this study, Saccharomyces cerevisiae (BY4741 w.t.) was used as a model cell to investigate the role of oxidative stress (OS) in promoting protein aggregation, a mechanism that has been hypothesized in AB plaques and tau pathology. However, the exact relationship between the OS and protein aggregation remains obscure. Cell cultures were incubated for 48 hours on YED agar medium before being treated with hydrogen peroxide concentrations ranging from 0-2.0 mM for incubation periods of 15-270 minutes. Cells were cleaned 2x with PBS to allow for molecular redox reactions to stabilize. Reactive oxygen species accumulation was confirmed using DCFDA fluorescence, while amyloid fibrils were quantified through Thioflavin T fluorescence probe. Preliminary findings showed a significant increase in amyloid fibril accumulation in 1mM and 2 mM hydrogen peroxide treatment ($p<0.05$) as compared to the control. Furthermore, results reveal a window where increasing oxidative stress produces minimal aggregation until a threshold is reached, triggering rapid aggregation followed by a stabilization. If this pattern is further validated, findings could reinforce OS's potential as a biomarker for early-stage AD and guide therapeutic strategies.

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