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Rutin attenuates negatively charged surfactant (SDS) induced lysozyme aggregation/amyloid formation and its cytotoxicity

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Amyloid fibrils are highly ordered protein assemblies known to contribute to the pathology of a variety of genetic and aging-associated diseases. Here, we have investigated the aggregation propensity of lysozyme in the presence of a negatively charged surfactant (SDS) and evaluated the anti-aggregation activity of rutin. Multiple approaches such as turbidity measurements, dye binding assays, intrinsic fluorescence, circular dichroism (CD), MTT and Comet assays have been used for this purpose. We inferred that SDS induces aggregation of lysozyme in 0.2-0.6 mm concentration range while at higher concentration range (0.8-1.0 mm), it leads to solubilization/stabilization of protein. Intrinsic/extrinsic fluorescence and CD analysis confirmed significant conformational changes in lysozyme at 0.2 mm SDS. Thioflavin T (ThT) and Congo red binding further reaffirmed the formation of lysozyme fibrils. Moreover, MTT assay demonstrated cytotoxicity of these fibrils towards neuroblastoma cell lines (SH-SY5Y) and their attenuation by rutin. Comet assay supported the cytotoxicity mechanism via DNA damage. Molecular docking results also advocate a strong interaction between lysozyme and rutin. The current study indicates a mechanistic approach assuming structural constraints and specific aromatic interactions of rutin with HEWL aggregates.

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