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Acidic residue modifications restore chaperone activity of β-casein interacting with lysozyme

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Abstract

An important factor in medicine and related industries is the use of chaperones to reduce protein aggregation. Here we show that chaperone ability is induced in β-casein by modification of its acidic residues using Woodward's Reagent K (WRK). Lysozyme at pH 7.2 was used as a target protein to study β-casein chaperone activities. The mechanism for chaperone activity of the modified β-casein was determined using UV–vis absorbencies, fluorescence spectroscopy, differential scanning calorimetry and theoretical calculations. Our results indicated that the β-casein destabilizes the lysozyme and increases its aggregation rate. However, WRK-ring sulfonate anion modifications enhanced the hydrophobicity of β-casein resulting in its altered net negative charge upon interactions with lysozyme. The reversible stability of lysozyme increased in the presence of WRK-modified β-casein, and hence its aggregation rate decreased. These results demonstrate the enhanced chaperone activity of modified β-casein and its protective effects on lysozyme refolding.

Abbreviations

ANS, 8-anilino-1-naphthalenesulfonic acid; DTT, dithiothreiotol; WRK, Woodward's reagent K; EP, electrostatic potential; ASA, accessible surface area

Keywords

Modified β-casein; Lysozyme; Hydrophobicity; Woodward's Reagent K; Electrostatic potential; Accessible surface area