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Studies of the transition metal complex with Human Serum Albumin

Abstract Body:

Abstract: Human serum albumin (HSA) is a vital plasma protein that maintains osmotic pressure and enhances ligand binding efficiency as a carrier for various substances, including hormones, fatty acids, and metal ions. The presence of multiple metal-binding sites within HSA facilitates the binding and interaction of metal ions without inducing major structural deformation. Transition metals which include iron (Fe), copper (Cu), zinc (Zn), and manganese (Mn) elements found in the d-block of the periodic table, can exert significant influence on the structure and function when interacting with HSA. This present study investigates the ligand binding and conformational changes induced by metal ions, particularly focusing on the tryptophan residue, a strong fluorophore located in the hydrophobic region of HSA. Optical spectroscopic (UV/Vis absorption, steady-state fluorescence, circular dichroism (CD)) techniques, were employed to carry out this investigation. Additionally, SDS-PAGE experiments were conducted. CD-based concentration-dependent studies revealed that HSA self- associates and forms oligomers at concentrations exceeding 10 μM in aqueous solution. Notably, significant conformational changes were observed in HSA structure with copper (Cu), compared to iron (Fe), at the same concentration. However, at concentration below 1mM Fe- HSA ligand binding interaction occurred without structural changes while Cu-HSA ligand binding interaction induced more pronounced structural changes. The versatility of HSA's interactions with metal presents opportunities which can be explored for designing therapeutic agents such as metal-based drugs. Future studies will explore the effects of other transition metals, such as silver and manganese, on HSA's structural conformation.