Investigating the effect of lysine 89 residue alteration using a site-directed mutagenesis on the structure and function of mnemiopsin 2 photoprotein via bioinformatics study

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Abstract: Mnemiopsin 2 is a family of calcium-regulated photoproteins, which like other photoproteins, emits light in the presence of substrates such as imidazopyrazine coelenterazine, molecular oxygen and calcium ion trigger. They contain three EF-hand Ca^{2+}-binding loops. The first residue of the EF-hand II loop of this photoprotein, lysine residue position of 89, is one of the residues involved in the cavity of the coelenterazine. Since EF-hand II has lost its function during evolutionary stages, we substituted the lysine position 89 with residues of alanine (neutral residue), arginine (positive charge), and aspartic acid (negative charge) to examine the possible changes in the structure and function of the photoprotein. Then, the modeling of the mutants structures was carried out using Moderller 9v18 software. Afterwards, for further evaluations, the best model was selected based on structural parameters using ModEval, SAVES, SpdbViewer and Pic Server softwares. Finally, the situation of interactions and biochemical-physical properties of wild type and mutant proteins were investigated. Also, the three-dimensional structure of the mutants were constructed and drawn with Chimera software. It was found that the three mutations mentioned in this situation improved the structure stability, which caused increasing the stability of the colonetrazine substrate in the junction of its cavity.

Keywords: Mnemiopsin2; calcium; coelenterazine; photoprotein; side directed mutagenesis

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