How copper ions and membrane environment influence the structure of the human and chicken tandem repeats domain?

Autorzy

Aleksandra Hecel

Daniela Valensin

Henryk Kozłowski

Rok wydania

2019

Czasopismo

Journal of Inorganic Biochemistry

Numer woluminu

191

Strony

143-153

DOI

10.1016/j.jinorgbio.2018.11.012

Kolekcja

Naukowa

Język

Angielski

Typ publikacji

Artykuł

Streszczenie

Prion proteins (PrPs) from different species have the enormous ability to anchor copper ions. The N-terminal domain of human prion protein (hPrP) contains four tandem repeats of the –PHGGGWGQ– octapeptide sequence. This octarepeat domain can bind up to four Cu^{2+}ions. Similarly to hPrP, chicken prion protein (chPrP) is able to interact with Cu^{2+} through the tandem hexapeptide -HNPGYP- region (residues 53–94). In this work, we focused on the human octapeptide repeat (human $Octa_4$, $hPrP_{60–91}$) (Ac-PHGGGWGQPHGGGWGQPHGGGWGQPHGGGWGQ-NH_2) and chicken hexapeptide repeat (chicken $Hexa_4$, $chPrP_{54–77}$) (Ac-HNPGYPHNPGYPHNPGYPHNPGYP-NH_2) prion protein fragments. Due to the fact that PrP is a membrane-anchored glycoprotein and its unstructured and flexible N-terminal domain may interact with the lipid bilayer, our studies were carried out in presence of the surfactant sodium dodecyl sulfate (SDS) mimicking the membrane environment in vitro. The main objective of this work was to understand the effects of copper ion on the structural rearrangements of the human and chicken N-terminal repeat domain. The obtained results provide a fundamental first step in describing the thermodynamic (potentiometric titrations) and structural properties of Cu(II) binding (UV–Vis, NMR, CD spectroscopy) to both human $Octa_4$ and chicken $Hexa_4$ repeats in both a DMSO/water and SDS micelle environment. Interestingly, in SDS environment, both ligands indicate different copper coordination modes, which results of the conformational changes in micelle environment. Our results strongly support that copper binding mode strongly depends on the protein backbone structure. Moreover, we focused on previously obtained results for amyloidogenic human and chicken fragments in membrane mimicking environment.

Słowa kluczowe

Prion proteins, Copper ions, Histidine residues, Membrane mimicking environment, Micelles

Adres publiczny

http://dx.doi.org/10.1016/j.jinorgbio.2018.11.012

Strona internetowa wydawcy

http://www.elsevier.com