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Zinc protection in cadmium-induced Blood Brain Barrier permeability: a metabolic and morphological in vitro study

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Cadmium (Cd) is a worldwide occupational and environmental pollutant [1]. Cd toxicity is widely known and studied in many tissues and organs such as testis, kidney, liver, lung and brain [2,3]. On the other hand, zinc (Zn) is a trace element known as coenzyme for many proteins such as methallothionein [4]. To date, very little is known about the role of Cd and Zn in BBB permeability.

To study their effects in BBB permeability in vitro, the RBE4 cell line was used and different concentrations of $CdCl_2$ and $ZnCl_2$ were tested. Metabolic activity (MTT assay) was performed to test the protective and preventive role of $ZnCl_2$ on $CdCl_2$ toxicity. Western blotting analysis was used to better investigate the molecular pathway involved in Cd-induced BBB permeability evaluating GRP78 (ER stress marker) and caspase-3 protein expression levels. Furthermore, ZO-1 and F-actin immunofluorescent staining was performed to better understand the morphological alterations and BBB permeability achieved by Cd treatment.

Our preliminary data highlight the role of Cd in evoking BBB permeability by F-actin and ZO1 dislocations, triggering the caspase-3 molecular pathway activation induced by GRP78-ER stress increase. Moreover, the data clearly show how Zn is able to counteract the metabolic impairment induced by Cd treatment.

Taken together these data point out the possible role of Zn in counteracting the Cd-induced BBB impairment.

References

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Keywords

Zinc, Cadmium, BBB permeability, morphology, in vitro study