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Treatment Of Magnesium-L-Threonate Elevates The Magnesium Level In The Cerebrospinal Fluid And Attenuates Motor Deficits And Dopamine Neuron Loss In A Mouse Model Of Parkinson's disease

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Abstract

Purpose: Epidemiology research has demonstrated that magnesium (Mg) deficiency is associated with a high incidence of Parkinson's disease (PD). It is known that the systemic administration of $MgSO_4$ is not able to elevate the Mg concentration in cerebrospinal fluid (CSF). This study aims to verify the protective effect of magnesium-L-threonate (MgT) in 1-methyl-4-phenyl-1, 2, 3, 6-tetrahydropyridine (MPTP) mouse model.

Methods: C57BL/6J mice were orally administered MgT or $MgSO_4$ for 4 weeks, and received MPTP in the third week. After analysis of open-field and rotarod tests on the last day, tyrosine hydroxylase (TH) immunopositive cells and protein levels were quantified in the substantia nigra pars compacta (SNpc) and striatum. The expression of inducible nitric oxide synthase (iNOS) level was evaluated. Mg concentration in serum and CSF was measured after oral administration of $MgSO_4$ or MgT in normal mice. Mg concentration in the CSF was increased in the mice treated with MgT but not $MgSO_4$.

Results: The total distance and mean speed in open-field tests, and the time spent on rotarod in the MgT group were increased, compared with MPTP group. The MgT treatment but not $MgSO_4$ dose-dependently attenuated the loss of TH-positive neurons, and the reduction of the TH expression in the SNpc. The MgT treatment also inhibited the expression of iNOS as measured by immunohistochemistry and Western blots. Double-immunofluorescence staining of TH and iNOS showed iNOS-positive cells were collocalized for TH-positive cells.

Conclusion: The treatment with MgT is associated with an increase of Mg in the CSF. MgT, rather than MgSO4, can significantly attenuate MPTP-induced motor deficits and dopamine (DA) neuron loss.

Keywords: cerebrospinal fluid; magnesium; magnesium-L-threonate; Parkinson's disease.

Conflict of interest statement

The authors report no conflicts of interest in this work.

Figures

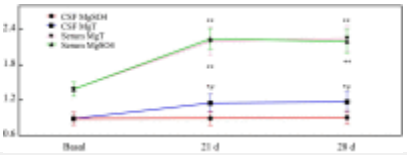

Figure 1

The changes of magnesium concentration…

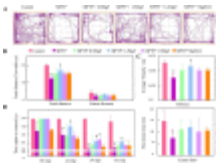

Figure 2

Open-field and rotarod tests. (...

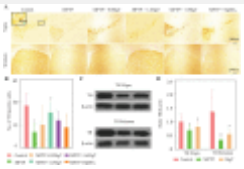

Figure 3

Immunohistochemical staining and Western blot...

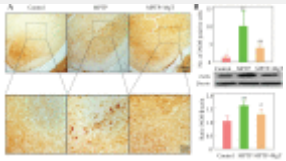

Figure 4

Immunohistochemical staining (**A**)...

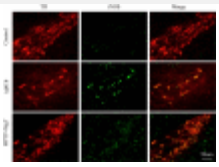

Figure 5

The results of immunofluorescence staining...

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