

The Role of Alpha-Tocotrienol during Development of Primary Hippocampal Neurons

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Objectives: Alpha-tocotrienol (α -TCT), a form of vitamin E, is a lipophilic antioxidant with neuroprotective properties. We recently reported that α -TCT treatment prevents oxidative stress-induced proteolytic cleavage of B-cell lymphoma-extra large (Bcl-xL), a pro-survival mitochondrial protein necessary during neuronal growth. However, it is still unclear if α -TCT exhibits beneficial effects during the physiological development of neurons. In this study, we hypothesized that chronic α -TCT treatment advances the development of primary hippocampal neurons by improving mitochondrial function.

Methods: Primary rat hippocampal neurons were grown in neurobasal media with or without α -TCT for three weeks, and media was replaced with conditioned media containing fresh α -TCT every week. Intracellular α -TCT levels were quantified using HPLC-MS, and intracellular ATP and mitochondrial superoxide levels were determined using luciferase and mitoSOX, respectively. Neurite morphology was examined by Sholl analysis. mRNA and protein levels of Bcl-xL were quantified using qPCR and immunoblotting, respectively.

Results: Primary hippocampal neurons grown in media containing α -TCT had increased intracellular α -TCT levels and decreased mitochondrial superoxide. Treatment with α -TCT increased mRNA and protein levels of Bcl-xL, neuronal ATP, and the number of neurite branches in primary hippocampal neurons.

Conclusions: We found that primary rat hippocampal neurons treated with α -TCT developed advanced neurite complexity. We suggest that α -TCT treatment improves mitochondrial function via upregulation of Bcl-xL, supporting normal neuron development.

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