The comparative effects between tocotrieonol-rich fraction (TRF) and α-tocopherol on glutamate toxicity in neuron-astrocyte mono- and co-culture systems

Abstract

Background: Vitamin E, which can be categorized into tocotrienols and tocopherols, is known to protect cells from glutamate neurotoxicity. Studies have shown that tocotrienol-rich fraction (TRF) protecting the brain against oxidative damage more efficient than α-tocopherol. The role of astrocyte in promoting neuronal survival and recovery after glutamate neurotoxicity is also increasingly appreciated. Aims: To elucidate the effects of TRF and α-tocopherol and the synergism between astrocyte and neuron against glutamate neurotoxicity. Methods: Astrocyte and neuron were subjected to glutamate injury followed by TRF and α-tocopherol treatments (100 – 300 ng/ml). Effects of TRF and α-tocopherol on nerve cell viability and glutathione contents against glutamate toxicity were examined. The synergism between astrocyte and neuron was elucidated through co-culture model. Statistical analysis was performed using one way ANOVA. Results: Both TRF and α-tocopherol improved approximately 10% of glutamate-injured astrocyte and neuronal cell viability. In co-culture model, TRF and α-tocopherol provided nearly complete protection from glutamate toxicity. Besides, TRF and α-tocopherol treatments significantly restored at least 20% of glutathione contents in glutamate-injured neurons. In the presence of astrocyte, 300 ng/ml TRF and α-tocopherol completely restored glutathione contents in glutamate-injured neuron. Conclusions: TRF and α-tocopherol had shown promising neuroprotective effects in astrocyte and neuron from glutamate toxicity. Great scavenging effect of both TRF and α-tocopherol against glutamate toxicity was observed in neuron. Similar protective effects between TRF and α-tocopherol were observed. Co-culture model demonstrated the synergistic properties between neuron and astrocyte. Supplementation of TRF and α-tocopherol in co-culture further improved the recovery process.

Keyword: Tocotrienol-rich fraction; α-tocopherol; Glutamate neurotoxicity; Neuron-astrocyte co-culture