Differential effects of natural polyphenols on neuronal survival in primary cultured central neurons against glutamate- and glucose deprivation-induced neuronal death

楊玲玲;王靜瓊
Lee HH;Yang LL;Wang CC;Hu SY;Chang SF;Lee YH

Abstract

Neuronal injury in the central nervous system following ischemic insult is believed to result from glutamate toxicity and glucose deprivation. In this study, polyphenols isolated from Scutellaria baicalensis Georgi, including baicalin, baicalein, and wogonin, were investigated for their neuroprotective effects against glutamate/NMDA (Glu/NMDA) stimulation and glucose deprivation in primary cultured rat brain neurons. Cell death was accessed by lactate dehydrogenase (LDH) release assay for necrosis, and mitochondrial activity was accessed by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT) reduction activity assay. It was found that both baicalin and baicalein decreased LDH release of the cultured neurons after 24 h treatment, whereas wogonin profoundly increased LDH release after 2 h treatment and resulted in neuronal death after 24 h. Glu/NMDA treatment profoundly increased LDH release and moderately decreased MTT reduction activity in an NMDA receptor-dependent manner. Both baicalin and baicalein significantly reduced Glu/NMDA-increased LDH release, in which baicalein is much more potent than baicalin. Glu/NMDA-increased intracellular calcium was also significantly attenuated by baicalin and baicalein. Baicalin and baicalein did not affect glutamate receptor binding activity, but baicalein did moderately decrease Glu/NMDA-induced nitric oxide (NO) production. In the glucose deprivation (GD) study, baicalein but not baicalin showed significant protective effects on the GD-increased LDH release, without affecting the GD-induced NO production, in cultured rat brain neurons. These results suggest that baicalein is the most effective compound among three polyphenols tested in preventing neurotoxicity induced by both glutamate and GD, whereas baicalin was only effective in preventing glutamate toxicity. Wogonin might have a neurotoxic effect on the brain.