NADPH oxidase contributes to oxidative damage and mitochondrial impairment induced by acute ethanol treatment in rat hippocampal neurons

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Acute ethanol treatment induces neurodegeneration in cultured neurons and can lead to brain damage in animal models. Neuronal cells exposed to ethanol showed an increase in reactive oxygen species (ROS), oxidative damage and mitochondrial impairment contributing to synaptic failure. However, the underlying mechanisms of these events are not well understood. Here, we studied the contribution of NADPH oxidase, as a relevant source of ROS production in the brain, to mitochondrial impairment and oxidative stress induced by ethanol. We used primary hippocampal neurons subjected to an acute treatment of ethanol at increasing concentrations (25, 50, and 75 mM, 24 h), and we evaluated ROS production, mitochondrial function, and synaptic vesicle activity. Our studies showed that after ethanol administration, hippocampal neurons presented an increase in ROS levels, mitochondrial dysfunction, calcium handling defects, and synaptic impairment. Interestingly, treatment with the NADPH inhibitor, apocynin, significantly prevented oxidative stress, mitochondrial dysfunction, and the impairment of synaptic vesicle activity induced by ethanol treatment. These results indicate that NADPH oxidase could be a key participant in the molecular mechanism by which alcohol affects the brain.

Alcohol

Mitochondria

NADPH oxidase

Oxidative stress

adenosine triphosphate

alcohol

apocynin

mitochondrial permeability transition pore

reactive oxygen metabolite

reduced nicotinamide adenine dinucleotide phosphate oxidase

animal tissue

Article

bioenergy

cell viability

controlled study

cytosol

embryo

enzyme inhibition

enzyme mechanism

enzyme synthesis

fluorescence

hippocampus

incubation time

limit of quantitation

mitochondrion

nerve cell culture

nonhuman

oxidative stress

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synapse vesicle

ultraviolet spectrophotometry

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