PLoS One. 2017 May 3;12(5):e0176992. doi: 10.1371/journal.pone.0176992. eCollection 2017.

Molecular hydrogen protects against oxidative stress-induced SH-SY5Y neuroblastoma cell death through the process of mitohormesis

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PMID: 28467497 PMCID: PMC5415102 DOI: 10.1371/journal.pone.0176992

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Abstract

Inhalation of molecular hydrogen (H2) gas ameliorates oxidative stress-induced acute injuries in the brain. Consumption of water nearly saturated with H2 also prevents chronic neurodegenerative diseases including Parkinson's disease in animal and clinical studies. However, the molecular mechanisms underlying the remarkable effect of a small amount of H2 remain unclear. Here, we investigated the effect of H2 on mitochondria in cultured human neuroblastoma SH-SY5Y cells. H2 increased the mitochondrial membrane potential and the cellular ATP level, which were accompanied by a decrease in the reduced glutathione level and an increase in the superoxide level. Pretreatment with H2 suppressed H2O2-induced cell death, whereas post-treatment did not. Increases in the expression of anti-oxidative enzymes underlying the Nrf2 pathway in H2-treated cells indicated that mild stress caused by H2 induced increased resistance to exacerbated oxidative stress. We propose that H2 functions both as a radical scavenger and a mitohormetic effector against oxidative stress in cells.

Figures

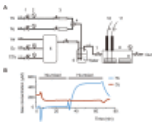

Fig 1. Cell culture system under an…

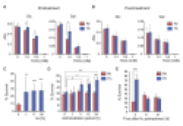

Fig 2. Protective effect of H $_{2}$…

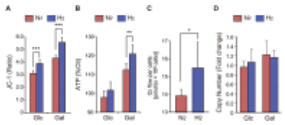

Fig 3. Enhancement of mitochondrial activities by…

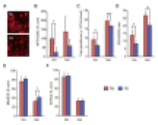

Fig 4. Induction of oxidative stress by…

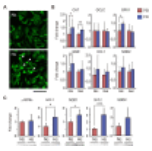

Fig 5. The H $_{2}$ -induced anti-oxidative…

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