Ecotoxicology and Environmental Safety
Volume 56, Dicember 2017, Pages 191-197

Environ Toxicol Pharmacol. 2017 Dec;56:191-197. doi: 10.1016/j.etap.2017.09.012. Epub 2017 Sep 20

Cellular pathways involved in silica nanoparticles induced apoptosis: A systematic review of in vitro studies.

Asweto CO[1], Wu J[1], Alzain MA[1], Hu H[1], Andrea S[1], Feng L[1], Yang X[1], Duan J[2], Sun Z[3].

Author information

1. Department of Toxicology and Sanitary Chemistry, School of Public Health, Capital Medical University, Beijing 100069, PR China; Beijing Key Laboratory of Environmental Toxicology, Capital Medical University, Beijing 100069, PR China.
2. Department of Toxicology and Sanitary Chemistry, School of Public Health, Capital Medical University, Beijing 100069, PR China; Beijing Key Laboratory of Environmental Toxicology, Capital Medical University, Beijing 100069, PR China. Electronic address: jcduan@ccmu.edu.cn.
3. Department of Toxicology and Sanitary Chemistry, School of Public Health, Capital Medical University, Beijing 100069, PR China; Beijing Key Laboratory of Environmental Toxicology, Capital Medical University, Beijing 100069, PR China. Electronic address: zwsun@ccmu.edu.cn.

Abstract

Silica nanoparticles (SiNPs) have been found to pass through biological barriers and get distributed in the human body. They induce cell apoptosis via various mechanisms in body organs. To understand these mechanisms, we carried out systematic review of in vitro studies on SiNPs-induced cell apoptosis. Office of Health Assessment and Translation approach for Systematic Review and Evidence Integration was used to identify 14 studies dating from the year 2000 to current. Four studies showed an increase in DNA damage, cell cycle arrest, proapoptotic factors and decrease in antiapoptotic factors resulting to apoptosis. Eight studies showed induction of mitochondrial dysfunction, Bax upregulation, Bcl-2 downregulation, and caspase-3, -7, -9 activities increase. Increase in FADD, TNFR1 and Bid proteins was observed in one study, while the other NO production and caspase-3 activity was increased. These studies found the potency of SiNPs to induce cell apoptosis through DNA damage, mitochondrial, tumor necrosis factor, and nitric oxide related pathways.

KEYWORDS:

Cell apoptosis; DNA damage; In vitro studies; Mitochodrial damage; Pathways; Silica nanoparticles