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## Potential neurological lesion after nasal instillation of TiO<sub>2</sub> nanoparticles in the anatase and rutile crystal phases

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### Abstract

Nanoscale titanium dioxide (TiO<sub>2</sub>) is massively produced and widely used in living environment, which hence make the potential risk to human health. Central nervous system (CNS) is the potential susceptible target of inhaled nanoparticles, but the studies on this aspect are limited so far. We report the accumulation and toxicity results in vivo of two crystalline phases of TiO<sub>2</sub> nanoparticles (80 nm, rutile and 155 nm, anatase; purity >99%). The female mice were intranasally instilled with 500 µg of TiO<sub>2</sub> nanoparticles suspension every other day for 30 days. Synchrotron radiation X-ray fluorescence analysis (SRXRF) and inductively coupled plasma mass spectrometry (ICP-MS) were used to determine the contents of titanium in murine brain. Then, the pathological examination of brain tissue, oxidative stress-mediated responses, and levels of neurochemicals in the brain of exposed mice were also analyzed. The obvious morphological changes of hippocampal neurons and increased GFAP-positive astrocytes in the CA4 region were observed, which were in good agreements with higher Ti contents in the hippocampus region. Oxidative stress occurred obviously in whole brain of exposed mice such as lipid peroxidation, protein oxidation and increased activities of catalase, as well as the excessive release of glutamic acid and nitric oxide. These findings indicate anatase TiO<sub>2</sub> nanoparticles exhibited higher concern on some tested biological effects. To summarize, results provided the preliminary evidence that nasal instilled TiO<sub>2</sub> nanoparticles could be translocated into the central nervous system and cause potential lesion of brain, and the hippocampus would be the main target within brain.

**Keywords:** TiO<sub>2</sub> nanomaterials; Neurotoxicology; Redox status; Protein oxidation; Lipid peroxidation; GFAP expression

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Conflict of interest

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