Titanium Dioxide Nanoparticles Induce Toxicity in vitro, and in vivo After Repeated Administration in Mice

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Abstract

Nanoparticles of titanium dioxide (TiO2) are often used as white pigment in a wide range of products including paints, paper, plastic, sunscreen and cosmetics, as well as pharmaceutical and food additives. Therefore, in this work we show a series of toxicity studies with TiO2 nanoparticles in vitro and in vivo. The evaluation of toxicity in vitro were done using two cells lines, Vero and MDCK, and in vivo, using Swiss albino male mice. The cells were treated with 500 µg/mL of TiO2 nanoparticles during 24 h, and the toxicity in vitro was evaluated by analysis of DNA content, ROS formation, changes in mitochondrial membrane potential and in cell cycle. These results suggest that TiO2 nanoparticles formulation exert its toxicity increasing ROS amounts, disturbing the mitochondrial membrane potential and blocking the G0/G1 and S phase of the cell cycle, followed by the increase in the number of cells in phase Sub/G1, to Vero cells. The toxicity studies in vivo were done by administration of 2mg/Kg/day of TiO2 nanoparticles intraperitoneally for 10 days. At the end of the treatment a statistically significant decrease in weight gain in mice treated with TiO2 nanoparticles was observed, as well as an accumulation of TiO2 nanoparticles throughout the peritoneal cavity. The weight of the spleen and kidneys showed significant difference in control animals. Additionally, through the hematologic and biochemical parameters analysis, changes in red blood cells, MCV, MCH, hemoglobin, hematocrit, leukocytes and basophiles were observed, as well as an increase in serum AST, which characterize liver injure.

Keywords: TiO2 nanoparticles, toxicity, in vitro, in vivo