POTASSIUM DICHROMATE INDUCED CYTOTOXICITY, GENOTOXICITY AND OXIDATIVE STRESS IN HUMAN LIVER CARCINOMA (HepG2) CELLS.

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Abstract: Chromium can be found in the environment in two main valence states: hexavalent [Cr(VI)] and trivalent [Cr(III)]. Cr (VI) salts are well known human carcinogens, but the results from in vitro studies are often conflicting. Cr (VI) primarily enters the cells and undergoes metabolic reduction; however, the ultimate product of this reduction, Cr (III) predominates within the cell. The reduction of Cr (VI) to Cr (III) results in the formation of reactive intermediates together with the oxidative tissue damage and a cascade of cellular events. However, the mechanism of the toxic action of chromium is not completely elucidated. The main purpose of this study was to evaluate the occurrence of cytotoxicity, genotoxicity and oxidative stress, in the human liver carcinoma [HepG2] cells exposed to potassium dichromate. HepG2 cells were cultured following standard protocol and exposed to various concentrations [0 – 50 µM] of potassium dichromate [K₂Cr₂O₇]. Following exposure to the toxic metal, we performed the MTT assay to assess the cytotoxicity, thiobarbituric acid test to evaluate the degree of lipid peroxidation as an indicator of oxidative stress and DNA damage evaluation using alkaline comet assay. Study results indicated that potassium dichromate was cytotoxic to HepG2 cells, showing LD₅₀ values of 8.83 ± 0.89 µg/ml, 6.76 ± 0.99 µg/ml for cell mortality upon 24 and 48 hrs of exposure respectively; indicating a dose- and time-dependent response with regard to cytotoxic effect of potassium dichromate. Statistically significant increase in the concentration of malondialdehyde [MDA], an indicator of lipid peroxidation, was recorded in exposed cells [15.9 – 69.9 µM] compared to control [13 µM]. Similarly, a strong dose-response relationship (p<0.05) was also obtained with respect to potassium dichromate induced DNA damage [comet assay] in HepG2 cells exposed [3.16 ± 0.70 – 24.84 ± 1.86 microns] to potassium dichromate than control [3.07 ± 0.26 microns]. Our results demonstrate that potassium dichromate is highly cytotoxic to HepG2 cells, and its cytotoxicity seems to be mediated by oxidative stress and DNA damage.

Keywords: HepG2 cells, cytotoxicity, DNA damage, lipid peroxidation, malondialdehyde, potassium dichromate.

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