

Induction of apoptosis in cancer cells by NiZn ferrite nanoparticles through mitochondrial cytochrome C release

ABSTRACT

The long-term objective of the present study was to determine the ability of NiZn ferrite nanoparticles to kill cancer cells. NiZn ferrite nanoparticle suspensions were found to have an average hydrodynamic diameter, polydispersity index, and zeta potential of 254.2 ± 29.8 nm, 0.524 ± 0.013 , and -60 ± 14 mV, respectively. We showed that NiZn ferrite nanoparticles had selective toxicity towards MCF-7, HepG2, and HT29 cells, with a lesser effect on normal MCF 10A cells. The quantity of Bcl-2, Bax, p53, and cytochrome C in the cell lines mentioned above was determined by colorimetric methods in order to clarify the mechanism of action of NiZn ferrite nanoparticles in the killing of cancer cells. Our results indicate that NiZn ferrite nanoparticles promote apoptosis in cancer cells via caspase-3 and caspase-9, downregulation of Bcl-2, and upregulation of Bax and p53, with cytochrome C translocation. There was a concomitant collapse of the mitochondrial membrane potential in these cancer cells when treated with NiZn ferrite nanoparticles. This study shows that NiZn ferrite nanoparticles induce glutathione depletion in cancer cells, which results in increased production of reactive oxygen species and eventually, death of cancer cells.

Keyword: Cancer cells; Cytochrome C; Mitochondrial membrane potential; NiZn ferrite nanoparticles; p53; Reactive oxygen species.