Intercalation of curcumin into liposomal chemotherapeutic agent augments apoptosis in breast cancer cells

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Abstract

Resistance to common chemotherapeutic agents is a frequent phenomenon in late-stage breast cancers. An ideal system capable of the co-delivery of hydrophobic and hydrophilic chemotherapeutic agents can regulate the dosage and co-localization of pharmaceutical compounds and thereby improve the anticancer efficacy. Here, for the first time, we have intercalated curcumin (Cur) into a double-layered membrane of cisplatin (Cis) liposomes to obtain a dosage controlled co-delivery formulation, capable of inducing apoptosis in breast cancer cells. The concentrations of Cur and Cis in nanoliposome (Cur-Cis@NLP) were optimized by response surface methodology (RSM); RSM optimization showed 99.81 and 23.86% entrapment efficiency for Cur and Cis, respectively. TEM analysis demonstrated the fabrication of nanoparticles with average diameter of 100 nm. The anticancer and apoptotic effects of Cur-Cis@NLPs were also evaluated using MTT assay, fluorescent staining and flow cytometry assays. Cytotoxicity assessments of various Cur-Cis@NLPs concentrations demonstrated a concentration-dependent manner. In comparison to free and liposomal Cis, Cur-Cis@NLP reduced breast cancer cells' viability (82.5%) in a significant manner at a final concentration of 32 mu g.mL(-1) and 20 mu g.mL(-1) of Cur and Cis, respectively. Combination index values calculation of Cur-Cis@NLP showed an overall CI value <1, indicating synergetic effect of the designed co-delivery system. Additionally, flow cytometry assay demonstrated Cur-Cis@NLPs triggered apoptosis about 10-folds higher than liposomal Cis. This co-drug delivery system has a potential for the encapsulation and release of both hydrophobic and hydrophilic drugs, while taking the advantages of the reduced cytotoxic effect along with achieving high potency.

Keywords

Author Keywords: Curcumin; liposome; cytotoxicity; breast cancer; apoptosis assays