**Assessing the Influence of a Chitosan Layer on Curcumin Nanoemulsions Bioaccessibility and Apparent Permeability Coefficient**

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Introduction:
Driven by consumers' awareness towards a healthier life style, food industry is seeking edible nanosystems able to encapsulate, protect, and release bioactive compounds, and that should offer the possibility to create new, healthier, and safer food products while improving their quality.

Nanoemulsion-based technology offers the methodologies to encapsulate, protect, and control release, while improving the solubility and bioavailability of these compounds.
The main purposes of this study were to evaluate the behavior of lipid-based nanosystems under in vitro digestion and to assess the cytotoxicity, cellular antioxidant activity, apparent permeability coefficient, and cellular uptake using Caco-2 cells line of undigested nanosystems.

Method:
Curcumin-loaded nanoemulsions and multilayer nanoemulsions were successfully developed using high-pressure homogenization and high-pressure homogenization followed by layer-by-layer (LbL) electrostatic technique.

Significance:
This study suggests that lipid-based nanosystems can be designed as delivery systems offering the opportunity to create functional foods able to maximize curcumin antioxidant capacity.

Results:
The size stability and zeta potential studies showed that both lipid nanosystems were stable during storage (35 days), obtaining hydrodynamic diameters values of 185.6 ± 3.9 nm and 189.1 ± 3.4 nm and zeta potential values of -51.9 ± 2.4 mV and 40.1 ± 1.2 mV for nanoemulsions and multilayer nanoemulsions, respectively. Results showed that both nanosystems were stable at stomach conditions, whereas creaming and phase separation occurred at intestine conditions. The deposition of a chitosan layer onto the nanoemulsions did not significantly increased ($p<0.05$) the curcumin bioaccessibility of 41.6 ± 6.2 % when compared to the nanoemulsions bioaccessibility of 31.6 ± 4.9 %.
The cellular antioxidant activity studies performed revealed that nanoemulsions and multilayer nanoemulsions had respectively 8.5 and 9.9 times higher antioxidant capacity at cellular level (1.79 ± 0.08 and 2.08 ± 0.16 µmol L-1 QE mg-1 curcumin, respectively), when compared to pure curcumin solubilized in ethanol (0.21 ± 0.01 µmol L-1 QE mg-1 curcumin). Permeability assays showed that the use of a chitosan layer significantly increased ($p<0.05$) the apparent permeability coefficient of curcumin through Caco-2 cells by 1.55-folds (1.93 ± 0.02 × 10−6 cm s-1) when compared to the nanoemulsions (1.25 ± 0.05 × 10−6 cm s-1).

Category:
Food Engineering