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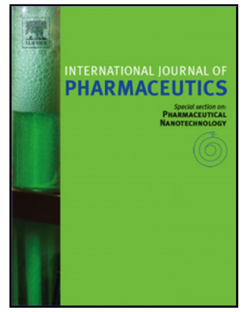

Title: Submicron complex lipid carriers for curcumin delivery to intestinal epithelial cells: effect of different emulsifiers on bioaccessibility and cell uptake

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Submicron complex lipid carriers for curcumin delivery to intestinal epithelial cells: effect of different emulsifiers on bioaccessibility and cell uptake

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Graphical Abstract

Abstract
Submicrometric lipid-based carriers were developed to encapsulate curcumin and deliver it to intestinal epithelial cells.
A lipid matrix comprising monoolein, sunflower oil and water at weight ratio 1:1:1 was selected, upon screening of different combinations of amphiphilic molecules, vegetable oils and water, because of its high encapsulations efficiency of curcumin, retained over time and relatively lower content of amphiphilic molecules.
Upon dispersion in aqueous phase, the carriers were stabilized by: (a) whey protein isolates (WPI), alone and (b) in combination with modified starch (WPI-MS), or by (c) polysorbate 20 (T20). Whereas T20-stabilized systems exhibited extremely fine particles (120 nm), WPI and WPI-MS stabilized carriers were characterized by a significantly larger mean particle size (270 nm). The thicker macromolecular layer of WPI and WPI-MS enabled better (a) physical stability, (b) controlled shell degradation during simulated digestion, and (c) curcumin bioaccessibility targeted at the intestinal digestion phase than T20-systems.
However, uptake studies in HT29 cell lines, simulating intestinal epithelial cells, showed that WPI and WPI-MS carriers exhibited after 24 h a lower relative uptake than T20-stabilized systems (about 60 % and 80 %, respectively), as a consequence of smaller size and higher cell adherence of T20 carriers to the cell membrane.

Keywords: Curcumin; Lipid-based carriers; Whey protein isolates; Simulated digestion; Cell uptake; HT29 cell line
Chemical compounds studied in this article:
Monoolein (PubChem CID: 5283468); Tween 20 (PubChem CID: 443314).

Introduction
The incorporation of natural antioxidants into food systems is becoming increasingly important as part of a strategy to promote health and well-being through nutrition (Chen et al., 2006). However, the poor water solubility of some bioactive compounds, such as curcumin, a powerful natural antioxidant with well documented anti-inflammatory and anti-cancer activities (Anand et al., 2008, Maheshwari et al., 2006, Ali et al., 2006), prevents them from being easily mixed with other food ingredients, as well as from being significantly assimilated upon ingestion (Donsì et al., 2013).
The encapsulation of bioactive compounds represents an efficient strategy to improve their dispersibility in foods, to prevent their degradation under adverse environmental conditions, such as