Bio-based nanocarriers incorporating curcumin – bioaccessibility and cell viability evaluation

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For decades, curcumin (Cur), a natural polyphenol product derived from turmeric (*Curcuma longa*) has been considered one of the most promising bioactive compounds due to its health benefits such as anti-inflammatory, antioxidant and anticarcinogenic properties. However, Cur application as functional compound in food products has been limited due to light, heat, and oxidation sensitive and mainly, to poor aqueous solubility which limit its bioavailability [1]. To increase Cur bioaccessibility and consequently, increase bioavailability, several carriers have been investigated, particularly nanocarriers. Among the various nanocarriers described in the literature, lipid-based nanocarriers may offer a promising tool to increase the stability, efficacy and safety of lipophilic compounds, namely Cur [2]. Moreover, the understanding of Cur-loaded nanocarriers' behaviour under gastrointestinal (GI) conditions is fundamental to produce safe and customized nanocarriers with optimized bioactivity for oral consumption.

The aim of this study was to comparatively analyze the impact of two different lipid nanocarriers incorporating Cur - solid lipid nanoparticles (SLN) and nanoemulsions (NE) – on bioaccessibility and Caco-2 cells viability.

The evaluation of the Cur-loaded lipid-based nanocarriers was performed based on their physicochemical properties and bioaccessibility under *in vitro* simulated GI conditions (using INFOGEST *in vitro* digestion method). During digestion process, samples were collected at each stage (i.e. mouth, stomach and intestine) and nanocarriers' size, ζ-potential, free fatty acids' release (FFA) and cur bioaccessibility were evaluated. Furthermore, *in vitro* cell viability of different nanocarriers was analyzed in Caco-2 cell line by MTT assay. Caco-2 cells were incubated with free Cur and different nanocarriers formulations at CU concentration of 0-25 $\mu g.mL^{-1}$ for 24 h.

The results from the *in vitro* digestion indicated Cur-loaded SNL and Cur-loaded NE stability under simulated mouth and stomach conditions. On the other hand, these nanocarriers were destabilized under simulated intestinal conditions; Cur-loaded NE showed less stability because particle size increased indicating droplet coalescence. Also, higher amount of FFA was released from NE compared to SNL. NE and SLN increased 3.4 and 2.5 times Cur bioaccessibility, respectively. *In vitro* cell viability assay revealed that the highest concentration of Curc on both NE and SLN formulations that one can use without interfere with cellular viability was 15 $\mu g.mL^{-1}$ after 24 h incubation.

This study showed the potential of fabricated NE and SLN for oral delivery of Cur, a hydrophobic nutraceutical molecule, by assembling essential information on digestion and safety of different nanocarriers.

References

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