Original Research

**Development and characterization of lipid-polymeric nanoparticles for oral insulin delivery**

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**Abstract**

**Introduction**: The oral route is widely accepted as the most physiological path for exogenous administration of insulin, as it closely mimic the endogenous insulin pathway. Thus, in this work it is proposed an innovative lipid-polymeric nanocarrier to delivery insulin orally.

**Areas covered**: Nanoparticles were produced through a modified solvent emulsification-evaporation method, using ethyl palmitate and hydroxypropylmethylcellulose acetate succinate as matrix. Lipid-polymeric nanoparticles were around 300 nm in size, negatively charged (-20 mV) and associated insulin with efficiency higher than 80%. Differential scanning calorimetry suggested thermal stability of nanoparticles. *In vitro* release assays under simulated gastrointestinal conditions resulted in 9% and 14% of insulin released at pH 1.2 during 2 h and at pH 6.8 for 6 h, respectively, demonstrating the ability of those nanoparticles to protect insulin against premature degradation. Importantly, nanoparticles were observed to be safe at potential therapeutic concentrations as did not originate cytotoxicity to intestinal epithelial cells. Lastly, the permeability of nanoencapsulated insulin through Caco-2 monolayers and a triple Caco-2/HT29-MTX/Raji B cell model correlated well with slow release kinetics, and fosters the effectiveness of nanoparticles to promote intestinal absorption of peptidic drugs.

**Expert Opinion**: Lipid-polymeric nanoparticles were developed to encapsulate and carry insulin through intestine. Overall, nanoparticles provide insulin stability and intestinal permeability.

Keywords: [ethyl palmitate](http://www.tandfonline.com/keyword/Ethyl%2BPalmitate), [HPMC-AS](http://www.tandfonline.com/keyword/HPMC-AS), [insulin](http://www.tandfonline.com/keyword/Insulin), [lipid-polymeric nanocarrier](http://www.tandfonline.com/keyword/Lipid-polymeric%2BNanocarrier), [oral administration](http://www.tandfonline.com/keyword/Oral%2BAdministration), [intestinal permeability](http://www.tandfonline.com/keyword/Intestinal%2BPermeability)

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