

Oral Insulin Delivery: How Far Are We?

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Abstract

Oral delivery of insulin may significantly improve the quality of life of diabetes patients who routinely receive insulin by the subcutaneous route. In fact, compared with this administration route, oral delivery of insulin in diabetes treatment offers many advantages: higher patient compliance, rapid hepatic insulinization, and avoidance of peripheral hyperinsulinemia and other adverse effects such as possible hypoglycemia and weight gain. However, the oral delivery of insulin remains a challenge because its oral absorption is limited. The main barriers faced by insulin in the gastrointestinal tract are degradation by proteolytic enzymes and lack of transport across the intestinal epithelium.

Several strategies to deliver insulin orally have been proposed, but without much clinical or commercial success. Protein encapsulation into nanoparticles is regarded as a promising alternative to administer insulin orally because they have the ability to promote insulin paracellular or transcellular transport across the intestinal mucosa. In this review, different delivery systems intended to increase the oral bioavailability of insulin will be discussed, with a special focus on nanoparticulate carrier systems, as well as the efforts that pharmaceutical companies are making to bring to the market the first oral delivery system of insulin. The toxicological and safety data of delivery systems, the clinical value and progress of oral insulin delivery, and the future prospects in this research field will be also scrutinized.

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Abbreviations: (DPPC) dipalmitoyl phosphatidylcholine, (GIT) gastrointestinal tract, (HPMCP) hydroxypropyl methylcellulose phthalate, (MC) methyl cellulose, (MMA) methyl methacrylate, (PEG) polyethylene glycol, (PLGA) polylactic-co-glycolic acid, (SLN) solid lipid nanoparticles, (T1DM) type 1 diabetes mellitus, (T2DM) type 2 diabetes mellitus, (TPP) tripolyphosphate, (WGA) wheat germ agglutinin

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