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Development and Evaluation of PEG-Gelatin-Based Microparticles to Enhance the Oral Delivery of Insulin

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Abstract

Background: Diabetes mellitus is a global disease identified by hyperglycemia due to defects in insulin secretion, insulin action, or both.

Objective: The main objective of this research was to evaluate the ability of gelatinized Poly (ethylene glycol) (PEG) microparticles to be used as carriers for oral insulin delivery via double emulsion preparation.

Methods: Five different batches of the formulation consisting of gelatin:PEG were prepared as follows: 0:1 (W1), 1:0 (W2), 1:1 (W3), 1:3 (W4), and 3:1 (W5). The prepared microparticles (from insulin-loaded batches) had particle sizes ranging from 19.5 ± 0.32-23.9 ± 0.22 μm and encapsulation and loading capacities ranging from 78.8 ± 0.24-88.9 ± 0.95 and 22.2 ± 0.96-29.7 ± 0.86%, respectively. The minimum and maximum in vitro release rates were 8.0 and 66.0%, respectively, for batches W1 and W2 at 8 h.

Results: Insulin-loaded MPs induced a significant decrease in glucose levels, with a reduction from 100 to 33.35% in batch W5 at 9 h compared to that of subcutaneous insulin (100 to 22.63%). A liver function study showed that the formulation caused no obvious toxicity to the experimental rats.

Conclusion: Gelatinized PEG-based microparticles as insulin delivery systems may open a new window into the development of oral insulin for diabetic treatment.

Keywords: Gelatin: PEG; diabetes; in vitro.; toxicity.