Properties and Formulation of Oral Drug Delivery Systems of Protein and Peptides

A. SEMALTY*, MONA SEMALTY, R. SINGH, S. K. SARAF[1] AND SHUBHINI SARAF[2]
Department of Pharmaceutical Sciences, H.N.B. Garhwal University, Srinagar - 246 174, India, [1]Faculty of Pharmacy, NIEC, Lucknow - 226 001, India, [2]Faculty of Pharmacy BBDNITM, Lucknow - 226 001, India

Semalty, *et al.*: Oral Drug Delivery of Proteins and Peptides

Although most protein pharmaceuticals are usually formulated as a solution or suspension and delivered by invasive routes such as subcutaneous injections, major efforts in both academic and industrial laboratories have been directed towards developing effective oral formulations and increasing the oral absorption of intact protein through the use of formulations that protect the macromolecule and/or enhance it's uptake into the intestinal mucosa. However, in spite of these major attempts, relatively little progress has been made. For the efficient delivery of peptides and proteins by non-parenteral route, in particular via the gastrointestinal tract, novel concepts are needed to overcome significant enzymatic and diffusion barriers. The properties of protein and peptides, which are of major interest in oral delivery, are highlighted in the article. This article reviews the various problems associated and novel approaches for formulation and development of oral protein and peptide drug delivery systems.

Key words: Oral protein delivery, protein and peptide, oral insulin

Peptide and polypeptides are low and/or high molecular weight biopolymers, which yield two or more amino acid on hydrolysis. Peptides and polypeptides are the principle component of the protoplasm of cells and are high molecular weight compounds consisting of alpha amino acid connected together by peptide linkages. These proteins serve as enzymes, structural element, hormones or immunoglobulin and are involved in metabolic process, cell growth, immunogenic defense mechanisms and other biological activities[1-4].

Peptides and polypeptides or proteins are an important class of biological substances which are not only the essential nutrients of human body, but some of the polypeptide hormones like insulin are used in treating various diseases resulting from hormonal deficiency[5]. As this use of peptides and polypeptides for systemic treatment of certain diseases is well accepted in medical practice, research activities are being directed towards the synthesis of large quantities by rDNA technology.

The most common route of administration for protein and peptide drug delivery has been parenteral, although many other routes have been tried with varying degree of success. Routes such as intranasal, transdermal, buccal, intraocular, rectal, vaginal and pulmonary route will deliver the drug to the systemic circulation while avoiding transit through the digestive system[6-12]. A major factor that limits the usefulness of these substances for their intended therapeutic application is that they are easily metabolized by plasma proteases when they reach the peripheral circulation. In addition, adverse effects associated with applying these drugs to the pulmonary or the other mucosal surfaces, may be limiting.

Delivering therapeutically active protein and peptides by the oral route has been a challenge and a goal for many decades. Currently only two biotechnology drugs (Interferon alpha and human growth hormone) that can be given orally are known to be in clinical development in the US[13]. For such drugs to be absorbed through the gastrointestinal tract, they must be protected from enzyme and must traverse through the luminal barriers into the blood stream in an unchanged form. This article reviews the problems associated with the oral delivery of proteins and peptides and presents approaches for the formulation of the delivery system for the same.

***For correspondence**
E-mail: semaltyajay@gmail.com