# Oral Delivery Challenges and Solutions through the Novel Research

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## Introduction

The prime leaders of pharmaceutical industry consider oral delivery to be the most convenient mode of drug administration in spite of failure to achieve better bioavailability by certain promising therapeutics. A therapeutic entity and its final formulation which selectively smashes market target mainly due to its effective pharmacokinetic profile and ultimate therapeutic outcome decides its success. The problems associated with oral delivery are being corrected through plethora of efforts which resulted into invention of creative strategies to overcome the physical, chemical and biological barriers responsible for poor absorption of drugs following oral administration. The existing technologies used to design these successful oral formulations are not to be trivialized based on their inability to meet the current challenges of oral delivery. The specific problems associated with new therapeutic moieties such as gastrointestinal instability, insufficient bioavailability due to poor uptake, poor pharmacokinetic profiles, and incomplete target access present challenges for the pharmaceutical scientists in designing the successful oral delivery formulations and are issues that must be addressed urgently. Pharmaceutical companies spent billions for the invention of therapeutic molecules suitable for successful oral delivery [1]. Ultimately most of these companies performed through multiple, extensive, high-throughput screens and alternatively looked at herbal products and traditional medicines [2]. Further efforts were put in combination of interdisciplinary approaches such as genomic, proteomic, kinomic, and metabolic data [3] and yielded a few entities. These efforts may not yield expected results in the invention of many new entities, but formulation scientists have to logically focus on ways to improve the bioavailability of therapeutic agents that would not be otherwise considered appropriate for oral drug delivery. Some reported studies revealed that we become success in optimizing the oral delivery of existing approved therapeutics to specific segments of the gastrointestinal tract. By keeping the existing knowledge as a base, more efforts have focused on stability aspects including improvement of drug uptake approaches for oral delivery.

In the present day scenario, nanostructures have been claimed to be alternative remedies to improve oral drug delivery in many ways even though the concept is still not clear and yet to be proved in clinical developments. Drug encapsulated nanostructures are said to be suitable answer for problems such as poor absorption from intestinal lumen with improved bioavailability. It is further expected that these nanoformulations achieve greater drug distribution at the farthest surface of intestinal epithelium when compared to other solid dosage forms. This expects a potentially improvement in the uptake outcome and/or absorption profile of the drug.

## Polymeric Nanostructured Dosage Forms

The colloidal drug carriers, such as, solid lipid nanoparticles, micelles, nanoemulsions, nanosuspensions, polymeric nanoparticles, and liposomes might overcome many of the solubility related problems. For the last 2-3 decades, these drug delivery systems gained more attention. The varieties of lipids are used in these formulations. The diversity in physical and chemical properties and biocompatibility of lipids helps to enhance oral bioavailability of drugs and hence, lipid nanoparticles are considered very attractive carriers for oral drug delivery. Nanostructured Lipid particles are capable enough to promote oral absorption of the encapsulated drugs via selective lymphatic uptake. Moreover, their tiny size made these formulations to rarely undergo blood clearance by the reticuloendothelial system. Overall, lipid based nanoformulations exhibited strong potential as oral drug delivery carriers. Utilization of protein and peptides as bio-therapeutic agents has been started since the discovery of insulin in 1922. This is mainly because of their high activity, specificity and improved efficacy compared with conventional therapeutics. Enhanced evidence of the therapeutic potential of these macromolecules has promoted not only to the production of these compounds in large, but has also gained attention of biomedical scientists to develop the nanostructured oral systems of these macromolecules. In current medical practice, most of the marketed proteins and peptides are unfortunately administered by parenteral route due to their instability and selected permeability. Parenteral route is invasive in nature and suffers with several important drawbacks including cost issues. Hence, oral route is thought to be more convenient modality of administration among all other alternative modes of administration which are currently being explored. Certain protein and peptides are found to be more suitable by oral administration because this route mimics physiological pathways by which they may reach their site of action. For instance, oral insulin encapsulated in nanostuctured material absorb through portal vein, would directly lead insulin to the target organs, thus reducing adverse systemic effect [4]. The work on improvement of insulin nanocomplex uptake across Caco-2 cell monolayer in vitro has been reported [5].

## Conclusion

Nanotechnology has been attracted and identified as a great potential to make successful of an oral delivery. By rightful utilization of this technology formulation scientists can engineer the delivery carrier to slowly degrade, react to stimuli and be site-specific. Nanotechnology has also gained importance in enhancing of oral bioavailability of poorly soluble drugs, achieving controlled release, and drug targeting which resulted into increased efficacy and safety as well as improved patient compliance. Nanomedicine may be the vital to revealing the advance

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of oral delivery of proteins and peptides such as insulin. Due to faster developments and dynamic changes taking place in nanotechnology area, it is very difficult for us to predict the future this field in drug delivery systems. There is a urgent need to address the major health care problems through nanotechnology which can be achieved by mutual efforts of multidisciplinary scientists, so that the future of nanotechnology in drug delivery may become optimistic to solve the major health problems.

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