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Short Commentary

Solid Lipid Nanoparticles (SLN) for Oral Drug Delivery: An Overview

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Past few decades have witnessed significant advances in the drug delivery technologies. Conventional tablets are yet the most common, the "Nano" and "lipid" has gained a lot of attention amongst the researchers to develop the delivery systems for various types of drugs. When they are combined, nanoparticles formulated form various lipids have shown a huge success [1]. Solid lipid nanoparticles were introduced in early 1990s, as an effort to enhance the bioavailability of poorly water-soluble drugs [2]. Solid lipid nanoparticles combine the advantages of both the drug delivery systems: nanoparticles and lipid emulsion. They are formulated with lipids which are solid at body temperature and at the room temperature. Some of the most common advantages the lipid based nanoparticles are the reduced particle size leading to increased surface area, faster dissolution and subsequently improved bioavailability. In general, these nanoparticles are having a solid lipid core stabilized by an emulsifier at the interfacial region [3]. Further, surface modifications can also be done to achieve targeted drug delivery and/or improved therapeutic efficacy. Since these nanoparticles comprised of solid lipids, it offers the advantages of both delivery systems: lipid emulsion systems and polymeric nanoparticle systems and most importantly overcome stability issues that other drug delivery approaches suffer. The formulation of drug-loaded SLN is mainly comprised of solid lipid, drug, and emulsifier which are biocompatible and biodegradable and have been used for controlled and specific targeting drug delivery. Various lipids such as cetyl palmitate, stearic acid, palmitic acid, glyceryl mono stearate (Imwitor® 900, Geleol®), tricaprin, trilaurin, trimyristin, triopalmitin, tristearin, glyceryl behenate (Compritol®888 ATO), Glyceryl palmitostearate (Precirol® ATO 5) etc have been widely used to prepare SLN [4]. Various techniques are available to produce SLN such as high-pressure homogenization, high shear homogenization, microemulsion method etc. [5]. Depending upon the physicochemical properties of the drugs and the lipid, suitable method should be selected. Prepared nanoparticles are often characterized in terms ofparticle size, surface charge (zeta potential), crystallinity, drug loading and drug entrapment, In vitro drug release kinetic and In vitro lipid degradation [6].

One of the major advantages to deliver drug in solid lipid nanoparticles over other drug delivery systems is that it can incorporate poorly soluble drug and can improve the oral bioavailability. In general, upon oral administration, the drug release could occur from the nanoparticles and/or the intact nanoparticles could be absorbed via active absorption mechanism. This intact particle absorption can be beneficial when the drug molecule has instability in gastric environment and most importantly, if suffers high first pass metabolism. These nanoparticles are often formulated using physiological lipid, and therefore are biodegradable as well. Since they are physiological lipids, administration of SLN can trigger the secretion of bile salts, phospholipids and cholesterol and forms a crude emulsion leading to solubilization of the poorly water-soluble drug which might have released from the SLN [7]. The chances of solubilization of drug is more over the precipitation as micelles are formed due to the presence of pancreatic lipase and other lipolytic products. [8]

Another major mechanism of higher bioavailability for drug from SLN is due to active absorption of SLN through intestinal epithelium. Several researchers have shown that SLN can be absorbed by endocytosis through the intestinal epithelium [9-11]. Followed by internalization, the SLN can be taken up by the transferrin-related endosomes, lysosomes, endoplasmic reticulum and Golgi apparatus [12]. Researchers have also reported the absorption of SLN through lymphoid tissue that consists of either isolated or aggregated lymphoid follicles, which form Peyer's patches, in the intestine [11] and this absorption can occur via either endocytosis, phagocytosis, pinocytosis, and micropinocytosis or combination of thereof [13]. In general, depending upon the physicochemical properties of nanoparticles and the component of the system, one or more mechanism can contribute for the enhanced bioavailability. There are many research articles published with success in achieving enhanced bioavailability when studied In vitro and/or In vivo and there is still more research going on to use SLN as a drug delivery platform to overcome the solubility and oral bioavailability issues.

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