Development of Ibuprofen Loaded Glycerine Nanoparticles for Skin Application

Gul Rehman Elmi, Shahana Khattak, Farah Azhar, Humaira Naureen, Hina Ahsan, Isra Rana, Saba Sohail

Riphah Institute of Pharmaceutical Sciences, Riphah International University, Islamabad, Pakistan

ABSTRACT

Background: Glycerine nanoparticle (GNP) is an emerging nanotechnology for solubility improvement by glycerine. Glycerine in being as polyol compound is responsible for enhanced solubility of drug in GNPs. Ibuprofen has low oral bioavailability and topical permeability because of poor solubility and transdermal permeability barriers. When administered orally, poor solubility results in low bioavailability, increased dosage and large inter-subject and intra-subject variation. Cardiovascular and gastrointestinal safety could also be enhanced by topical application of ibuprofen. However, the poor permeability of IBU through human skin makes it difficult to get good bioavailability.

Objectives:

- To prepare Ibuprofen glycerine nanoparticles (IBU-GNPs) and formulate IBU-GNP hydrogel.
- To evaluate the physical characteristics IBU-GNP and IBU-GNP hydrogel.
- To determine and compare in vitro release and in vivo anti-inflammatory response of IBU-GNP hydrogel and marketed gel.

Methods: IBU-GNPs were prepared by precipitation method and subjected to zetasizer, scanning electron microscopy (SEM), differential scanning calorimetry (DSC), fourier transform infrared spectroscopy (FTIR) and entrapment efficiency (EE) analysis. After obtaining required results from IBU-GNPs, they were formulated as hydrogel dosage form for topical application using carbopol 934 (2%w/v). Physical characterization of hydrogel including appearance, homogeneity, spreadability, pH, viscosity and EE were followed by in vitro release, by dialysis bag method, and in vivo anti-inflammatory study, by carrageenan induced rat edema model, in comparison to marketed ibuprofen gel was performed for IBU-GNP hydrogel.

Results: IBU-GNPs had uniform Z average diameter of 492.9 ± 44.22 nm with spherical shape and polydispersity index of 0.392, indicating uniform distribution of particles and homogeneity. DSC thermogram and FTIR spectrum indicated interaction of ibuprofen with glycerine and encapsulation of ibuprofen inside nanoparticles, respectively. The EE of IBU-GNPs and hydrogel was 96.36% and 93.98%, respectively. Physical characteristics of hydrogel were upto the mark with in vitro data revealing quick and controlled release and was best fitted to Higuchi model and followed Fickian diffusion as release mechanism as value of n = 0.368. IBU-GNP hydrogel rapidly lowered inflammation induced by carrageenan followed by sustained anti- inflammatory activity confirming in vitro release pattern.

Conclusion: From the current research, it was concluded that glycerine based ibuprofen nanoparticles incorporated in hydrogel dosage form is a competent nanotechnology to safely and effectively deliver ibuprofen topically for the treatment of chronic inflammatory disorders including osteoarthritis and rheumatoid arthritis.