International Journal of Applied Pharmaceutics

ISSN- 0975-7058 Vol 14, Issue 5, 2022

Original Article

BIOAVAILABILITY ENHANCEMENT OF REPAGLINIDE USING NANO LIPID CARRIER: PREPARATION CHARACTERIZATION AND *IN VIVO* EVALUATION

ROOHI KESHARWANI[1], DILIP K. PATEL[2], PANKAJ KUMAR YADAV[1]

[1,1]Department of Pharmaceutical Sciences, Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj, U. P., India, [2]Department of Pharmacy, Government Polytechnic Jaunpur, U. P. India
Email: roohi4mail@gmail.com

Received: 26 Apr 2022, Revised and Accepted: 23 Jun 2022

ABSTRACT

Objective: The aim of this study to manufacture the prolonged release lipid nanoparticle (Solid lipid nanoparticle and nanostructure lipid carrier) of repaglinide for enhance the oral bioavailability.

Methods: Solid lipid nanoparticles (SLN) and Nanostructured lipid carriers (NLC) were prepared by slight modification in the solvent diffusion method. The core material used as cetyl alcohol while blend with oleic acid was used in the preparation of NLC dispersion. Tween 80 were utilized as a Surfactant and lecithin as a cosurfactant in both types of lipid formulation. Lipid nanoparticles were characterized for size distribution, entrapment parameter, zeta potential, surface morphology, *in vitro* drug release and stability study. Pharmacodynamic study were also performed to evaluate the antidiabetic activity of repaglinide-loaded lipid nanodispersion.

Results: It was observed that lipid matrix-based SLN and NLC having significant particle size (157.8±15.8 nm for NLC and 238.4±48.2 nm for SLN dispersion), entrapment efficacy 79.82±0.84% for NLC and 72.04±1.03% for SLN dispersion. Zeta potential report was also clarifying that the formulation is in a stable state for a prolong time. SEM study size distribution of particle as evaluated by Malvern instrument. The formulation was also confirmed to be stable after 180 d of storage, according to the data from the stability study. The *in vivo* antidiabetic assessment showed that Repaglinide-loaded SLN and NLC dispersion were able to reduce the blood sugar level. Interestingly, in the case of the RPG-SLN, RPG-NLC-I and RPG-NLC-II groups, and the average blood sugar values at all-time intervals were significantly less than that of the basal glucose value ($p<0.05$).

Conclusion: The prepared SLN and NLC dispersion having the ability to control the release and make nano formulation suitable to resolve poor bioavailability of repaglinide.

Keywords: Repaglinide, Nanostructure lipid carrier, NLC, SLN, Solid lipid nanoparticle, Lipid nanoparticle

DOI: https://dx.doi.org/10.22159/ijap.2022v14i5.45032. Journal homepage: https://innovareacademics.in/journals/index.php/ijap

INTRODUCTION

The oral route administration provides a treasured option for treating numerous diseases as it shows compliance, cost-effectiveness and ease of administration and is considered as the most commonly acknowledged route for drug administration. Miserably, more than 40% of API emerged from the drug discovery and development processes are not appropriate for the drug delivery via oral route as a consequence of their hydrophobic nature and present poor oral bioavailability ultimately the insufficient concentration of the drug is reached to the site of action with consecutively deficient pharmacological response [1-6].

Diabetes mellitus is a widespread, persistent ailment with serious life-threatening results on different parts/functions all over the body. The maximum number of diabetic sufferers is observed to be type II diabetes mellitus, i.e., (non-insulin dependent). To control this type of diabetes, various classes of oral anti-diabetic drugs are commonly utilized in the market to decrease dosage and adverse events accompanying the drug [7, 8]. Belongs to this various medications available from different classes being utilized, such as Sulfonylurea Thiazolidinedione, Biguanide Meglitinide analogs, and Glucosidase inhibitors etc. [9, 10].

The drug (Repaglinide) is an oral medicament utilized to treat type 2 diabetes; shows poor water solubility is associated with class II Biopharmaceutical Classification System [11-15].

The different Repaglinide (RPG) nanoparticles were formulated, such as nanoemulsions, self-nano emulsifying systems, nanocrystals, and solid lipid nanoparticles and NLC [16-19]. The SLN and NLC, both types of lipid nanocarriers, exhibit the great potential to improve the therapeutic effectiveness of numerous drugs by various routes of administration like oral, parenteral and dermal. There are innumerable investigations which have established the SLN or NLC formulation with therapeutic potential [20-22]. Nowadays, solid lipid nanoparticles (SLNs) and NLC have fascinated much recognition as nanotechnology-based drug delivery systems. Their main benefits such as the chance of controlled and targeting drug release, potential incorporation of hydrophobic as well as hydrophilic drugs, amazing biocompatibility and low biotoxicity [23, 24]. The administration of SLNs via oral route can assuredly increase the lymphatic transport of drugs, consequently, decreased first-pass hepatic metabolism and increased oral bioavailability of the drug is observed [25-27].

MATERIALS AND METHODS

Materials

Repaglinide raw material was a gift sample from Guapha Pharm. INDIA, Cetyl alcohol was obtained from Gift sample from Guapha Pharm. INDIA, Oleic acid procured from Loba Chemie Pvt. Ltd., INDIA, Lecithin and Tween80 were purchased from Fizmerk Chemical India; all remaining reagents utilized in this study were high-performance liquid chromatography (HPLC) grade.

Preparation of lipid-based nano dispersion

Repaglinide-loaded nanodispersion (RPG-SLNs/NLCs) was prepared by solvent diffusion method as showed in fig. 1. Optimal amounts of solid lipid and Repaglinide (for NLC liquid lipid also added) were dissolved in 3 ml (for larger size formulation 5 ml) ethanol at 75 °C with stirring. Furthermore, 10 ml aqueous solution consists of 0.5% Lecithin (w/v) (in case of large size formulation 1% Tween 80 used) was heated to the similar temperature and stirring rate. Subsequently, the organic phase was dispersed rapidly in the aqueous phase. After that, under high-speed stirring with the use of T 25 digital Ultra Turrax® (IKA Works GmbH and Co, Germany) at 12000 rpm for 10 min the lipid phase was dispersed into the