International Journal of Applied Pharmaceutics

ISSN: [illegible]

Vol 14, Issue 6, [illegible]

Original Article

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

ROOHI KESHARWANI, DILIP K. PATEL*, PANKAJ KUMAR SAHU*

[1]Department of Pharmaceutical Sciences, Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj, U. P., India. [2]Department of Pharmacy, Government Polytechnic Sarangarh, C. P. India

Email: [illegible]

Received: 22 Apr 2022, Revised and Accepted: 23 Jun 2022

ABSTRACT

Objective: The aim of this study is formulation the prolonged release lipid nanoparticle (Solid lipid nanoparticle and nanostructure lipid carrier) of repaglinide for enhancement the oral bioavailability.

Methods: Solid lipid nanoparticles (SLN) and Nanostructured lipid carriers (NLC) were prepared by slight modification of the solvent diffusion method. The root materials used in solid dispersal vehicle blend with olive oil/ oil was used in the preparation of NLC dispersion. Tween 80 were utilized as a surfactant and lecithin as a coadjutant in both types of lipid formulations. 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 nanoparticles.

Results: It was observed that lipid matrix based SLN and NLC having significant particle size (127 to 215 nm for the NLC and 138-[illegible] nm for SLN dispersion), entrapment efficiency 79.[illegible]% for NLC and 71.[illegible]% for SLN dispersion. Zeta potential report was also showing that the formulation is in a stable state for a prolonged time. SEM study also distribution of particle as evaluated by Malvern instrument. The formulation was also mentioned 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 80% SLN, 80% NLC-1 and 80% 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 more formulation suitable to improve oral bioavailability of repaglinide.

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

© 2022 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/) DOI: https://doi.org/10.22159/ijap.2022v14i6.45[illegible] Journal homepage: https://innovarepublications.com/ijap/index.php/ijap

INTRODUCTION

The oral route administration provides a treasured notion for treating numerous diseases as it shows consistency, cost-effectiveness and ease of administration and is considered as the most commonly acknowledged route for drug administration. Moreover, 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 lipid solubility nature and present poor oral bioavailability ultimately, the healthcare administration of the drug is resulted to the use of active with unsatisfactorily 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 incident of diabetic ailments 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 extensively utilized in the market to decrease dosage and adverse events accompanying the drug [7, 8]. Dosage in this various medications available from different classes being utilized such as Sulfonylurea, Thiazolidinedione, Biguanide, Meglitinide analogs, and Alpha-glucosidase inhibitors are [9, 10].

The drug (Repaglinide) is an oral hypoglycemic utilized to treat type 2 diabetes, shows poor water solubility as consistent with class II Biopharmaceutical Classification System [11-13].

The different repaglinide (RPG) nanoparticles were formulated, such as nanoemulsion, self-nano emulsifying systems, nanosuspensions, and solid lipid nanoparticles and NLC [14-16]. The SLN and NLC, both types of lipid nanoparticles, exhibit the great potential to improve the therapeutic effectiveness of numerous drugs by various routes of administration like oral, parenteral and dermal. There are incomparable investigations which were established the SLN or NLC formulations with therapeutic potential [17-19]. Nowadays, solid lipid nanoparticles (SLNs) and NLC have fascinated much recognition as nanotechnology-based drug delivery systems. Their basic benefits such as the chance of controlled and targeting drug release, potential incorporation of hydrophilic as well as lipophilic drugs, showing biocompatibility and low toxicity [20, 21]. The administration of SLNs via oral route can assuredly increase the lymphatic transport of drugs, consequently, decreased first-pass impact, metabolism and increased oral bioavailability of the drug is observed [22-27].

MATERIALS AND METHODS

Materials

Repaglinide raw material was a gift sample from Sanofin Pharma (INDIA). Cetyl alcohol was obtained from GPL sample from Genphe Pharm (INDIA). Oleic acid procured from Loba Chemie Pvt. Ltd. (INDIA). Lecithin and Tween80 were purchased from Research 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. Optimized amounts of solid lipid and repaglinide (for NLC, liquid lipid also added) were dissolved in 3 ml (for target oral 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 formulations 1% Tween 80 used) was heated to the similar temperature and stirring was subsequently. The organic phase was dispersed rapidly in the aqueous phase. After that, under high-speed stirring with the use of T 10 digital Ultra Turrax® (IKA Works GmbH and Co, Germany) at 12000 rpm for 10 min the lipid phase was dispersed into the