Abstract

Fungal infections, such as ringworm and athlete's foot, along with yeast infections and nail afflictions, can cause significant discomfort and have a prolonged duration. Onychomycosis is a persistent nail fungal illness that is frequently misdiagnosed in underdeveloped nations because of inadequate medical infrastructure. Oral antifungal medications are recommended in addition to topical antifungal medications for the treatment of nail and skin fungal infections. Topical treatments are particularly efficient for superficial, cutaneous, and subcutaneous skin infections as well as onychomycosis; however, because drugs cannot penetrate the skin and nails, their efficacy is diminished. Common problem for topical delivery is the poor penetration ability of the drug and low retention time. Different approaches are used for enhancing the penetration and prolonging the retention of the drugs after topical application. In the present investigation, nanoemulsion and nanostructured lipid carriers have been selected as the lipid based nanocarriers for loading of the anti-fungal agents. Luliconazole works on fungal cell membranes by blocking the synthesis of ergosterol. Tavaborole is a synthetic oxaborol antifungal agent. Through the boron atom in its structure, it attaches to the editing site to trap leucyl tRNA and stop it from being catalytically turned over, preventing the synthesis of new proteins in fungi. LZNE and TBNE were synthesized using a high-energy technique. Developed formulations were evaluated for size, zeta potential, %entrapment efficiency, *in-vitro* drug release, ex-vivo drug release, ex-vivo skin deposition, pharmacokinetic study, pharmacodynamic study, cytotoxicity study, cellular uptake studies, Ex-vivo fluorescence microscopy study, transungual permeation study and anti fungal activity by zone of inhibition. The pharmacokinetic study indicated minimal systemic drug absorption, thereby reducing potential side effects. Luliconazole and Tavaborole formulations achieved higher cellular uptake compared to their free drug counterparts after four hours, suggesting an enhancement in therapeutic efficacy. In vitro studies focusing on nail fungal infections demonstrated the effectiveness of these formulations in treatment applications. Pharmacodynamic evaluations showcased the superior efficacy of these formulations compared to existing market products. Stability study outcomes revealed minor changes, including a marginal increase in vesicle/particle size and a slight reduction in zeta potential and entrapment efficiency percentages. Despite these variations, the measurements remained within the acceptable limits, demonstrating the formulations' stability over the three-month period.