ABSTRACT

Diabetes mellitus (DM) is a progressive metabolic disorder often associated with hyperglycemia and dyslipidemia, which leads to multi-organ damage. Although conventional therapies such as insulin are effective in controlling blood glucose, they do not fully prevent long-term complications and may have unwanted side effects with extended use. We developed sericin-coated liposomal formulations of *Lactobacillus acidophilus* (LA) and Fenugreek seed extract (FG) as an oral therapy for alloxan-induced diabetes in mice. The formulations were thoroughly characterized using FTIR, zeta and GC–MS, showing particle sizes in the nanoscale range (103–157 nm), uniform distribution (PDI < 0.30), and stable surface charges (−19 to −42 mV). Encapsulation was high (LA 87%, FG 79.5%), and in vitro tests confirmed a sustained release profile under simulated gastric and intestinal conditions. The diabetic mice were treated orally for 21 days, and changes in body weight, blood glucose, lipid profile, renal and liver function along with the histological architecture of liver and pancreas were assessed. Liposomal formulations, particularly the combination of LA+FG-Lipo, significantly improved glycemic control, normalized lipid parameters (LDL, HDL, TC, TG), and restored renal (creatinine, urea) and hepatic markers (ALT, AST, ALP, total bilirubin) to near-normal levels, with outcomes comparable to insulin. Histopathological findings revealed substantial preservation of hepatic and pancreatic architecture in liposomal groups, aligning with biochemical findings. The current study concluded that combining probiotics and phytochemicals in a sericin-coated liposomal carrier improves stability, pharmacokinetic efficiency, and therapeutic potential, suggesting its role as a safe and effective adjunct to conventional diabetes therapy.