

Abstract

In Vitro Evaluation of Topical Follicular Delivery of Minoxidil and Latanoprost Co-Entrapped in Lipid Nanocarriers [†]

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[†] Presented at the 6th International Congress on Health Innovation—INOVATEC 2025, Hybrid, 21–23 November 2025.

Keywords: topical therapy; pilosebaceous unit; nanoparticle

Introduction: A major challenge in treating androgenic alopecia topically is delivering high drug levels in hair follicles while minimizing systemic absorption. Based on our previous study using nanostructured lipid carriers (NLCs) co-encapsulating minoxidil and latanoprost, we investigated their in vitro targeted delivery to pilosebaceous units (PSUs) in porcine skin, from NLC-aqueous and -serum formulations. **Methodology:** UHPLC-MS/MS method was validated to quantify drugs extracted from PSUs. Drug permeation of minoxidil and latanoprost was performed using Franz-type diffusion cells with porcine skin over 24 h, with and without massage, and targeting was assessed by comparing drug levels in PSU-containing and PSU-free biopsies. Statistical analyses were performed in GraphPad Prism 8.0 with a significance level of $p < 0.05$. **Results:** Limits of detection and quantification were below 4 ng/mL for both drugs. Matrix effect was minimal and within the acceptable $\pm 15\%$ range. Delivery of latanoprost to PSUs from NLCs was notably more effective, increasing by 3-fold compared to control ($p \leq 0.0001$). Differences were less evident for minoxidil; however, NLC still accumulated 1.4 times more than the control ($p \leq 0.05$). No difference was observed between the aqueous dispersion and serum formulations of NLCs for minoxidil, while the aqueous NLC formulation was far superior to the serum in the case of latanoprost, showing 5.6- and 6.3-fold greater accumulation in PSU and non-PSU models, respectively ($p \leq 0.0001$). Massage improved the delivery of both molecules to the PSU by approximately 1.5-fold ($p \leq 0.01$). **Conclusions:** NLCs are a promising strategy for topical alopecia treatment, enabling targeted delivery of minoxidil and latanoprost to PSUs.



Academic Editors: Andreanne Vasconcelos, Amílcar Damazo and José Roberto Leite

Published: 27 February 2026

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Author Contributions: Conceptualization, C.O.C., T.G., M.C.-F., Y.Y.K. and G.M.G.; methodology, C.O.C., P.M.O. and M.T.S.; validation, C.O.C., P.M.O. and M.T.S.; formal analysis, C.O.C.; investigation, C.O.C.; resources, T.G., M.C.-F., Y.Y.K. and G.M.G.; data curation, C.O.C., P.M.O. and M.T.S.; writing—original draft preparation, C.O.C.; writing—review and editing, T.G., M.C.-F., Y.Y.K. and G.M.G.; visualization, C.O.C.; supervision, Y.Y.K. and G.M.G.; funding acquisition, G.M.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by CNPq process n° 00193-00002389/2023-76, and Edital DPG/UnB n° 001/2025.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data will be made available on request.

Conflicts of Interest: The authors declare no conflict of interest.

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