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Design and Evaluation of Mucoadhesive Nasal Gel for Brain Targeting

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Abstract: *Mucoadhesive nasal gels have emerged as a promising strategy for efficient brain targeting of therapeutics, offering a non-invasive alternative to overcome the formidable challenge posed by the blood-brain barrier. This review highlights the anatomical advantages of the nasal cavity, examines the use of advanced polymers and nanoparticles for enhancing mucoadhesion and retention, and discusses formulation strategies that exploit the olfactory and trigeminal nerve pathways for direct nose-to-brain drug delivery. Special emphasis is placed on the design and evaluation of thermoreversible in situ gels, their physicochemical and mucoadhesive characterization, and comparative pharmacokinetic outcomes versus conventional routes. Recent studies demonstrate that mucoadhesive nasal gels significantly improve brain bioavailability and targeting efficiency while maintaining patient safety and tolerability. Limitations such as variability in nasal physiology, formulation irritancy, and scalability are also discussed. Overall, this review presents a comprehensive perspective on the advances, opportunities, and ongoing challenges in developing mucoadhesive nasal gels for targeted brain delivery of diverse therapeutics.*

Keywords: *Mucoadhesive*

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