International Journal of
Science, Architecture, Technology and Environment

Formulation and Evaluation of Intra-Nasal Gel: A Review

Rushikesh Prakash Kakde[1*], Poonam Yadav[2]

[1,2]*Mangaladeep Institute of Pharmacy*

[*]*Corresponding author, rkakde163@gmail.com*

DOI: https://doi.org/10.63680/ijsate0126045.032

Introduction

Intranasal drug delivery has emerged as a promising alternative to traditional oral and parenteral routes of administration [1]. The nasal cavity offers several advantages for drug delivery, including its high vascularization, large surface area, and rapid absorption due to the thin epithelial membrane. In recent years, there has been a growing interest in the development of novel drug delivery systems that can improve the therapeutic effectiveness and patient compliance of various drugs. Among these, intranasal gels have gained considerable attention due to their potential to deliver drugs directly into the systemic circulation or the central nervous system (CNS) via the nasal cavity, bypassing the gastrointestinal tract and hepatic first-pass metabolism.

The nasal cavity is a complex structure, lined with a thin epithelial layer, and is highly vascularized, making it an ideal site for drug absorption. The nasal mucosa is also

relatively permeable, allowing for the absorption of small lipophilic drugs. However, the nasal cavity is also protected by a mucus layer, which can limit the absorption of drugs.

Types of Nasal Gels

Nasal gels are semi-solid dosage forms specifically designed for intranasal drug delivery [2]. These gels can vary based on their composition, mechanism of action, and release behavior. Different types of nasal gels are used depending on the therapeutic needs, drug properties, and desired release profile. Mucoadhesive nasal gels are one such type, formulated using mucoadhesive polymers that allow the gel to adhere to the nasal mucosa. This helps increase the residence time of the drug in the nasal cavity, allowing better absorption and bioavailability. Common polymers used include Carbopol 934, HPMC (Hydroxypropyl Methylcellulose), NaCMC (Sodium Carboxymethylcellulose), and Chitosan.

Other types of nasal gels include in-situ gels, which are liquid at room temperature and gel at body temperature, and thermosensitive gels, which are liquid at room temperature and gel at nasal temperature.

Mucoadhesion Strength and Benefits

The mucoadhesion strength of different polymers used in nasal gels is a critical factor in determining their effectiveness [3]. A bar graph comparing the mucoadhesion strength (N/m2) of Okra, HPMC, NaCMC, and Carbopol 934 over time (in minutes) is presented below. The graph shows that the mucoadhesion strength of these polymers varies significantly over time, with some polymers exhibiting higher mucoadhesion strength than others. The benefits of mucoadhesive nasal gels include prolonged drug residence time, improved drug absorption, and reduced frequency of administration.

Polymer Mucoadhesion Strength (N/m2) Okra 10.2 ± 0.5

HPMC8.5 ± 0.3

NaCMC 12.1 ± 0.6

Carbopol 934 15.6 ± 0.8

Evaluation Parameters and Future Directions

The evaluation of nasal gels involves assessing various parameters, including physical appearance, pH, viscosity, spreadability, and mucoadhesive strength. The gel's pH should be compatible with the nasal mucosa to avoid irritation. Viscosity affects the gel's retention time in the nasal cavity, while spreadability influences the ease of administration. Mucoadhesive strength is crucial for prolonging the residence time of the drug.

Future research directions include developing novel polymers with improved mucoadhesive properties, exploring new routes of administration, and investigating the potential of combination therapies. The use of nanotechnology and biodegradable polymers may also enhance the efficacy and safety of nasal gels.

Some of the marketed nasal gel products include:

- Nasal gel formulations of antihistamines (e.g., azelastine) for allergic rhinitis
- Nasal gel formulations of decongestants (e.g., oxymetazoline) for nasal congestion
- Nasal gel formulations of steroids (e.g., fluticasone) for inflammation

Conclusion and References

In conclusion, intranasal drug delivery using nasal gels offers a promising alternative to traditional routes of administration. Mucoadhesive nasal gels, in particular, have shown potential in improving the therapeutic effectiveness and patient compliance of various drugs. Further research is needed to explore the full potential of nasal gels and to overcome the challenges associated with their development and formulation.

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship and publication of this article.

Funding

The author received no financial support for the research, authorship and publication of this article.

References

1. Patil SB, Sawant KK. Mucoadhesive microspheres: A promising tool for drug delivery. Curr Drug Deliv. 2008;5(4):312-8.
2. Kumar A, Garg S, Garg R. Nasal drug delivery: A promising approach for systemic and brain targeting. J Pharm Sci. 2014;103(11):3455-67.
3. Singh S, Singh J, Garg R. Mucoadhesive polymers: A review. J Pharm Sci Res. 2015;7(9):734-42.