

Comparative Efficacy of Intranasal Fluticasone Furoate With Oxymetazoline Versus Fluticasone Propionate With Azelastine in Moderate-to-severe Allergic Rhinitis: A Randomized Pilot Study

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Article

Keywords: Allergic rhinitis, fluticasone furoate, oxymetazoline, fluticasone propionate, azelastine, fixed-dose combination, intranasal corticosteroids, Total Nasal Symptom Score, eosinophil count, immunoglobulin E

Posted Date: August 6th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10056887/v1>

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Additional Declarations: No competing interests reported.

Abstract

Background: Allergic rhinitis (AR) affects 20–30% of the Indian population, with its incidence increasing as air quality worsens. Intranasal corticosteroid-based fixed-dose combinations (FDCs) offer superior symptom control over monotherapy. Fluticasone furoate with oxymetazoline and fluticasone propionate with azelastine have each demonstrated efficacy over their individual components; however, no comparative data exist between these two regimens.

Objectives: To compare the clinical efficacy, anti-inflammatory effect, medication adherence, and safety of Fluticasone furoate with oxymetazoline (once daily) versus fluticasone propionate with azelastine (twice daily) in moderate-to-severe AR over 4 weeks.

Methods: This single-centre, randomized, open-label pilot study enrolled 60 patients aged 12–60 years with moderate-to-severe AR (TNSS ≥ 6). Patients were randomized to Group A (FF with OXY once daily, $n=26$) or Group B (FP with AZE twice daily, $n=27$). Total Nasal Symptom Score (TNSS), absolute eosinophil count (AEC), serum IgE, and medication adherence (PDC) were assessed at baseline, day 14, and day 30. Data were analyzed using two-way repeated-measures ANOVA.

Results: Both groups showed a significant reduction in TNSS over time ($p<0.0001$; $\eta^2=0.95$). A significant drug $\times$ time interaction ($p=0.020$) indicated faster early relief with FP with AZE, though both groups achieved near-complete resolution by day 30. AEC and serum IgE declined significantly across time points in both groups ($p<0.0001$) with no significant difference between groups. Medication adherence was high in both groups (Group A: 94%; Group B: 93% PDC). No adverse drug reactions were reported.

Conclusion: Both FDCs demonstrated significant and comparable efficacy in moderate-to-severe AR. FP with AZE provided faster early symptom onset, while FF with OXY offered the advantage of once-daily dosing with high adherence. Treatment selection should be individualized based on patient preference and clinical profile.

INTRODUCTION

The deteriorating air condition increases the incidence of allergic rhinitis (AR) inhalation by aeroallergens, causing inflammation of the nasal mucosa, characterised by the infiltration of inflammatory cells into the tissue and nasal secretions, along with structural alterations in the nasal mucosa, often accompanied by ocular manifestations mediated through immunoglobulin E (IgE) hypersensitivity reactions. The median worldwide prevalence of AR is 18.1%, with Asia holding a median prevalence of 15%[1], and about 20–30% of the Indian population is affected with AR[1]. With rising air pollution in major cities of India, the Particulate matter (PM) of sizes PM_{10} ($\leq 10 \mu m$) and $PM_{2.5}$ ($\leq 2.5 \mu m$) exhibits a 14%–25% increase in rhinitis prevalence, while NO_2 showed a 6%–9% probability increase in rhinitis occurrence [2]. Allergic rhinitis is not life-threatening, but it has a big effect on sleep, cognitive ability, quality of life, work productivity, eventually causing health burden and

economic burden indirectly [3]. It costs human overall productivity, so the treatment provided should have less “time to clinical relief”.

The guidelines and prior research suggest intranasal corticosteroids (INCSs), oral antihistamines (OAHs), and intranasal antihistamines (INAHs) as the first-line treatment for AR. Among which INCSs is most effective as it acts as an all-sided anti-inflammatory effects and comprehensive symptom control. The problem arises when prolonged time to reach peak efficacy, which is later resolved with the combination therapy including INCS plus Anti-Histamine (AH) and INCS plus Intra-nasal anti-histamine (INAH). The combination therapy provided a better effect than single-drug treatment. The fluticasone furoate and oxymetazoline, a fixed dose combination (FDC) of the intranasal corticosteroids and the nasal decongestant, relieved the nasal congestion and reduction of Total Nasal Symptom Score in allergic rhinitis patients more than the fluticasone alone group [4], as does the fluticasone propionate and azelastine FDC, which outperformed the single drug treatment [5].

These FDCs have been an effective treatment and better symptomatic management for moderate to severe allergic rhinitis against its single effective drug; nevertheless, no data are available concerning efficacy and faster time to relief of these two FDCs. Thus, this pilot study aimed to evaluate the effectiveness of fluticasone furoate and oxymetazoline compared to that of fluticasone propionate and azelastine.

MATERIALS AND METHODS

Registration and Study Design:

This was a single-centre randomised, open-label, parallel-group, prospective pilot study conducted at a tertiary care hospital in India. This pilot study is conducted by the ENT consultant, lab technicians and the clinical pharmacist. The ethics committee of SRM Medical College Hospital and Research Center (Ethical Clearance Number: SRMIEC-ST0124-822) approved the study and written informed consent was obtained from the patient before the initiation of any study activity. The study was conducted in compliance with the principles of the Declaration of Helsinki.

Randomization and Blinding:

The Block Randomization codes (block size: 4) were generated using computer-generated permuted blocks by an independent biostatistician. The allocation was concealed using sequentially numbered, sealed envelopes used for the allocation of the Participants. Participants were randomized 1:1 to treatment groups. Blinding was not performed in this study due to practical and logistical limitations associated with the differing dosing schedules and formulation characteristics of the two intranasal fixed-dose combinations. The fluticasone furoate with oxymetazoline regimen was administered once daily, whereas the fluticasone propionate with azelastine regimen required twice-daily administration, making participant blinding impractical.

This open-label prospective pilot study was designed as an exploratory comparative efficacy and feasibility study to inform the design of future adequately powered trials of effectiveness among fluticasone furoate with oxymetazoline versus fluticasone propionate with azelastine. To reduce the risk of bias, randomization and allocation concealment were deployed, as well as objective laboratory parameters, including absolute eosinophil count and serum IgE levels, which were incorporated alongside validated clinical symptom scoring tools (TNSS), which were conducted using standardized protocols.

Inclusion criteria:

This study included patients aged 12–60 years of either sex who were clinically diagnosed with allergic rhinitis and had a documented history of AR with the presence of typical nasal symptoms (nasal obstruction, rhinorrhea, sneezing, and/or nasal itching), and Symptom duration consistent with allergic rhinitis (intermittent or persistent). The patients with moderate to severe allergic rhinitis, defined by the baseline Total Nasal Symptom Score (TNSS) ≥ 6 , indicated clinically significant symptoms and ability to comply with study procedures, including Use of intranasal medications as prescribed, and Completion of follow-up visits and symptom assessments. Willingness to provide written informed consent before participation.

Exclusion criteria:

Patients were excluded if they had AR with little or no seasonal exacerbations and had documented history of the acute or chronic sinusitis, chronic purulent postnasal drip, rhinitis sicca, atrophic rhinitis, or rhinitis medicamentosa, chronic rhinosinusitis or nasal polyposis, nasal structure abnormalities that could interfere with drug delivery or symptom assessment also with nasal mucosa ulcerations or nasal septum perforation, Nasal or sinus surgery within the last year. Participants are excluded in the presence of an acute upper respiratory tract infection at the time of enrolment and an active pulmonary disorder, including asthma. The patients diagnosed with Non- allergic rhinitis were also excluded. Severe comorbid medical conditions that could affect study outcomes or patient safety (e.g., uncontrolled diabetes mellitus, severe cardiovascular disease).

Exclusion applied if the patients had hypersensitivity to fluticasone furoate, oxymetazoline, fluticasone propionate, azelastine, or had used systemic corticosteroids within 4 weeks before enrollment and any type of intranasal corticosteroids, antihistamines, or decongestants within 2 weeks before enrollment, also patients with known hypersensitivity or contraindication to any of the study medications. The patients with a medication history of nasal or oral decongestants and nasal or oral antihistamines within the 72 hours of administration and nasal or inhaled corticosteroids, 5-lipoxygenase inhibitors, methylxanthines, and leukotriene receptor antagonists within a 7-day interval.

Pregnant or lactating women, or participation in another clinical study within the preceding 3 months.

Sample size determination:

Sample size was calculated using GraphPad Prism (version 10.6.1). The minimum required sample size was calculated assuming a unpaired two-sample t-test, with a significance level of 0.05 and 80% power. To detect a standardized effect size (Cohen's d) of 0.8, a minimum of 26 participants per group was required, resulting in a total sample size of 52. To ensure robust final analyses, a total of 60 participants were targeted, accounting for possible dropouts and ensuring a minimum of 30 patients per group.

Assessment:

After the assessment by the physician, the patients were prescribed Nasal Endoscopy and were inserted with a thin, flexible tube. A flexible nasal endoscope was introduced into the nasal cavities (rhinoscopy) for the visual examination of the nasal passages, sinuses, and nasopharynx (area behind the nose) for inflammation. The eligible patients are given a nasal local anaesthetic before the procedure, and the procedure lasts between 5 and 10 minutes. No procedure-related complications were reported. The verbal consent is obtained before the procedure. No fasting required, a blood sample is drawn from a vein into a plain vial (red cap) The blood sample is analysed in the institutional laboratory using an automated haematology analyser for testing the Absolute Eosinophil Count (AEC) Test and the serum is separated and analysed using techniques ImmunoCAP/RAST, a Gold standard, quantitative test for the allergen specific immunoglobulin E(IgE) test had performed at the baseline followed by the first follow up period (14th day) and the second follow up period (30th day) for the evaluation of the efficacy of the both the combination treatment. The patient's medication adherence was calculated using the derivation of concept, Proportion of Days Covered (PDC), where patients recorded the date and number of sprays used daily over the period of 30 days in a preprepared chart.

Procedure:

The eligible patients with moderate to severe AR were enrolled after informed consent and eligibility defined by a Total Nasal Symptoms Score (TNSS) ≥ 6 (where Moderate condition 6–9, Severe condition score 10–12), Nasal Endoscopic findings consistent with allergic inflammation, including pale edematous mucosa and/or inferior turbinate hypertrophy without any structural pathology. Peripheral blood absolute eosinophil count ≥ 600 cells/ μ L was considered supportive of allergic inflammation. The baseline parameters are defined among the 60 cohort of patients before randomisation, subsequently patients who satisfies the criteria were equally randomised into Group- A (26 patients) given with Fluticasone Furoate(FF) (27.7mcg) with Oxymetazoline (50mcg) sprayed once daily and Group- B(27 patients) given with Fluticasone Propionate(FP) (50mcg) with Azelastine (140mcg) sprayed for twice daily for 4 weeks of treatment. The patient had two additional visits on day 14 and day 30, where the TNSS score, peripheral blood absolute eosinophil count and serum IgE were observed at each visit. Adherence to therapy is ensured using a mobile phone reminder for the patient. The medication adherence was calculated from the data of a preprepared chart of PDC, as the percentage of prescribed

treatment days on which the study medication was used. Adherence was summarized descriptively and, where appropriate, categorized using a predefined threshold ($PDC \geq 80\%$). The patient was prohibited from taking other medication for the treatment of Allergic Rhinitis and advised not to take any home remedies during the course of the treatment (Fig. 1).

Adverse drug reactions (ADRs) were monitored throughout the study duration at each time point on baseline, day 14, and day 30. Safety assessment was conducted through structured patient interviews, clinical examination by the ENT consultant, and review of concomitant medication use at every visit. Participants were also instructed to report any unexpected symptoms between visits via telephone. Causality assessment of any reported ADR would have been performed using the WHO-Uppsala Monitoring Centre (WHO-UMC) causality classification system. All safety data were recorded in the case report form and reviewed by the principal investigator.

Statistical analysis:

The primary analysis was conducted according to the intention-to-treat (ITT) principle, including all randomized participants in their originally assigned groups regardless of adherence or study completion. Missing outcome data at week 4 were handled using the last observation carried forward (LOCF) approach. Given the known limitations of LOCF, a per-protocol (PP) analysis was pre-specified and conducted as a sensitivity analysis, including only participants who completed the study. Safety analyses were performed in the as-treated population to reflect actual study drug exposure.

The normality was assessed using the Shapiro–Wilk test. Continuous variables are presented as mean $\pm$ standard deviation (SD) or median (interquartile range), and the categorical variables are presented as %, as appropriate. For within-group analysis and between-group analysis, RM-Two-way ANOVA was performed. Effect sizes were quantified using Cohen's d for between-group differences, and 95% confidence intervals (CIs) were reported for all key outcomes. Exact p -values are presented throughout. All statistical analyses were performed using Python (version 3.12) and the numpy, pandas, pingouin and statmodels libraries.

RESULTS

Patient Characteristics:

At the end of the study, out of 60 patients screened, data from 53 patients were analysed, of whom 5 were found to be taking other medication for treatment of AR, and 2 voluntarily withdrew from the study. Finally, the analysed data from Group A included 26 patients, and Group B had 27 patients. Among the screened population, both groups A and B had higher dominance of male individuals, contributing about 65.37% and 55.55% despite this dominance, there is no significant difference between the groups ($p = 0.65$). The patients who arrived are mostly adults. The seasonal rhinitis patient population is less compared to those with perennial rhinitis, which was determined by analysing the patient exposure history. (Table 1)

Participants' demographics and baseline characteristics:

Change in Parameters:

Primary Outcome:

The Severity of Allergic Rhinitis was assessed using TNSS (0-12) at 3 time points. The Two-way repeated measures ANOVA revealed no statistical significance ($p=0.39$) in the main effect of drug treatment across all the time points, and the overall treatment did not differ between groups. The key finding was the time effect, which was highly statistically significant ($p<0.0001$), demonstrating a substantial change in the dependent variable across the time points, with a very large effect size. The drug $\times$ time interaction effect was statistically significant ($p=0.020$), indicating that the trajectory of change over time differed by drug treatment. The results are numerically represented in Table 2 and Table 3.

Secondary Outcomes:

Absolute Eosinophil Count:

The Two-way repeated measures ANOVA revealed that there is no statistically significant drug $\times$ time interaction, indicating that the trajectory of AEC in all time points did not differ between groups, and the main drug effect was not statistically significant, implying no difference in AEC between groups A and B. Nevertheless, there was a highly significant main effect of time with a very large effect size (Table 4 and Table 5).

IgE:

There is no statistical significance in the interaction between drug $\times$ and time on IgE, indicating that the trajectory of IgE levels over time was consistent across both groups. The analysis of main effects showed a high significance in the effect of time, demonstrating a change across the measured time points with a large effect size. However, the main effect of the drug was not statistically significant, recommending that there is no overall difference in IgE levels (Table 6 and Table 7).

Medication Adherence:

The mean of medication adherence in Baseline of Group A is 94 % and that of Follow up 1 is 94 % and Follow up 2 is 94 % which shows a no statistical difference with p value 0.146. Similarly the Mean of Group B in Baseline is 93 % and that of Follow up 1 is 92 % and Follow up 2 is 93 % which shows no statistical difference with p value 0.414. Medication adherence was assessed using the proportion of days covered (PDC) using a predefined threshold ($PDC \geq 80\%$), showing both groups had better adherence to the nasal spray with slightly increased adherence among group- A (Table 8).

Safety and Tolerability:

Safety was assessed in all 53 participants throughout the study period who received the study medication (treated population). No adverse drug reactions were reported in either treatment group throughout the 4-week study period. Specifically, no participant reported local nasal adverse effects such as nasal burning, stinging, dryness, epistaxis, or nasal irritation. No participant discontinued treatment due to drug-related adverse effects. Both fixed-dose combinations were well tolerated across all age groups enrolled, including participants below 18 years of age.

DISCUSSION

This prospective randomised control trial comparing two nasal sprays fixed dose combination medicine, Fluticasone Furoate (FF) (27.7mcg) with Oxymetazoline (50mcg) sprayed once daily to Group- A and Fluticasone Propionate (FP) (50mcg) with Azelastine (140mcg) sprayed for twice daily to Group- B and this study interpreted with efficacy of the both FDC in reducing the inflammatory mediator Absolute eosinophil count and IgE antibodies were used primarily for the detection that the FDC has similar effect in reducing. Though no studies comparing this two combinations existed there are studies by Xinling et al[5] and Dhanya et al[6] individually highlighting azelastine hydrochloride and fluticasone propionate nasal spray and Fluticasone Furoate and Oxymetazoline Nasal Spray efficacy towards AR. The FP and Azelastine treatment demonstrated a significant superiority when compared with the group treated with Azelastine only or the FP only groups [7]. Similarly, FF with oxymetazoline spray showed better effect than the FF alone group[4], where both combinations are aligned with the study results in reducing the TNSS.

Primary findings of this study is both medications showed a rapid reduction in TNSS scores by both groups. These reductions represent near-complete symptom resolution, which aligns with international treatment objectives for moderate-to-severe allergic rhinitis. The TNSS instrument employed in this study is a validated, reliable measure that demonstrates a strong correlation of $r = 0.77$ with quality-of-life assessment [8]. Both treatment groups show considerable and significant reductions in AEC, confirming the anti-inflammatory action and potency. Particularly, fluticasone propionate with azelastine combination may achieve a slightly superior reduction in eosinophil count. The treatment groups produced reductions in serum allergen-specific IgE levels. Both the therapy combination groups effectively improve AR symptoms through symptomatic control mechanisms; neither regimen provides immunological tolerance or disease modification in the manner achieved by allergen-specific immunotherapy.

Patients present with a variety of symptoms in allergic rhinitis. Despite the increasing number of medications and delivery systems on the market, including the expanding availability of over-the-counter products, AR continues to substantially impact patients' quality of life. Patients continue to report maddening symptoms, including nasal congestion, headache, rhinorrhoea, nasal itching, episodes of sneezing on a daily or near-daily basis during peak nasal allergy exacerbations, sometimes regardless of treatment. In our study, the severe and most common symptoms in AR with TNSS assessment were found to be Sneezing, Nasal congestion and Rhinorrhoea.

Future Directions:

To conduct a large-scale, multi-centre, double-blind or observer-blind randomised controlled trial with a sample size calculated to detect small-to-moderate between-group differences (Cohen's $d = 0.3-0.5$) with at least 80% power, necessitating an estimated more than 150 participants per arm.

Trial can also incorporate a follow-up duration of 12 weeks to assess the sustained efficacy and long-term safety. Future research should also conduct the subgroup analysis in patients who were inadequately powered for analysis in the present study. Specifically, comparative efficacy analyses of rhinitis subtype, perennial versus seasonal. Severity at baseline (moderate TNSS 6–9 versus severe TNSS 10–12). Age group analysis - paediatric population aged between 12 to 17 years versus adults. The incorporation of more responsive and mechanistically informative biomarkers in future studies would substantially strengthen the immunological evaluation. Future trials can also incorporate a comprehensive, multi-dimensional outcome framework beyond TNSS. Finally, the well-tolerated safety profile observed in both arms of this study, with no adverse drug reactions reported, provides preliminary reassurance for the safety of both regimens in a supervised clinical setting.

Limitations:

The present study has several limitations that should be considered when interpreting the findings. The relatively moderate sample size of 53 participants, distributed across two groups, Group A ($n = 26$) and Group B ($n = 27$), represents the most significant methodological constraint of this pilot study. The open-label design of this study, though justified by the differing dosing frequencies and formulation characteristics of the two fixed-dose combinations, introduces the risk of performance and detection bias. Participants and clinicians were aware of the treatment allocation, which may have influenced symptom reporting, particularly for subjective patient-reported outcomes such as the TNSS. The follow-up period of 4 weeks, although appropriate for evaluating acute-to-intermediate symptomatic response in allergic rhinitis, is insufficient to draw conclusions regarding sustained efficacy, long-term safety, or disease-modifying potential. This was a single-centre study conducted at a single tertiary care hospital in South India, which limits the generalisability of our findings to broader patient populations across different regions, allergen profiles, and levels of air pollution exposure. Missing outcome data at week 4 for seven participants (5 due to concomitant medication use and 2 due to voluntary withdrawal from the study) were managed using the last observation carried forward (LOCF) approach, which assumes that outcomes remain stable after dropout. This assumption may not hold in conditions with inherent symptom fluctuation, such as allergic rhinitis, and more robust missing data approaches, such as multiple imputation or mixed-effects models for repeated measures, can also be considered in future trials. Finally, the lack of prospective trial registration limits transparency regarding pre-specified endpoints and analysis plans.

CONCLUSION

Both intranasal fixed dose combinations showed significant clinical improvements and provided quick, substantial, and comparable symptom relief in moderate-to-severe allergic rhinitis patients. Fluticasone propionate and azelastine provided faster and earlier symptom relief and greater suppression of eosinophil count, whereas the fluticasone furoate and oxymetazoline showed comparable efficacy with the advantage of patient adherence due to once daily dosing. Treatment selection should be individualized based on patient preference, dosing convenience, and tolerability.

Abbreviations

AR
Allergic Rhinitis
IgE
Immunoglobulin E
PM
Particulate Matter
PM10
Particulate Matter 10
PM2.5
Particulate Matter 2.5
NO2
Nitrogen Dioxide
INCSs
Intranasal Corticosteroids
OAHs
Oral Antihistamines
INAHs
Intranasal Antihistamines
AH
Antihistamine
FDC
Fixed Dose Combination
ENT
Ear, Nose and Throat
TNSS
Total Nasal Symptom Score
AEC
Absolute Eosinophil Count
PDC
Proportion of Days Covered
FF

Fluticasone Furoate
FP
Fluticasone Propionate
ITT
Intention-To-Treat
RM-Two-way ANOVA
Repeated Measures Two-way Analysis of Variance
IQR
Interquartile Range
SD
Standard Deviation
BMI
Body Mass Index
RAST
RadioAllergoSorbent Test
CONSORT
Consolidated Standards of Reporting Trials

Declarations

Ethics approval and consent to participate:

The Institutional Ethics Committee of SRM Medical College Hospital & Research Centre, with reference number SRMIEC-ST0124-822 provided approval. Informed consent was obtained from every participant in the study. After an exhaustive explanation of the purposes of the study, procedures, potential risks and benefits, and confidentiality of the data, each participant signed written informed consent. All participants were clearly informed that participation in the study was entirely at their own discretion and that they were free to withdraw at any point without adverse effects on their medical care or penalty. All the information collected was anonymized and solely for use within this research.

Consent for publication:

The authors affirm that signed informed consent was obtained from the participants for the publication of their data presented in this manuscript.

Availability of data and materials

The dataset supporting the conclusions of this study was obtained from the hospital records of SRM Medical College Hospital and Research Centre. The data are not publicly available due to institutional and patient confidentiality policies, but are available from the corresponding author upon reasonable written request and with permission from the institution.

Competing Interests: Not Applicable

Funding: Not Applicable

Authors' contributions

The two authors, namely E. Arun and P. Karthick, were responsible for obtaining approval from the ethics committee. E. Arun, P. Karthick, S. S. Pravin and Lokesh. R carried out patient recruitment and data collection. S. S. Pravin and Lokesh. R performed the data analysis. S. S. Pravin and Lokesh. R contributed to the preparation and writing of the manuscript. Dr T. M. Vijayakumar provided critical guidance during the study design and conduct, and reviewed the manuscript. All authors read and approved the final manuscript.

Acknowledgements

The authors would like to express their sincere gratitude to Dr T. M. Vijayakumar for his invaluable guidance and support throughout this study. The authors also thank the staff of SRM Medical College Hospital and Research Centre for their assistance during patient recruitment and data collection.

References

1. M. Savouré, J. Bousquet, J. J. K. Jaakkola, M. S. Jaakkola, B. Jacquemin, and R. Nadif, "Worldwide prevalence of rhinitis in adults: A review of definitions and temporal evolution," *Clin. Transl. Allergy*, vol. 12, no. 3, Mar. 2022, doi: 10.1002/clt2.12130.
2. S. Maio *et al.*, "Relationship of long-term air pollution exposure with asthma and rhinitis in Italy: an innovative multipollutant approach," *Environ. Res.*, vol. 224, p. 115455, May 2023, doi: 10.1016/j.envres.2023.115455.
3. S. K. S, B. S. Bagepally, and B. Rakesh, "Air pollution attributed disease burden and economic growth in India: Estimating trends and inequality between states," *The Lancet Regional Health - Southeast Asia*, vol. 7, p. 100069, Dec. 2022, doi: 10.1016/j.lansea.2022.100069.
4. R. Kumar *et al.*, "Efficacy and Safety of Fluticasone Furoate and Oxymetazoline Nasal Spray: A Novel First Fixed Dose Combination for the Management of Allergic Rhinitis with Nasal Congestion," *J. Asthma Allergy*, vol. Volume 15, pp. 783–792, Jun. 2022, doi: 10.2147/JAA.S357288.
5. X. Han *et al.*, "Efficacy and safety of azelastine hydrochloride and fluticasone propionate nasal spray in treating allergic rhinitis: A randomized controlled trial," *Asia Pac. Allergy*, vol. 15, no. 1, pp. 7–14, Mar. 2025, doi: 10.5415/apallergy.0000000000000161.
6. D. Krishnakumar, B. Faizal, and A. S. Nair, "Comparison of the Effects of Azelastine and Fluticasone Nasal Sprays in the Treatment of Allergic Rhinitis," *Indian Journal of Otolaryngology and Head & Neck Surgery*, vol. 74, no. S2, pp. 1632–1637, Oct. 2022, doi: 10.1007/s12070-021-02686-7.
7. B. Zhou *et al.*, "A Clinical Study to Assess the Efficacy and Safety of MP-AzeFlu Nasal Spray in Comparison to Commercially Available Azelastine Hydrochloride and Fluticasone Propionate Nasal

Sprays in Chinese Volunteers with Allergic Rhinitis,” *Pulm. Ther.*, vol. 9, no. 3, pp. 411–427, Sep. 2023, doi: 10.1007/s41030-023-00238-8.

8. L. Tamasauskiene, E. Gasiuniene, and B. Sitkauskiene, “Translation, adaption and validation of the total nasal symptom score (TNSS) for Lithuanian population.,” *Health Qual. Life Outcomes*, vol. 19, no. 1, p. 54, Feb. 2021, doi: 10.1186/s12955-020-01659-8.

Tables

Tables 1 to 8 are available in the supplementary files section

Figures

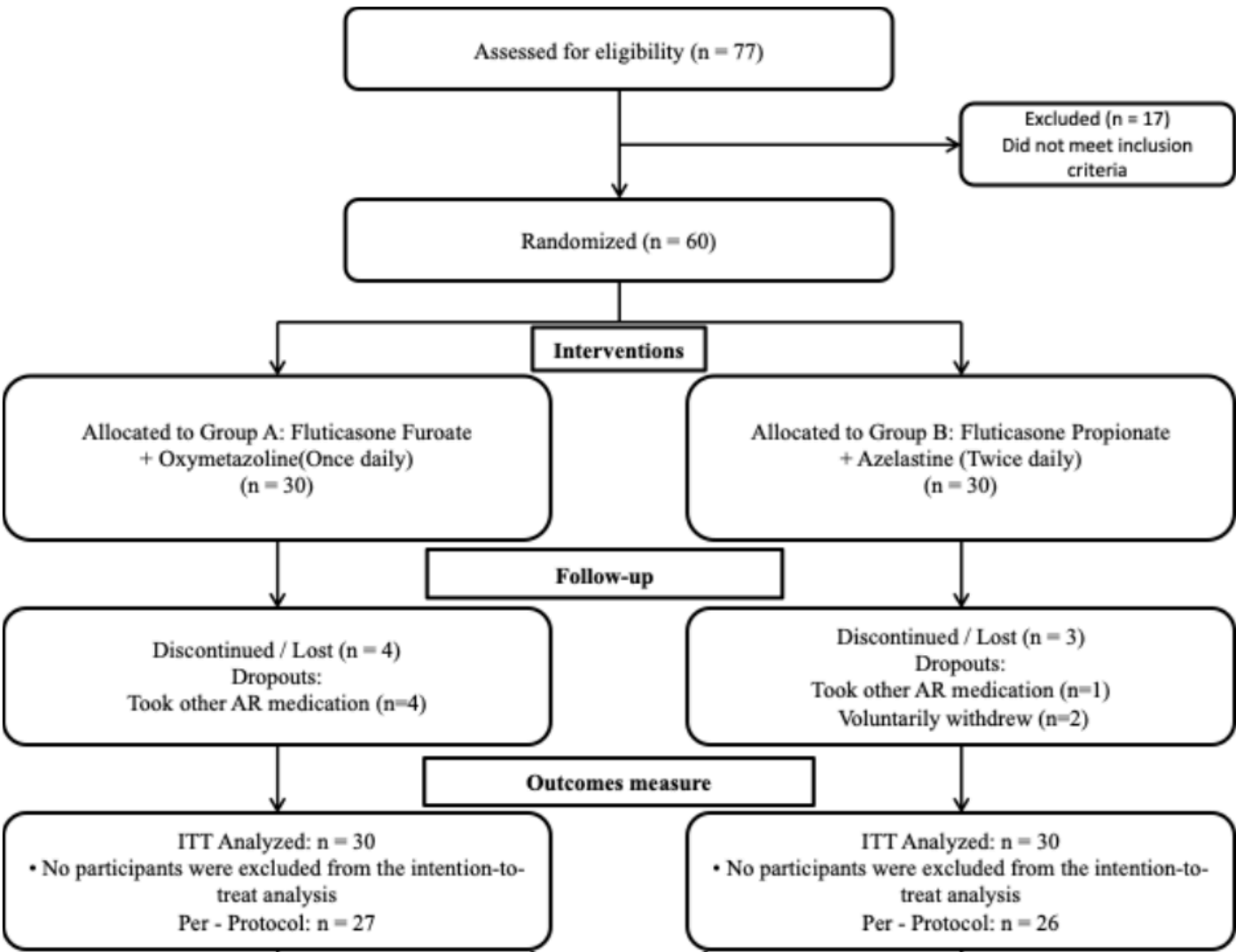


Figure 1

CONSORT 2020 flow diagram showing participant enrollment, randomization, follow-up, and analysis.

Supplementary Files

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