



Impact of Pomegranate Juice (*Punica granatum*) on the Severity of Allergic Rhinitis: A Randomized Controlled Clinical Trial

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ARTICLE INFO	ABSTRACT
<i>Article type:</i> Research Paper	Introduction: <i>Punica granatum</i> (pomegranate) possesses well-documented antioxidant and anti-inflammatory properties and has demonstrated therapeutic potential in several metabolic and inflammatory disorders. However, evidence regarding its effectiveness in the management of allergic rhinitis remains limited. This randomized controlled trial evaluated the effects of concentrated pomegranate juice as an adjunct to conventional therapy on clinical symptoms and quality of life in patients with allergic rhinitis.
<i>Article History:</i> Received: 25 May 2026 Accepted: 21 Sep 2026	Methods: Sixty patients with clinically confirmed allergic rhinitis were randomly assigned to either an intervention group or a control group using a randomization table. Baseline demographic characteristics, symptom severity, and health-related quality of life were assessed before treatment. Participants in the intervention group received 50 mL/day of concentrated pomegranate juice in addition to standard medical therapy, whereas those in the control group received standard therapy alone for two months. The primary endpoint was the change in the total Sino-Nasal Outcome Test-22 (SNOT-22) score from baseline to the end of the intervention.
<i>Keywords:</i> Pomegranate juice Allergic rhinitis Quality of life	Results: The mean age of participants was 28.9 years in the intervention group and 31.4 years in the control group, and half of the study population was male. Baseline demographic and clinical characteristics were comparable between the two groups, with atopic dermatitis representing the most frequently reported comorbidity. Clinical symptoms improved over the two-month treatment period in both groups; however, the magnitude of improvement did not differ significantly between groups. Similarly, reductions in SNOT-22 scores were observed in both groups without a statistically significant advantage for adjunctive pomegranate supplementation.
	Conclusion: The addition of concentrated pomegranate juice to standard pharmacological treatment was associated with improvements in allergic rhinitis symptoms over time, but these improvements were comparable to those achieved with conventional therapy alone. These findings do not support a significant additional therapeutic effect of pomegranate juice in this patient population. Future large-scale, placebo-controlled studies with adequate statistical power are warranted to further investigate its potential role in the management of allergic rhinitis.

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Introduction

Medicinal plants have served as an important source of therapeutic agents throughout human history, and many modern pharmaceuticals have originated from compounds first identified through traditional medical practices. Traditional systems of medicine, including

Islamic traditional medicine, have long relied on herbal remedies for the prevention and treatment of a wide range of diseases. The writings of renowned physicians such as Muhammad ibn Zakariya al-Razi, Avicenna (Ibn Sina), Antaki, and Ibn Bitar provide valuable documentation of medicinal plants that continue to inspire contemporary pharmacological

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research. Among these plants, *Punica granatum* (pomegranate) has been widely recognized for its medicinal value. Various parts of the plant, including its fruit and derived products, have traditionally been used to manage numerous health conditions, particularly upper respiratory symptoms such as rhinorrhea, nasal congestion, and cough (1,2).

Punica granatum, a member of the Punicaceae family, is indigenous to a geographical region extending from Iran to northern India. In Iran, pomegranate is not only an important agricultural crop but also a common dietary component, consumed as fresh fruit and processed into products such as juice and pomegranate paste. Iran is among the world's leading producers of pomegranate, with an annual production approaching one million tons. The fruit is rich in bioactive phytochemicals, including flavonoids, anthocyanins, hydrolyzable tannins, and condensed tannins. These polyphenolic constituents are largely responsible for the diverse biological activities of pomegranate, particularly its antioxidant, anti-inflammatory, and immunomodulatory effects (1).

Allergic rhinitis is one of the most prevalent allergic disorders worldwide, affecting approximately 20% of the population in many Western countries. The disease is characterized by symptoms including sneezing, nasal itching, rhinorrhea, and nasal obstruction, all of which can substantially impair daily functioning and quality of life while increasing healthcare utilization. Based on symptom duration, allergic rhinitis is classified as intermittent or persistent, whereas allergen exposure allows further classification into seasonal and perennial forms (3). Increasing evidence suggests that oxidative stress contributes significantly to the pathophysiology of allergic rhinitis by promoting airway inflammation and amplifying immune responses. Consequently, antioxidant-based interventions, including several herbal preparations, have attracted considerable interest as potential adjunctive therapies and have demonstrated encouraging results in experimental and clinical studies (4).

Although pomegranate has been extensively investigated for its beneficial effects in chronic inflammatory conditions such as cardiovascular disease, diabetes mellitus, metabolic syndrome, and cancer, its therapeutic potential in allergic rhinitis has received limited attention (5). Considering the established involvement of oxidative stress in allergic rhinitis and the biological properties of pomegranate polyphenols, evaluating pomegranate as an

adjunctive treatment appears justified. Therefore, the present randomized controlled clinical trial was designed to investigate whether supplementation with concentrated sweet pomegranate juice, in combination with standard medical therapy, could improve clinical symptoms and quality of life in patients with allergic rhinitis.

Materials and Methods

Study Design and Participants

This randomized controlled clinical trial was conducted in Mashhad, Iran, between May 2023 and February 2024. A total of 60 adult patients diagnosed with allergic rhinitis and referred to outpatient Allergy and Otolaryngology clinics were recruited. Participants were randomly assigned in a 1:1 ratio to either the intervention group (n = 30) or the control group (n = 30).

Eligible individuals were patients with allergic rhinitis who had received standard pharmacological treatment, including antihistamines and corticosteroids, for at least four weeks but continued to experience persistent symptoms. Exclusion criteria included pregnancy or lactation, non-allergic rhinitis, significant systemic disorders, hepatic or renal impairment, thyroid disease, current use of antioxidant herbal supplements, a history of seizure disorders, and known hypersensitivity to pomegranate or its derivatives.

Prior to enrollment, all participants received detailed information regarding the study procedures and objectives, and written informed consent was obtained.

Intervention

Participants allocated to the intervention arm received concentrated pomegranate juice at a dose of 50 mL per day in addition to their routine medical treatment, which consisted of antihistamines and corticosteroids. The intervention period lasted two months. Patients in the control group continued to receive standard therapy alone for the same duration.

Clinical Assessment

At baseline and at the completion of the intervention period, participants underwent clinical evaluation by a physician. Symptom severity was assessed for the major manifestations of allergic rhinitis, including sneezing, nasal itching, rhinorrhea, and nasal obstruction. Skin-prick testing was used to confirm the allergic etiology of the disease.

Health-related quality of life was evaluated using the validated Sino-Nasal Outcome Test-22 (SNOT-22) questionnaire. The questionnaire was administered at study entry and again after two

months of treatment. Participants were also monitored throughout the study for potential adverse effects, including drowsiness, headache, constipation, dizziness, fatigue, nausea, decreased appetite, and pruritus.

Sample Size Calculation

The required sample size was determined using PASS software (version 11). Calculations were based on a two-sided significance level of 0.05, a statistical power of 80%, and an anticipated 25% reduction in total SNOT-22 score in the intervention group. Under these assumptions, a minimum of 27 participants per group was required. To compensate for an anticipated dropout rate of approximately 10%, the target sample size was increased to 30 participants per group, resulting in a total enrollment of 60 patients.

Randomization

Participants were assigned to treatment groups using a random-number table. The randomization sequence was generated before recruitment began, and group allocation was performed according to the predetermined sequence to ensure equal distribution between the intervention and control groups.

Outcome Measures

The primary outcome was the change in total SNOT-22 score from baseline to the end of the two-month intervention period. Secondary outcomes included changes in the severity of sneezing, rhinorrhea, nasal obstruction, and nasal itching, as well as sleep-related complaints and the occurrence of adverse events.

Preparation of Concentrated Pomegranate Juice

Concentrated pomegranate juice was prepared according to previously described procedures, yielding a product with approximately 4.5-fold concentration relative to the original juice (6).

Statistical Analysis

Data analysis was performed using IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA). The Kolmogorov-Smirnov test was applied to evaluate the distribution of continuous variables. Normally distributed data are presented as mean $\pm$ standard deviation (SD), whereas non-normally distributed variables are reported as median and interquartile range (IQR).

Between-group comparisons were conducted using the independent-samples t-test for normally distributed variables and the Mann-Whitney U test for non-parametric variables. Categorical variables were expressed as frequencies and percentages and compared using the Chi-square test. Within-group changes from baseline to the end of treatment were assessed using paired-samples t-tests or Wilcoxon signed-rank tests, as appropriate. A two-sided p-value < 0.05 was considered indicative of statistical significance.

Results

Of the 60 participants enrolled in the study, 56 completed the two-month follow-up and were included in the final analysis. The mean age of participants was 28.9 years in the intervention group and 31.4 years in the control group, and 28 participants (50%) were male. Baseline demographic and clinical characteristics were comparable between the two groups, with no statistically significant differences observed (Table 1). Atopic dermatitis was the most frequently reported comorbidity in both groups. The monthly distribution of patients presenting to the Allergy and ENT clinics is illustrated in Figure 1. The greatest number of visits for allergic rhinitis occurred during August, October, and January.

Table 1. Baseline demographic characteristics of intervention and control groups.

Variable		Intervention (n=29)	Control (n=27)	P-value
Age (years)		28.86 $\pm$ 7.73	31.37 $\pm$ 9.68	0.28
Type of Rhinitis	Seasonal	9 (31%)	9 (34.6%)	0.77
	Persistent	20 (69%)	17 (65.4%)	
Conjunctivitis		2 (6.9%)	4 (14.8%)	0.33
Asthma		1 (3.4%)	1 (3.7%)	-
Atopic Dermatitis		6 (20.7%)	4 (14.8%)	0.56
Otitis Media		1 (3.4%)	2 (7.4%)	0.60
Laryngitis		1 (3.4%)	2 (7.4%)	0.65

The two sample T Test, and Fisher's exact test were performed by SPSS version22. The significant level was intended as * P value <0.05 and ** <0.001 .

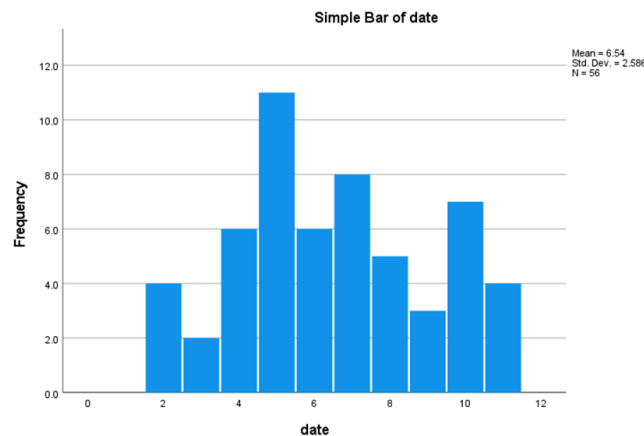


Figure 1. Number of visited Patients per Month

The severity of the principal allergic rhinitis symptoms, including sneezing, rhinorrhea, nasal obstruction, and nasal itching, was assessed using a five-point scoring system. At baseline, sneezing severity differed significantly between the intervention and control groups, whereas the remaining symptoms showed no significant between-group differences. Following the two-month intervention, improvements were observed in all evaluated symptoms in both groups. However, the magnitude of symptom improvement did not differ significantly between the intervention and control groups.

Quality of life was evaluated using the SNOT-22 questionnaire before and after treatment. Both groups demonstrated reductions in total SNOT-22 scores after the intervention, indicating overall clinical improvement. Likewise, sleep-related complaints, including difficulty initiating sleep, nocturnal awakening, insufficient sleep, and waking unrefreshed, improved in both groups. Nevertheless, none of these

improvements differed significantly between the intervention and control groups.

Although an initial comparison using the Mann-Whitney U test suggested a significant difference in post-treatment sneezing severity between groups ($p < 0.001$), baseline sneezing scores were also significantly different. Therefore, an analysis of covariance (ANCOVA) was performed to adjust for baseline values. After adjustment, the between-group difference was no longer statistically significant ($F(1,53) = 0.544$, $p = 0.464$), indicating that the apparent treatment effect was explained by the baseline imbalance rather than the intervention itself. In contrast, baseline sneezing severity remained a significant predictor of post-treatment sneezing scores ($F(1,53) = 22.306$, $p < 0.001$), emphasizing the importance of controlling for baseline differences in the analysis (Table 2).

The flow of participants throughout the study, including enrollment, allocation, follow-up, and final analysis, is presented in Table 3.

Table 2. Comparison of allergic rhinitis symptoms between Pomegranate Syrup and Control Groups.

Variable	Group	Mean $\pm$ SD (Before)	Mean $\pm$ SD (After)	Difference in Mean Between Two Groups	Within-Group Comparison
Sneezing Severity	Intervention	3.17 $\pm$ 1.62	1.24 $\pm$ 1.29	-1.93 $\pm$ 1.57	<0.01*
	Control	1.92 $\pm$ 1.70	0.96 $\pm$ 1.12	-0.96 $\pm$ 1.25	
	Between-Group Comparison	0.009*	0.35	-	
Rhinorrhea Severity	Intervention	2.95 $\pm$ 1.63	1.20 $\pm$ 1.14	-1.75 $\pm$ 1.50	0.94
	Control	2.51 $\pm$ 1.80	1.37 $\pm$ 1.41	-1.14 $\pm$ 1.13	
	Between-Group Comparison	0.33	0.63	-	
Nasal Blockage	Intervention	3.82 $\pm$ 1.33	1.55 $\pm$ 1.24	-2.27 $\pm$ 1.48	0.27
	Control	3.33 $\pm$ 1.75	1.48 $\pm$ 1.15	-1.85 $\pm$ 1.45	
	Between-Group Comparison	0.23	0.82	-	
Pruritus	Intervention	2.95 $\pm$ 1.63	1.20 $\pm$ 1.14	-1.75 $\pm$ 1.50	0.94
	Control	2.51 $\pm$ 1.80	1.37 $\pm$ 1.41	-1.14 $\pm$ 1.13	
	Between-Group Comparison	0.33	0.63	-	
Total SNOT-22 Score	Intervention	43.51 $\pm$ 21.81	22.17 $\pm$ 19.18	-21.34 $\pm$ 15.80	0.16
	Control	40.81 $\pm$ 21.50	25.22 $\pm$ 14.74	-15.59 $\pm$ 14.82	
	Between-Group Comparison	0.64	0.51	-	
Sleep Disturbances	Intervention	7.50 $\pm$ 5.96	4.55 $\pm$ 5.20	-2.82 $\pm$ 3.82	0.57
	Control	6.92 $\pm$ 5.63	4.62 $\pm$ 3.77	-2.29 $\pm$ 3.03	
	Between-Group Comparison	0.71	0.94	-	

Mann-Whitney U test was done to compare Sneezing Severity, and Sleep Disturbances between two groups. Covariant Test was done to compare the sneezing severity to control baseline significance and demonstrate the intervention effects between two groups. Two-Sample t-Test were done to compare Rhinorrhea Severity, Nasal Blockage, Pruritus, Total SNOT-22 Score, between two groups. The significant level was intended as *P value <0.05 and **<0.001.

Table 3. Participant Flow through the Study

Study Stage	Intervention Group	Control Group
Randomized	30	30
Completed Follow-up	29	27
Lost to Follow-up	1	3
Included in Final Analysis	29	27

Reasons for loss to follow-up are reported in the CONSORT flow diagram.

Discussion

This randomized controlled clinical trial investigated whether concentrated pomegranate juice could provide additional therapeutic benefits when administered alongside standard pharmacological treatment for allergic rhinitis. Although participants in both study groups experienced improvements in symptom severity and health-related quality of life over the two-month intervention period, no statistically significant differences were observed between the intervention and control groups. These findings suggest that adjunctive supplementation with concentrated pomegranate juice did not confer measurable clinical benefits beyond those achieved with conventional therapy alone.

An imbalance in baseline sneezing severity was identified between the two treatment groups. However, after adjustment for baseline values using analysis of covariance (ANCOVA), the apparent difference in post-treatment sneezing severity was no longer statistically significant. This finding indicates that the initially observed treatment effect was attributable to pre-existing differences rather than the intervention itself. Collectively, our results do not support an additional therapeutic effect of concentrated pomegranate juice in reducing allergic rhinitis symptoms under the conditions evaluated in this study.

Pomegranate has attracted considerable scientific interest because of its high content of polyphenols and other bioactive compounds with antioxidant, anti-inflammatory, and immunomodulatory properties. Experimental and clinical evidence has suggested that these compounds may attenuate inflammatory responses and oxidative stress, both of which are implicated in the pathogenesis of allergic diseases. Nevertheless, the present findings indicate that these biological properties did not translate into a significant improvement in clinical outcomes among patients receiving standard treatment for allergic rhinitis.

Our findings should be interpreted in the context of previous clinical studies. Hosseini et al. reported that pomegranate extract supplementation improved clinical manifestations and reduced eosinophil, basophil, and neutrophil counts in patients with allergic

asthma, suggesting a potential immunomodulatory effect (7). Likewise, Israeli et al. demonstrated that topical nasal administration of pomegranate fruit extract improved several symptoms of chronic rhinitis, including thick nasal discharge, sleep quality, concentration, and work productivity (8). In addition, Yousefi et al. observed significant reductions in inflammatory biomarkers, including C-reactive protein and interleukin-6, following pomegranate juice supplementation in patients with COVID-19 (6). A recent systematic review of clinical trials also concluded that pomegranate and its derivatives may exert beneficial effects in a variety of inflammatory and respiratory disorders through antioxidant and anti-inflammatory mechanisms (9,10). Furthermore, a published case report described symptomatic improvement in a patient with chronic allergic rhinitis following treatment with pomegranate paste in combination with Persian medicine interventions (11).

Several factors may explain the discrepancy between our findings and those reported in earlier studies. First, differences in study populations, disease severity, and underlying inflammatory status may have influenced treatment responsiveness. Second, the pomegranate preparations differed substantially across studies, including the use of juice concentrate, extracts, topical formulations, or pomegranate paste, each of which may vary in the concentration and bioavailability of active phytochemicals. Variations in dosage, treatment duration, and outcome measures may also have contributed to inconsistent findings. Finally, all participants in the present study received guideline-recommended therapy with antihistamines and intranasal corticosteroids, which effectively improved symptoms in both groups and may have limited the ability to detect any additional benefit associated with pomegranate supplementation. Consequently, a modest adjunctive effect, if present, may have been obscured by the efficacy of standard pharmacological treatment.

Conclusion

The findings of this randomized controlled clinical trial indicate that supplementation with concentrated pomegranate juice, when used as

an adjunct to conventional treatment, did not produce statistically significant improvements in allergic rhinitis symptoms, sleep-related complaints, or overall SNOT-22 scores compared with standard therapy alone. Although clinical outcomes improved during the study period in both groups, the magnitude of improvement was comparable, suggesting no additional therapeutic advantage associated with pomegranate supplementation. Future well-designed, placebo-controlled randomized trials with larger sample sizes and longer follow-up periods are required to determine whether pomegranate may provide clinically meaningful benefits in the management of allergic rhinitis.

Limitations

Several limitations should be considered when interpreting the findings of this study. First, despite an a priori sample size calculation, the relatively small study population may have limited the statistical power to detect modest treatment effects. Second, the absence of a placebo in the control group precluded complete blinding and may have introduced expectation or performance bias. Third, a significant imbalance in baseline sneezing severity was observed between groups. Although this difference was addressed using ANCOVA, residual confounding cannot be entirely excluded. Finally, the two-month intervention period may not have been sufficient to evaluate the potential long-term effects of pomegranate supplementation on allergic rhinitis outcomes.

Declarations

Conflicts of Interest

The authors have disclosed that they have no significant relationships with, or financial interest in, any commercial companies pertaining to this article.

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Author's Contribution

M B: Conceptualization, Project administration, Supervision, Writing – Review & Editing, Validation ; **M A:** Methodology, Project administration, Supervision, Writing – Review & Editing ; **M Sh:** Investigation, writing – Original Drat ; **F JA:** Investigation, Writing – Review & Editing, Visualization ; **M BA:** Software, Writing – Review & Editing

Consent to Participate

Written informed consent was obtained from all participants prior to enrollment and data collection. Verbal assent was also obtained when appropriate.

Consent to Publish

All participants provided informed consent for the publication of anonymized clinical data.

Ethical Considerations

The study protocol was reviewed and approved by the Ethics Committee of Mashhad University of Medical Sciences (Approval No. IR.MUMS.MEDICAL.REC.1401.121). The trial was conducted in accordance with the ethical principles of the Declaration of Helsinki and its subsequent amendments. Written informed consent was obtained from all participants before enrollment. The trial was prospectively registered in the Iranian Registry of Clinical Trials under registration number IRCT20221012056153N1.

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