

Evaluation of Nasal Mucociliary Activity in Patients with Psoriasis Vulgaris

Mehmet Akif Dündar¹, Selami Aykut Temiz², İsmail Hakkı Tunçez³, Elif Emre⁴, Sadettin Emre⁵, Recep Dursun²

1 Necmettin Erbakan University Medical Faculty, Department of Ear Nose Throat

2 Necmettin Erbakan University Medical Faculty, Department of Dermatology

3 Konya Provincial Health Directorate, Department of Public Health

4 Fırat University Medical Faculty, Department of Anatomy

5 Fırat University Medical Faculty, Department of Ear Nose Throat

Key words: Psoriasis, Nasal Mucociliary Clearance, Inflammation, Respiratory Infection, Comorbidity

Citation: Dündar MA, Temiz SA, Tunçez İH, Emre E, Emre S, Dursun R. Evaluation of Nasal Mucociliary Activity in Patients with Psoriasis Vulgaris. *Dermatol Pract Concept*. 2025;15(2):5014. DOI:<https://doi.org/10.5826/dpc.1502a5014>

Accepted: November 28, 2024; **Published:** April 2025

Copyright: ©2025 Dündar et al. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial License (BY-NC-4.0), <https://creativecommons.org/licenses/by-nc/4.0/>, which permits unrestricted noncommercial use, distribution, and reproduction in any medium, provided the original authors and source are credited.

Funding: None.

Competing Interests: None.

Authorship: All authors have contributed significantly to this publication.

Corresponding Author: Selami Aykut Temiz. Clinic of Dermatology, Necmettin Erbakan University Medical Faculty, Konya — Turkey. E-mail: aykutmd42@gmail.com

ABSTRACT Introduction: Psoriasis, a chronic inflammatory dermatological condition, is marked by recurring periods of activity and quiescence. This persistent inflammation contributes to a range of associated health issues. The respiratory system relies on nasal mucociliary clearance as a fundamental defense mechanism. Mucociliary transport dysfunction is frequently observed in chronic inflammatory states.

Objective: We aimed to determine the relationship between psoriasis and concomitant clinical conditions and nasal mucociliary clearance time (NMCT).

Method: We conducted a study to evaluate NMCT in 34 individuals diagnosed with psoriasis and a control group of 35 healthy individuals.

Results: Our results revealed a statistically significant prolongation of NMCT in the psoriasis group (11.26 ± 2 minutes) compared to the control group (9.2 ± 1.85 minutes, $P < 0.001$). Moreover, a positive correlation was identified between NMCT and both the duration of psoriasis and the Psoriasis Area and Severity Index (PASI). This suggests that impaired nasal mucociliary clearance in individuals with psoriasis, especially those with more severe disease, may elevate their vulnerability to infections of the sinuses and nasal passages.

Conclusion: This highlights the need to consider strategies for enhancing mucociliary function in this patient population.

Introduction

Psoriasis is a chronic inflammatory skin disease with remission and relapses [1]. Immunological, autoimmune, genetic, and environmental factors play a role in the etiopathogenesis of the disease. Psoriasis is characterized by chronic inflammation accompanying the disease. Chronic inflammation in the course of the disease causes many co-morbidities associated with psoriasis. Cardiovascular disease, obesity, diabetes, hypertension, dyslipidemia, metabolic syndrome, non-alcoholic fatty liver disease, cancer, anxiety, depression, and inflammatory bowel diseases are co-morbidities associated with chronic inflammation in the disease course [2]. Nasal mucociliary clearance activity is determined by nasal mucociliary clearance time (NMCT) [3]. Nasal mucociliary clearance is the primary defense mechanism of the respiratory system. The mucosa begins in the nose and extends into the upper and lower airways. Inhaled particles adhere to the nasal mucosa, which covers the nasal cavity in a single layer, and efficient and coordinated ciliary activity transports mucus towards the oropharynx, thus protecting the respiratory system against inhaled particles and microorganisms. Ineffective ciliary activity may lead to acute or chronic infections in the upper and lower respiratory tract, even sepsis [4]. In the literature, NMCT has been found to be impaired in many chronic inflammatory diseases.

Objective

In our study, we aimed to determine the relationship between psoriasis and concomitant clinical conditions and NMCT.

Methods

Individuals with psoriasis and a comparison group without chronic inflammatory conditions were enrolled from a dermatology clinic. The study population comprised 34 patients diagnosed with psoriasis and 35 individuals serving as healthy controls. The control group had no reported history of chronic inflammatory diseases. Demographic information, the time elapsed since psoriasis diagnosis, and the current PASI score were documented for each psoriasis patient. Participants in both groups were excluded if they had a history of upper respiratory tract problems, infections, allergic rhinitis, substantial septal deviations, prior nasal surgery, any smoking history, any other chronic inflammatory disease, or nasal trauma. Ethical approval was granted by the Firat University Medical Faculty Hospital Ethics Committee, and informed consent was secured from all study participants (APPROVAL No: 2020/12-20).

Measurement of Nasal Mucociliary Clearance

Several techniques, both in vivo and in vitro, are available for evaluating nasal mucociliary clearance. In vitro

methods, such as stroboscopy, photon-electron techniques, and phase-contrast microscopy, offer the ability to measure ciliary beat frequency but are often expensive and impractical for routine clinical application. The saccharin transit test (STT) is commonly preferred for NMCT assessment due to its affordability, simple administration, and reliability [2]. A normal STT result typically falls within the range of 7 to 15 minutes, with values exceeding this range suggesting impaired mucociliary function. Our study adopted the STT method as described by Greenstone and Cole [3]. A small saccharin particle ($1 \times 1 \times 1 \text{ mm}^3$) was carefully positioned on the nasal mucosa approximately 1 cm posterior to the anterior edge of the inferior turbinate, ensuring avoidance of the squamous epithelium. Participants were instructed to abstain from food or drink for six hours before the test. To mitigate the influence of circadian rhythms on mucociliary clearance, all measurements were conducted between 13:00 and 15:00. The testing environment was controlled for temperature ($20\text{--}23^\circ\text{C}$) and humidity (40%–60%). The nasal passage offering the least resistance to airflow and reported as most comfortable for breathing by the participant was selected for testing. Participants signaled the initial perception of a sweet taste on their tongue, indicating saccharin transit. STT values were recorded using a stopwatch. Throughout the STT procedure, participants were instructed to maintain their usual breathing pattern and allowed to swallow normally. However, actions that might influence mucociliary clearance, such as forced breathing, coughing, sneezing, sniffing, talking, and excessive movement, were discouraged.

Statistical Analysis

Statistical analyses were carried out using IBM SPSS Statistics version 23.0 (IBM Corp., Armonk, NY). Descriptive statistics are reported as means \pm standard deviations and percentages. The Kolmogorov-Smirnov test was employed to assess the normality of data distribution. Intergroup comparisons of continuous variables were performed using independent samples t-tests. Pearson correlation coefficients were calculated to examine relationships between numerical data. Categorical variables were analyzed using the chi-squared test. A *p*-value of less than 0.05 was considered statistically significant.

Results

Our study cohort included 34 participants with psoriasis (18 men [52.9%] and 16 women [47.1%], with a mean age of 40.7 ± 12 years) and 35 healthy control participants (17 men [48.6%] and 18 women [51.4%], with a mean age of 35.5 ± 14.2 years). No statistically significant difference in age or sex was found between the psoriasis and control groups. For the psoriasis group, the mean PASI score was 9.3 ± 8.3 , and the average disease duration was 11.3 ± 11 years. The mean

NMCT was measured as 11.26 ± 2 minutes in the psoriasis group and 9.2 ± 1.85 minutes in the control group. A statistically significant difference in NMCT was observed between the two groups, with a longer NMCT in the psoriasis group ($P < 0.001$) (Table 1). Furthermore, our analysis revealed positive correlations between NMCT and both the duration of psoriasis ($P = 0.02$, Figure 1) and the PASI score ($P < 0.001$, Figure 2). Figure 1 shows that as the duration of psoriasis disease increased, nasal mucociliary time increased in a positive correlation. Figure 2 shows that as the severity of psoriasis disease (PASI) increased, nasal mucociliary time increased in a positive correlation.

Conclusions

The nasal mucociliary clearance system provides essential protection to the upper respiratory tract and lungs by

Table 1. Nasal Mucociliary Clearance Times in Psoriasis and Control Groups

	Nasal Mucociliary Clearance (min)	P
Psoriasis	11.26 ± 2	< 0.001
Control group	9.2 ± 1.85	

removing inhaled foreign matter. This complex process depends on the interplay of several factors: the characteristics of the airway surface liquid (including mucus and periciliary fluid), the structure and beating pattern of the cilia, and the dynamic interaction between the mucus and cilia [3]. There are two main reasons for the inhibition of nasal mucociliary clearance: either the movement of the cilia can be directly inhibited, or dehydration and changes in consistency of the mucus can lead to increased viscosity, leading to ciliary dysfunction. This latter mechanism is the mechanism suggested in many inflammatory diseases [2,3]. Dysfunction of ciliary activity can increase the risk of both acute and chronic respiratory infections, potentially leading to serious complications like sepsis [4]. We also observed significant positive correlations between NMCT, psoriasis duration, and PASI score.

Prior research has produced inconsistent findings concerning the effects of age and sex on nasal mucociliary clearance [5]. Some studies suggest these demographic factors have minimal impact, while others note age-related mucosal changes that could affect clearance time. In our investigation, we found no significant difference in age or sex between the psoriasis and control groups.

Smoking is a well-known factor that disrupts nasal mucociliary clearance. The harmful compounds in cigarette smoke damage cilia, reducing their numbers and affecting

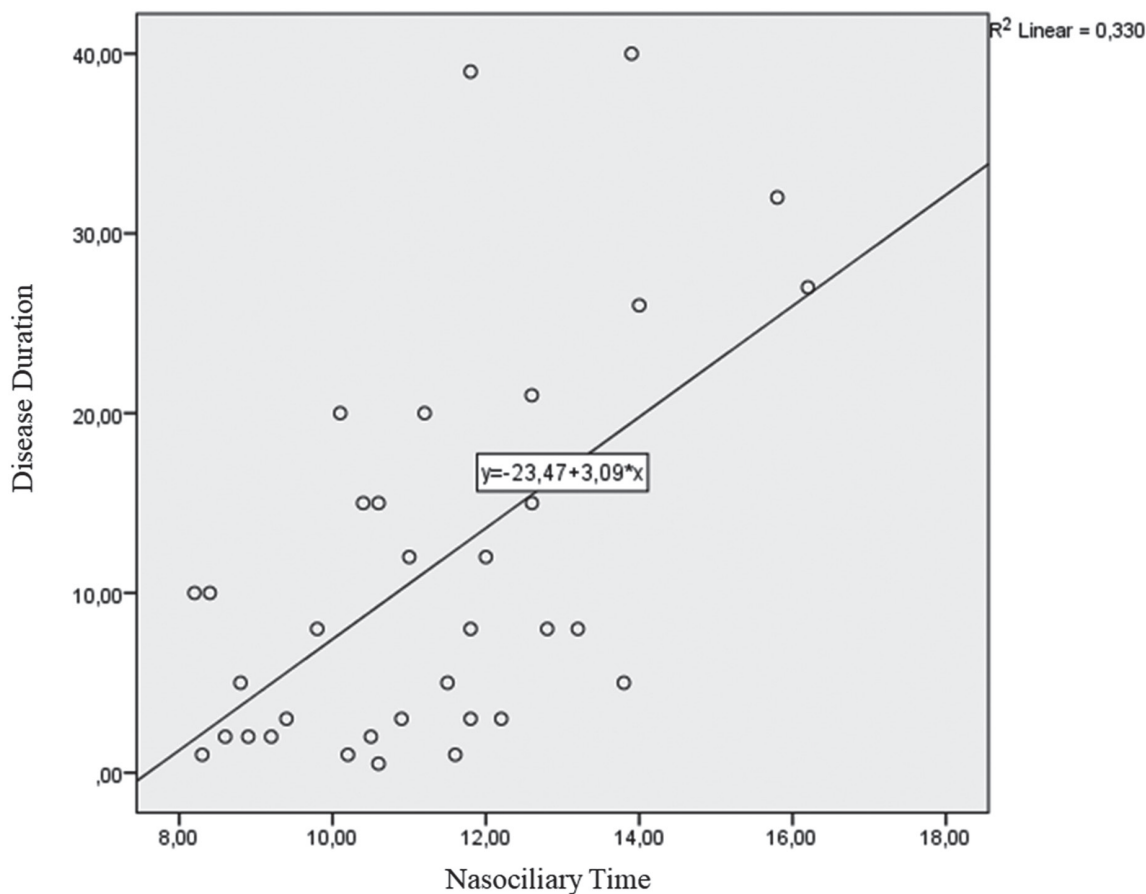


Figure 1. Correlation between nasal mucociliary time and psoriasis disease duration.

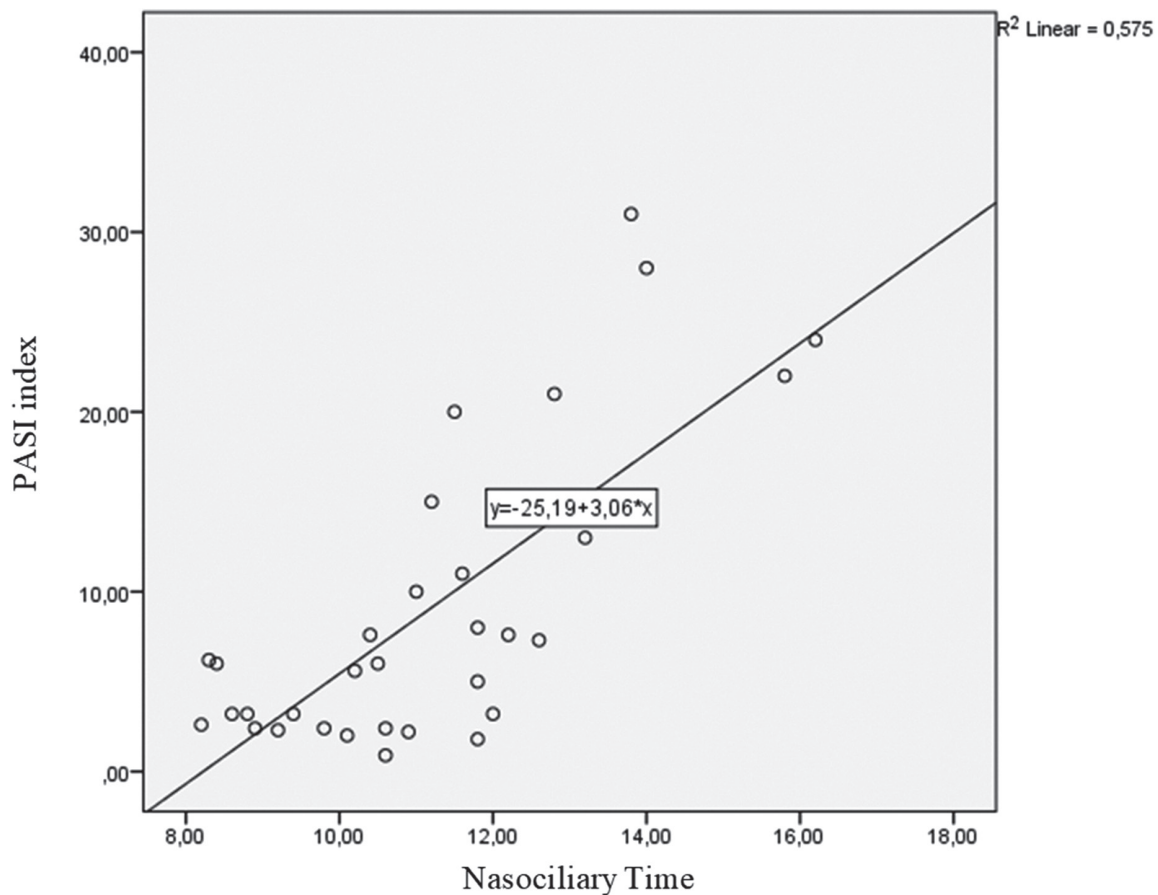


Figure 2. Correlation between nasal mucociliary time and Psoriasis Area Severity Index (PASI).

the physical properties of mucus, thereby hindering mucociliary transport. A comprehensive review of existing literature has confirmed that smoking is frequently associated with prolonged NMCT [6]. To avoid the confounding effects of smoking, both current and past smokers were excluded from our study population.

Infections of the upper respiratory tract, including COVID-19, have been shown to impair NMCT. [7] To control for this, individuals with active respiratory infections were excluded from both study groups. Impaired NMCT has also been documented in various other chronic inflammatory diseases, including diabetes, hypertension, celiac disease, Behçet disease, chronic renal failure, and obstructive sleep apnea [8-13]. To isolate the impact of psoriasis, individuals with any pre-existing chronic inflammatory condition were excluded from our study. The precise mechanisms by which chronic inflammation disrupts NMCT are not fully understood, but it is thought that inflammatory mediators and elevated cytokine levels may negatively impact ciliary function [11,12]. Our observation of increased NMCT in individuals with psoriasis, a condition characterized by chronic inflammation, supports this theory.

Studies have shown a higher prevalence of upper respiratory tract infections and otitis media in individuals with

psoriasis [14,15]. Psoriasis is also associated with accelerated atherosclerosis and microvascular disease progression [16], which may further contribute to impaired mucociliary function. Infectious complications pose a significant challenge in the management of psoriasis, especially for patients receiving conventional systemic or biologic therapies [17]. While biologic agents have revolutionized psoriasis treatment, they carry a known risk of lower and upper respiratory tract infections [18,19]. Our findings underscore the importance of investigating how impaired nasociliary clearance might influence the effectiveness of respiratory infection treatments in psoriasis patients. Future research should explore whether certain therapies can improve nasociliary function and reduce infection susceptibility and whether specific treatments might be linked to a higher risk of respiratory complications. A deeper understanding of the factors contributing to infections in psoriasis patients could inform the development of more effective preventative strategies.

Prompted by reports of altered NMCT in other chronic inflammatory conditions, we investigated whether psoriasis, a chronic inflammatory skin disease, also impacts NMCT. Our results demonstrate that individuals with psoriasis experience significantly longer NMCT compared to healthy individuals. The nasal mucociliary system appears to be

significantly compromised in psoriasis patients, particularly those with more severe disease. This finding has implications for the prevention of sinonasal infections and warrants consideration of interventions to enhance mucociliary activity in this population. Further investigation into the physiological changes associated with psoriasis will contribute to a more comprehensive understanding of the disease and its related comorbidities, ultimately leading to improved patient care.

Limitations

A key strength of our study is its novel investigation of NMCT in individuals with psoriasis. However, we acknowledge certain limitations, including the relatively small sample size and the preliminary data of our study. Despite these limitations, our preliminary findings offer valuable insights into the relationship between psoriasis and mucociliary clearance, paving the way for larger-scale, multicenter studies.

References

1. Özer İ, Temiz SA, Ataseven A, et al. Is prenatal testosterone-estrogen balance associated with psoriasis? *Dermatol Ther.* 2020; 33(6):e14213. DOI: 10.1111/dth.14213. PMID: 32820834
2. Takeshita J, Grewal S, Langan SM, et al. Psoriasis and comorbid diseases: epidemiology. *J Am Acad Dermatol.* 2017;76(3): 377-390. DOI: 10.1016/j.jaad.2016.07.064. PMID: 28212759
3. Koparal M, Kurt E, Altuntas EE, Dogan F. Assessment of mucociliary clearance as an indicator of nasal function in patients with COVID-19: a cross-sectional study. *Eur Arch Otorhinolaryngol.* 2021;278:1863-1868. DOI: 10.1007/s00405-020-06457-y. PMID: 33185743
4. Kesimci E, Bercin S, Kutluhan A, et al. Volatile anesthetics and mucociliary clearance. *Minerva Anesthesiol.* 2008;74(4):107-111. PMID: 18354365
5. Petrov VV. Age features of mucociliary system the mucous membrane of the nasal cavity of the human. *Adv Gerontol.* 2016;29(3):507-510. DOI: 10.1134/s2079057016030167. PMID: 28525702
6. Prasetyo A, Sadhana U, Budiman J. Nasal mucociliary clearance in smokers: a systematic review. *Int Arch Otorhinolaryngol.* 2021;25:160-169. DOI: 10.1055/s-0040-1702965. PMID: 33542766
7. Kahraman ME, Yüksel F, Özbuğday Y. The relationship between Covid-19 and mucociliary clearance. *Acta Otolaryngol.* 2021;141(11):989-993. DOI: 10.1080/00016489.2021.1991592. PMID: 34694199
8. Yue WL. Nasal mucociliary clearance in patients with diabetes mellitus. *J Laryngol Otol.* 1989;103(9):853-855. DOI: 10.1017/S0022215100110291. PMID: 2584876
9. de Oliveira-Maul JP, de Carvalho HB, Goto DM, et al. Aging, diabetes, and hypertension are associated with decreased nasal mucociliary clearance. *Chest.* 2013;143(4):1091-1097. DOI: 10.1378/chest.12-1183. PMID: 23100111
10. Comba A, Atan D. Evaluation of nasal mucociliary clearance time in children with celiac disease. *Int J Pediatr Otorhinolaryngol.* 2020;133, 109936. DOI: 10.1016/j.ijporl.2020.109936. PMID: 32088546
11. Ozbay I, Kucur C, Temizturk F, et al. Assessment of nasal mucociliary activity in patients with Behçet's disease. *J Laryngol Otol.* 2016;130(4):348-351. DOI: 10.1017/S0022215116000207. PMID: 26841706
12. Kucur C, Ozbay I, Gulcan E, et al. Evaluation of nasal mucociliary activity in patients with chronic renal failure. *Eur Arch Otorhinolaryngol.* 2016;273:1167-1171. DOI: 10.1007/s00405-015-3712-8. PMID: 26162451
13. Deniz M, Gultekin E, Ciftci Z, et al. Nasal Mucociliary Clearance in Obstructive Sleep Apnea Syndrome Patients. *Am J Rhinol Allergy.* 2014;28(5):e178-e180. DOI: 10.2500/ajra.2014.28.4094. PMID: 25198014
14. Joel MZ, Fan R, Damsky W, Cohen JM. Psoriasis associated with asthma and allergic rhinitis: a US-based cross-sectional study using the All of US Research Program. *Arch Dermatol Res.* 2023;315(6):1823-1826. DOI: 10.1007/s00403-023-02539-z. PMID: 36707438
15. Andersen YMF, Egeberg A, Gislason GH, et al. Burden of respiratory comorbidities in patients with atopic dermatitis and psoriasis. *Br J Dermatol.* 2017;177(4):e145-e146. DOI: 10.1111/bjd.15489. PMID: 28334421
16. Branisteanu DE, Nicolescu AC, Branisteanu DC, et al. Cardiovascular comorbidities in psoriasis. *Exp Ther Med.* 2022;23(2):1-5. DOI: 10.3892/etm.2021.11075. PMID: 35069833
17. Rademaker M, Agnew K, Anagnostou N, et al. Psoriasis and infection. A clinical practice narrative. *Australas J Dermatol.* 2019;60(2):91-98. DOI: 10.1111/ajd.12895. PMID: 30079566
18. Yiu ZZ, Exton LS, Jabbar-Lopez Z, et al. Risk of serious infections in patients with psoriasis on biologic therapies: a systematic review and meta-analysis. *J Invest Dermatol.* 2016;136(8): 1584-1591. DOI: 10.1016/j.jid.2016.03.035. PMID: 27085754
19. Kalb RE, Fiorentino DF, Lebwohl MG, et al. Risk of serious infection with biologic and systemic treatment of psoriasis: results from the Psoriasis Longitudinal Assessment and Registry (PSOLAR). *JAMA Dermatol.* 2015;151(9):961-969. DOI: 10.1001/jamadermatol.2015.0718. PMID: 25970800