



---

## **Characteristics of peak nasal inspiratory flow on high school students with rhinosinusitis in denpasar**

**Sari Wulan Dwi Sutanegara**

Department of Otorhinolaryngology, Head and Neck Surgery, Faculty of Medicine Udayana University, Sanglah General Hospital  
Denpasar, Denpasar, Indonesia

---

### **Abstract**

**Background:** The score of nasal obstruction is one parameter used to assess nasal obstruction. Examination with peak nasal inspiratory flow meter is the most practical examination, easy to carry, without any risk and has quick results.

**Objective:** To understand the characteristics of nasal obstruction based on the examination of peak nasal inspiratory flow meters in rhinosinusitis patients.

**Methods:** This study is a descriptive study using a cross-sectional design to understand the characteristics of patients with rhinosinusitis and assess the level of nasal obstruction in high school students with rhinosinusitis based on PNIF examination.

**Result:** The degree of nasal obstruction in rhinosinusitis patients in this study was a mild degree of 41 students or 67.2% with the mean PNIF value of 87.05 L/min, a moderate degree of 20 students or 32.8% with the mean PNIF value of 61.5 L/min and there was no severe degree nose obstruction.

**Conclusion:** It can be concluded that there are nasal obstructions in patients with rhinosinusitis.

**Keywords:** rhinosinusitis, PNIF, nasal obstruction

---

### **Introduction**

Rhinosinusitis is an inflammatory disease that affects the nasal mucosa and paranasal sinuses. This inflammation often originated from a viral infection, which due to several circumstances develops into a bacterial infection with pathogenic bacteria found in the upper respiratory tract. Other causes include fungal infections, dental infections and can also occur due to fractures or tumours [1, 2].

Nasal obstruction is the most common complaint in patients with rhinosinusitis. About 80-90% of patients with rhinosinusitis complain of nasal obstruction. Complaints of nasal obstruction, although not a symptom of severe disease, can reduce the quality of life and activities of rhinosinusitis patients [4, 5].

The nasal obstruction score is one of the parameters to assess a nasal obstruction. Simple objective examinations can be performed, such as peak nasal inspiratory flow meter (PNIF), rhinomanometry and acoustic rhinometry. Examination with the peak nasal inspiratory flow meter is the most practical examination.

It is easy to carry, without any risk, and has fast results. Until now, there is no data on the characteristics or description of nasal obstruction in rhinosinusitis patients based on PNIF examination. Therefore, the authors would like to conduct a study on the characteristics of nasal obstruction in rhinosinusitis patients based on PNIF [5].

### **Methods**

This study is a descriptive study using a cross-sectional design to determine the characteristics of rhinosinusitis patients and to assess the level of nasal obstruction in high school students with rhinosinusitis based on the PNIF examination. This study was conducted in three high schools in Denpasar, namely: SMA Negeri 1 Denpasar on April 18, 2017, SMA Santo Yosep Denpasar on April 22, 2017 and SMA 4 Denpasar on May 18, 2017.

### **Result**

The study has been conducted at SMA Negeri 1 Denpasar, SMA Santo Yosep Denpasar and SMA 4 Denpasar. In this study, out of the 360 students who were examined, the total sample that met the inclusion criteria for rhinosinusitis was 61 students. The data on the sample characteristics based on each school are presented in table 1. The total samples of rhinosinusitis patients at SMA Negeri 1 Denpasar is 21 students consisted of 13 male students (61.9%) and eight female students (38.1%). The samples obtained at SMA Santo Yosep Denpasar was 18 students consisted of 12 male students (66.7%) and six female students (33.3%). The total sample from SMA Negeri 4 Denpasar is 22 students consisted of 12 male students (54.5%) and ten female students (45.5%).

**Table 1:** Distribution of students with rhinosinusitis based on gender

Gender	School			Total
	SMA N1 Denpasar	SMA Santo Yosep Denpasar	SMA N4 Denpasar	
Male	13 (61, 9%)	12 (66, 7%)	12 (54, 5%)	37 (60, 7%)
Female	8 (38, 1%)	6 (33, 3%)	10 (45, 5%)	24 (39, 3%)
Total	21	18	22	61

The age range of the study sample ranged from 15 years to 17 years. Based on the table. 2, it was obtained that the highest number of rhinosinusitis patients at SMA N 1 Denpasar, SMA N

4 Denpasar and SMA Santo Yosep Denpasar was 29 students (47.5%) at the age of 16 years, followed by 23 students (37.7%) at 15 years old and nine students (14.8%) at the age of 17 years.

**Table 2:** Distribution of students with rhinosinusitis based on age

Age	School			Total
	SMA N 1 Denpasar	SMA Santo Yosep Denpasar	SMA N 4 Denpasar	
15 years old	8 (38, 1%)	6 (33, 3%)	9 (40, 9%)	23 (37,7%)
16 years old	9 (42, 9%)	9 (50, 0%)	11 (50, 0%)	29 (47, 5%)
17 years old	4 (19, 0%)	3 (16, 7%)	2 (9, 1%)	9 (14, 8%)
Total	21	18	22	61

Students who suffer from rhinosinusitis undergo a PNIF examination to determine the level or degree of nasal obstruction. Based on the result, from a total of 61 students with rhinosinusitis, 41 students experienced mild nasal obstruction or 67.2% with the mean PNIF value of 87.05 L/min, moderate nasal obstruction

were obtained in 20 students or 32.8% with the mean PNIF of 61.5 L/min. In this study, there were no rhinosinusitis patients with severe nasal obstruction. The details for each school are described in table. 3 and table. 4.

**Table 3:** Distribution of nasal obstruction degree in rhinosinusitis patients

Nasal obstruction degree	School			Total
	SMA N 1 Denpasar	SMA Santo Yosep Denpasar	SMA N 4 Denpasar	
Mild (80-120 L/mnt)	15 71, 4 %	13 72, 2%	13 59, 1%	41 67, 2%
Moderate (50-79 L/mnt)	6 28, 6%	5 27, 8%	9 40, 9	20 32, 8%
Severe (< 50 L/mnt)	0 0%	0 0%	0 0%	0 0%
Total	21	18	22	61

**Table 4:** The mean value of PNIF for each degree of nasal obstruction

Nasal obstruction degree	Mean value of PNIF (L/mnt)
Mild	87,05
Moderate	61,5
Severe	0

## Discussion

This study is a descriptive study using a cross-sectional design. The history and physical examination were carried out to determine if there were any disorders in the nose and paranasal sinuses and then followed by a PNIF examination to assess the level or degree of nasal obstruction.

In this study, it was found that a total of 61 students suffered from rhinosinusitis from 3 schools, namely SMA N 1 Denpasar, SMA Santo Yosep Denpasar, and SMA N 4 Denpasar. Of the three high schools, the highest sample was male, with as many as 37 students (60.7%) and 24 students (39.3%) were female. The study conducted by Zbislowski [13] also showed that rhinosinusitis patients were more likely to be male than female, namely 52.7% and 47.3%, respectively.

Patients with rhinosinusitis are more common in males than females, associated with different activities between both genders. Males are more often outside the house so that they are more often exposed to air pollution, dust, cold and dry air, resulting in mucosal changes and ciliary damage.

According to the European Position Paper on Rhinosinusitis and

Nasal Polyps 2012 [1], smokers tend to be more susceptible to rhinosinusitis. Therefore, it can be related that rhinosinusitis is more common in males because there are more smokers in males than females [1].

Rhinosinusitis can occur in children to adults. This study included high school students with an age range of 15-17 years old where they tend to have more activities outside the home, thus are at risk of being more easily exposed to dust and air pollution. The study conducted by Hesty *et al.* showed that most cases of rhinosinusitis occurred in the young and adult age groups (15-49 years) as many as 61.9%. Similar findings were also reported by Husni *et al.* They found that the distribution of patients with rhinosinusitis in the 15-24 years age group was 33.3%.

The main complaint of patients with rhinosinusitis is nasal obstruction. Several studies reported that 80-95% nasal obstruction was the most reported complaint. PNIF made by Clement Clark Ltd is a tool to measure the degree of nasal obstruction with its measurement results divided into severe degrees when the nasal inspiratory airflow rate is less than 50 l/min, moderate degrees when nasal inspired airflow is between

50-79 l/min, mild degree when nasal inspiratory airflow is between 80-120 l/min, and no nasal obstruction when nasal inspiratory airflow is more than 120 l/min<sup>[15]</sup>.

In this study, 41 students obtained mild nasal obstruction or 67.2% with the mean PNIF value of 87.05 L/min and moderate nasal obstruction in 20 students or 32.8% with the mean PNIF of 61.5 L/min. In this study, there were no rhinosinusitis patients with severe nasal obstruction. Based on the study conducted by Rodrigo *et al.*, the mean value of nasal obstruction in patients with inflammation of the nasal mucosa and paranasal sinuses was 114.0 L/min. While the study reported by Rachmawati, *et al.*, the mean value of airflow that experienced nasal obstruction with PNIF on three examinations was 63.88 l/min with the lowest value of 45 L/min and the highest value of 90 L/min. Then the results obtained in the study by Nursanti, the mean value of PNIF in patients with inflammation of the nasal mucosa was 79.5 ± 32.1 L/min.

Allergic rhinitis in experimental animal models can be assessed by the nasal symptom score after the study subjects were induced with ovalbumin. In this study, Wistar rats with allergic rhinitis were initiated by inducing intraperitoneal ovalbumin for 14 days in the sensitization phase, followed by repeated exposure to intranasal ovalbumin for 14 days. Repeated administration of intranasal ovalbumin can cause allergic rhinitis symptoms such as sneezing, scratching the nose in mice and is a good experimental animal model for allergic rhinitis study<sup>[6, 7, 8]</sup>.

### Conclusion

This study found a total of 61 students from three high schools in Denpasar, namely SMA Negeri 1 Denpasar, SMA Santo Yosep Denpasar and SMA 4 Denpasar. The distribution of gender is 37 male students (60.7%) and 24 female students (39.3%) with an age range of 15-17 years old.

The degree of nasal obstruction of patients with rhinosinusitis in this study resulted in mild nasal obstruction of 41 students or 67.2% with the mean PNIF value of 87.05 L/min, moderate nasal obstruction in 20 students or 32.8% with the mean PNIF of 61.5 L/min and no severe degree of nasal obstruction was found.

### References

1. Fokkens W, Lund Vm Bachert C, Clement P, Hellings P, Holmstrom M, Jones N *et al.* European Position Paper on Rhinosinusitis and Nasal Polyps 2012. *Rhinology*,2012;50(23):45:1-305.
2. Wang DY, Wardani RS, Singh K, Thanaviratnanich S, Vicente G, Xu G *et al.* A survey on the management of acute rhinosinusitis among Asian physicians. *Rhinology*,2011;49(3):264-71.
3. Soetjipto D, Wardhani RS. Guideline Penyakit THT di Indonesia. PP Perhati-KL, 2007.
4. Schalek P. Rhinosinusitis-Its Impact on Quality of Life. Dalam: Marseglia GL, editor. Peculiar Aspects of Rhinosinusitis. Edisi ke-1. China: InTech, 2011, 3-26.
5. Pynnonen MA, Kim HM, Terrell JE. Validation of the Sino-Nasal Outcome Test 20 (SNOT-20) Domains in Nonsurgical Patients. *Am J Rhinol Allergy*,2009;23:40-45.
6. Krouse JH, Stachler RJ. Anatomy and Physiology of the Paranasal Sinuses. Dalam: Brook I, penyunting. Sinusitis From Microbiology To Managemen. New York: Taylor & Francis Group, 2006, 95-108.

7. Ballenger JJ. Anatomy and Physiology of The Nose and Paranasal Sinuses. Dalam: Snow JB and Ballenger JJ, penyunting. Otorhinolaryngology Head and Neck Surgery. Edisi ke-16. Spanyol: BC Decker Inc, 2003, 547-60.
8. Walsh WE, Kern RC. Sinonasal Anatomy and Physiology. Dalam: Bailey BJ and Johnson JT, penyunting. Head & Neck Surgery Otolaryngology. Edisi ke-5. Volume ke-1. Philadelphia: Lippincott Williams & Wilkins, 2014, 359-370.
9. Welch KC, Goldberg AN. Sinusitis. Dalam: Mahmoudi M, penyunting. Allergy & Asthma, Practical Diagnosis and Management. New York: McGrawHill, 2008, 62-7.
10. Rosenfeld RM, Piccirillo JF, Chandrasekhar SS, Brook I, Kumar KA, Kramper M *et al.* Clinical Practice Guideline (Update): Adult Sinusitis. *Otolaryngology-Head and Neck Surgery*,2015;152(2S):S1-S39.
11. Johnson JT, Rosen CA, editor. Bailey's Head and Neck Surgery Otolaryngology. Edisi ke-5. Volume ke-1. Philadelphia: Lippincott Williams & Wilkins, 2014, 535-549.
12. Van Oene CM, van Reij EJJ, Sprangers MAG, Fokkens WJ. Quality Assessment of Disease-Specific Quality of Life Questionnaires for Rhinitis and Rhinosinusitis: A systematic review. *Allergy*,2007;62:1359-1371.
13. Teul I, Zbislawski W, Baran S, Czerwinski F, Lorkowski J. Quality of Life of Patients With Diseases of Sinuses. *Journal of Physiology and Pharmacology*,2007;58(5):691-697.
14. Kalpaklioglu AF, Baccioglu A. Evaluation of Quality of Life: Impact of Allergic Rhinitis on Asthma. *J Investig Allergol Clin Immunol*,2008;18(3):168-173.
15. Pusat Studi Ilmu Geografi Indonesia. Polusi Udara: Penyebab, Dampak, dan Upaya Menanggulangnya, 2016. Available from: <http://ilmugeografi.com/ilmu-bumi/udara/polusi-udara-penyebab-dampak-dan-upaya-menanggulangnya>. (Accesed 24 Februari 2017).
16. Teixeira RUF, Zappellini CEM, Alves FS, Costa EA. Peak nasal inspiratory flow evaluation as an objective method of measuring nasal airflow, Braz J Otorhinolaryngol,2011;77(4):473-80.
17. Teixeira RUF, Zappellini CEM, Oliveira LG, Basile LCG, Costa EA. Correlation between the peak nasal inspiratory flow and the visual analogue scale before and after using a nasal decongestant, In Arch Otorhinolaryngol,2011;15(2):156-62.