



# Applicability of Nasal Schirmer Test on Turkish Population and Identifying its Normal Range Values

## Nazal Schirmer Testinin Türk Nüfusunda Uygulanabilirliği ve Normal Aralık Değerleri

Ela Araz Server, Özlem Önerci Çelebi, Ecem Sevim Longur, Özgür Yiğit

Abstract/Öz

**Introduction:** Nasal schirmer test which is a modified schirmer test can be used in evaluating the amount of nasal secretion. However, we do not know the normalized values of nasal schirmer test on Turkish population. The aim of the study is investigation of applicability and normal range values of nasal schirmer test on Turkish population.

**Methods:** 200 healthy volunteers were included in the study. Standard schirmer test filter papers located adjacent to seromucinous glands of anterior septum, protruding from nostril anteriorly. Strip was removed by a forceps after 10 minutes of insertion. Moistened area on the strip was measured by millimeters.

**Results:** Out of 200 subjects between 18-45 years of age, 105 (52.5%) were female, 95 (47.5%) were male and mean age was  $32.0 \pm 7.2$ . No voluntary complaints of irritation among all subjects. Mean schirmer value of all voluntary was  $19 \pm 7$ . Mean schirmer value of females was  $19.1 \pm 6.6$  whereas it was  $20.3 \pm 7.2$  for males. No significance was detected in terms of gender.

**Conclusions:** Nasal dryness and runny nose, which are commonly seen symptoms of many diseases, could be investigated by Schirmer test and the average value for the Turkish population is  $19 \pm 7$ .

**Keywords:** Schirmer test, nasal secretion, nasal dryness, nasal function, objective tests

**Amaç:** Burun akıntı miktarını belirlemede modifiye nazal schirmer testi kullanılabilir. Ancak nazal schirmer testinin Türk popülasyonundaki normal değerlerini bilinmemektedir. Çalışmamızın amacı nazal schirmer testinin Türk popülasyonunda kullanılabilirliğini ve normal aralık değerlerini ortaya koymaktır.

**Yöntemler:** Çalışmaya 200 sağlıklı gönüllü dahil edildi. Standart schirmer test kağıdı nazal septumun ön bölgesindeki seromüsinöz bezlerine bitişik bölgesine burun deliğinden çıkacak şekilde yerleştirildi. Yerleştirildikten 10 dakika sonra forpisle çıkarıldı. Şeritteki nemli alan milimetre cinsinden ölçüldü.

**Bulgular:** 18-45 yaş aralığındaki 200 denekten 105'i (%52,5) kadın, 95'i (%47,5) erkekti ve ortalama yaş  $32,0 \pm 7,2$  idi. Hiçbir gönüllüde iritasyon bulguları olmadı. Ortalama nazal schirmer değeri  $19 \pm 7$  idi. Kadınların ortalama değeri  $19,1 \pm 6,6$  iken, erkeklerinki  $20,3 \pm 7,2$  idi. Cinsiyet açısından anlamlı bir farklılık saptanmadı.

**Sonuç:** Birçok hastalığın sık görülen semptomları olan burun kuruluğu ve burun akışı Nazal Schirmer testi ile değerlendirilebilir ve Türk nüfusu için normal değer ortalaması  $19 \pm 7$ 'dir.

**Anahtar Kelimeler:** Schirmer testi, burun akıntısı, burun kuruluğu, burun fonksiyonları, objektif testler

## Introduction

Nasal secretion has a vital role on humidifying, warming and cleaning the inspired air and functions as one of the most important protective effects of respiratory epithelium (1-3). Its amount, quality and content could be altered by local diseases such as geriatric rhinitis or systemic diseases such as Sjogren's Syndrome. Drugs, radiotherapy, climate changes and upper respiratory tract infections may also lead to dysfunction of epithelial protective mechanisms (4, 5). Hypersecretion of seromucous glands of nasalmucosa leads to runny nose, whereas hyposcretion results in nasal dryness. These two clinical findings are commonly seen in daily otolaryngological practice.

Runny nose and nasal dryness are usually graded by symptom scoring scales (6). Despite the fact that there are objective tests used in the diagnosis of diseases which lead to nasal dysfunction, there is a lack of evidence of objective methods for evaluating the complaints of runny nose and dryness. Nasal schirmer test which is a modified schirmer test used in evaluating lacrimation in ophthalmology practice can be used in evaluating the amount of nasal secretion. It is easily applicable, cheap and rapid test (7, 8). We used nasal schirmer test to measure the radioactive iodine effects on the nasal secretion in our previous study. However, we did not know the normalized values of nasal schirmer test, so we compared our results before and after treatment in that study (9). A study concerning the normal range values of nasal schirmer test of Turkish population has not been reported, yet. Therefore, in our study, we aimed to investigate the validity and normal range values of nasal schirmer test of Turkish population in order to maintain an objective method for follow up process and scientific research.

Department of Otorhinolaryngology/Head and Neck Surgery, Health Sciences University Istanbul Training and Research Hospital, Istanbul, Turkey

Address for Correspondence/

Yazışma Adresi:

Ela Araz Server

E-mail: serverela@hotmail.com

Received/Geliş Tarihi: 24.10.2017

Accepted/Kabul Tarihi: 13.01.2018

© Copyright 2018 by Available online at istanbulmedicaljournal.org

© Telif Hakkı 2018 Makale metnine istanbulmedjergisi.org web sayfasından ulaşılabilir.

**Methods**

Ethics committee approval was obtained from Istanbul Training and Research Hospital Clinical Researches Ethic Committee. Study group included patients who were admitted between 2015-2016. Patients were between 18-45 years of age and all had undergone nasal endoscopic examination. Exclusion criteria were comprised of subjects with nasal complaints, smoking, allergy history, rhinitis, history of systemic or topical nasal drug use, history of nasal surgery, history of exposure to inhalant agents, septal deviation, turbinate hypertrophy and any other nasal pathology. All patients were given written informed consents. Included subjects were requested to irrigate their noses with tap water. They waited approximately 1 hour under 22.5 °C room temperature with 33.8 % humidity before the procedure.

Standardschirmer test filter papers with 35 mm length and 5 mm width were used for all subjects (Dr. Mann Pharma, Berlin, Germany). By using a nasal speculum and a bayonette forceps, filter papers were located parallel to the nasal dorsum, immediately adjacent to anterior nasal septum. Strip was carefully located adjacent to seromucinous glands of anterior septum, protruding from nostril anteriorly (Figure 1). Lateral nasal wall was carefully preserved in order to avoid irritation. Strip was removed by a forceps after 10 minutes of insertion. Moistened area on the strip was measured by millimeters.

**Table 1. Demographic features, distribution according to age, schirmer results of right/left nasal cavities**

	Min-Max	Median	Mean.±s.s./n-%
Age	9-59	34	37.0±12.2
	18-25		11 5.5%
	25-30		69 34.5%
	31-35		49 24.5%
	36-40		32 16.0%
	41-45		39 19.5%
Gender	Female		105 52.5%
	Male		95 47.5%
Right	5-35	20.0	19.8±6.9
Left	4-35	19.0	19.5±7.0

**Table 2. Comparison of Schirmer results in terms of nasal cavity side, gender and age**

		Schirmer			p
		Min-Max	Median	Mean.±s.s.	
Side	Right	5-35	20	19.8±6.9	0.148 <sup>w</sup>
	Left	4-35	19	19.5±7.0	
Gender	Female	5-33	20	19.1±6.6	0.061 <sup>m</sup>
	Male	4-35	20	20.3±7.2	
Age	18-25	5-32	21	20.0±6.7	0.095 <sup>k</sup>
	25-30	4-35	21	21.0±7.6	
	31-35	7-32	19	19.1±6.5	
	36-40	5-34	19	19.5±7.3	
	41-45	5-28	18	17.9±5.8	

m: Mann-whitney u test; k: Kruskal-wallis; w: Wilcoxon test

The procedure was applied to each of the nasal cavity at the same time. None of the subjects needed any local anesthetic agent.

**Statistical Analysis**

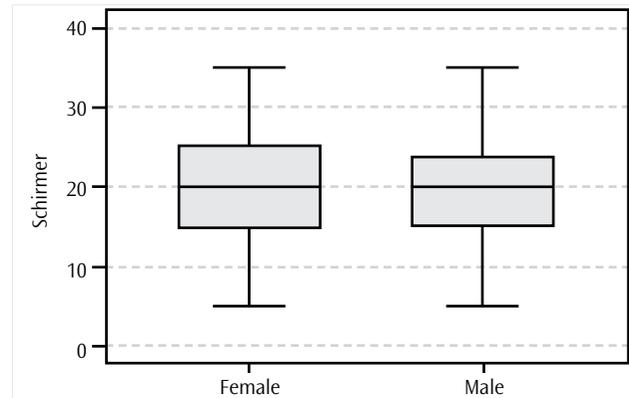
Mean, standard deviation, median lowest, highest, frequency and ratio values were used in the descriptive statistics of the data. The distribution of the variables was measured by the Kolmogorov-smirnov test. Kruskal-wallis, mann-whitney u test was used in the analysis of quantitative independent data. In the analysis of the dependent data, the test was used. Spearman correlation analysis was used for correlation analysis. Statistical Package for Social Sciences 22.0 program was used in the analyzes (IBM SPSS Corp.; Armonk, NY, USA).

**Results**

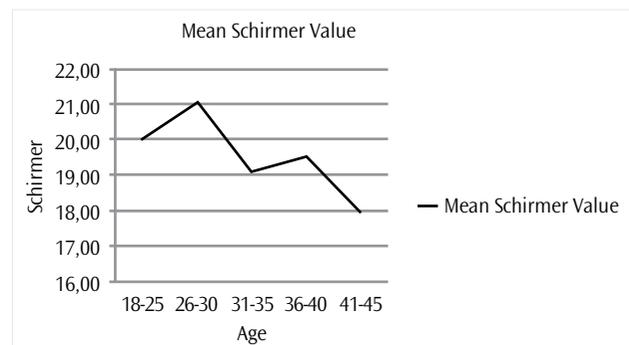
Out of 200 subjects between 18-25 years of age, 105 (52.5%) were female, 95 (47.5%) were male and mean age was 32.0±7.2. Among all subjects, mean schirmer value of nasal cavity was 20.0 (19.8±6.9) on the right side where as it was 19.0 (19.5±7.0) on the left side (Table1).

There was no significant difference between right and left schirmer values (p>0.05). There was a significant correlation between right and left schirmer values (p=0.000/r=0.892) (Table-2). Mean schirmer value of females was 19.1±6.6 whereas it was 20.3±7.2 for males. No significance was detected in terms of gender (p=0.061) (Figure 1). Mean schirmer value of all voluntary was 19±7.

In terms of age range of whole subject group, schirmer results reflected a decrease by increasing age but it was not found to be statistically significant (p>0.05) (Figure 2).



**Figure 1. Schirmer results with respect to gender**



**Figure 2. Schirmer results with respect to age**

## Discussion

Inspired air firstly contacts with the mucosa of the nasal cavity. It is humidified, warmed and cleaned by secretion of seromucinous glands. Nasal secretion affected by alterations of climate, humidity and temperature much more than other secretions because nasal cavity is the first contact point of inspired air (10). Not only the quality of inspired air but also local and systemic diseases, radiotherapy and medications may also affect the amount and content of nasal secretions (9, 10). The incidence of these factors affecting nasal secretion is also increasing. Incidence of hyposcretion and leading nasal dryness has recently been reported to increase with respect to climate changes and life style (11). The prevalence of rhinitis has also increased in recent decades (12). Despite the increased prevalence of nasal secretion changes, the objective test used in follow-up is limited. Runny nose and dryness are subjective findings and are usually evaluated by symptom scores and visual analogue scale (VAS) (13).

First study concerning objective evaluation of amount of nasal secretion had been reported by Saunte et al. (7) They investigated the effects of parasympathomimetic drugs on lacrimation, saliva and nasal secretions by objective tests and used modified Schirmer test for evaluating nasal secretion. Schirmer test can easily be applied by ophthalmologists in case of diminished lacrimation and dry eye. Modified version of this test is not limited with nasal cavity. Dry mouth and hypersalivation are also subjective symptoms and findings such as nasal dryness and runny nose, so, can not be easily evaluated by objective tests. Intraoral Schirmer test, a modified version, has been suggested to be an alternative method for these symptoms (14, 15).

In order to maintain a reliable objective test Lindemann et al. (8) investigated nasal Schirmer test on 159 non-smoker and 30 smoker subjects. They identified normal range as 6-18 mm on healthy subjects and signified that no value had been reported in the literature before. Test result of smokers were reported to be significantly lower than of non-smokers. In our study, for the purpose of identifying the normal range in Turkish population, we excluded the subjects who were smokers or had exposed to any inhalants and subjects who would be affected by any factor that may alter the parameters. We identified normal mean range as 19-20mm for normal population.

In order to measure the amount of lacrimation, ophthalmologists may use topical anesthetics to prevent irritative lacrimation while applying Schirmer test (16). In our study, we did not observe any finding of irritation, in concordance with the study of Lindemann et al. (8). We didn't use any medication. Avoiding any contact between lateral wall of the nasal cavity and the strip could prevent irritation while septal mucosa remarkably tolerates strip contact.

Nasal secretion can easily be affected by age, gender and hormonal alterations in healthy subjects. Reduction in the number of goblet cells of nasal mucosa results in hyposcretion (17). We preferred to exclude subjects over 45 years of age in order to prevent the statistical effect of geriatric rhinitis. Lindemann et al. (8) reported in a larger series of subjects that Schirmer test results were not effected by age. Postmenopausal women mainly suffer from nasal hypofunction due to atrophy of nasal mucosa which is not

only affected by age but also by hormonal alterations. Studies reported that nasal or systemic estrogen would improve these complaints (18). Besides, nasal congestion could be seen partly during menstrual cycle or pregnancy (19). In our study, we didn't find any significant difference between male and female test results. On the contrary, we should mention that we did not concern whether female subjects were in postmenopausal period or not and we also didn't consider the menstrual cycle of subjects. Further studies in larger groups of female subjects, which concern the menstrual cycle, could provide normal range of Schirmer test values.

## Conclusion

Modified Schirmer test is a rapid, cheap and practical objective test for the evaluation of the amount of nasal secretion. Our paper reports the first study which concerns the objective evaluation of the amount of nasal secretion of Turkish population. Nasal dryness and runny nose, which are commonly seen symptoms of many diseases, could be investigated by Schirmer test and identified values could be useful in further studies on Turkish population.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the ethics committee of İstanbul Training and Research Hospital Clinical Researches Ethic Committee.

**Informed Consent:** Written informed consent was obtained from the patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Design - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Supervision - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Resource - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Materials - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Data Collection and/or Processing - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Analysis and/or Interpretation - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Literature Search - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Writing - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Critical Reviews - E.A.S., Ö.Ö.Ç., Ö.Y.

**Conflict of Interest:** The authors have no conflict of interest to declare.

**Financial Disclosure:** The authors declared that this study has received no financial support.

**Etik Komite Onayı:** Bu çalışma için etik komite onayı İstanbul Eğitim ve Araştırma Hastanesi Klinik Araştırmalar Etik Kurulu'ndan alınmıştır.

**Hasta Onamı:** Bu çalışmaya katılan tüm hastalardan yazılı hasta onamı alınmıştır.

**Hakem Değerlendirmesi:** Dış Bağımsız.

**Yazar Katkıları:** Fikir - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Tasarım - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Denetleme - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Kaynaklar - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Malzemeler - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Veri Toplanması ve/veya İşlemesi - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Analiz ve/veya Yorum - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Literatür taraması - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Yazıyı Yazan - E.A.S., Ö.Ö.Ç., E.S.L., Ö.Y.; Eleştirel İnceleme - E.A.S., Ö.Ö.Ç., Ö.Y.

**Çıkar Çatışması:** Yazarlar çıkar çatışması bildirmemişlerdir.

**Finansal Destek:** Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

## References

1. Courtiss EH, Gargan TJ, and Courtiss GB. Nasal Physiology. *Ann Plast Surg* 1984; 13: 214-23. [\[CrossRef\]](#)
2. Rouadi P, Baroody FM, Abbott D, Naureckas E, Solway J, Naclerio RM. A technique to measure the ability of the human nose to warm and humidify air. *J Appl Physiol* 1999; 87: 400-6. [\[CrossRef\]](#)
3. Ballenger JJ. Symposium: the nose versus the environment. *Laryngoscope* 1983; 93: 56-7. [\[CrossRef\]](#)
4. Keck T, Lindemann J. Numerical simulation and nasal air-conditioning. *GMS Curr Top Otorhinolaryngol Head Neck Surg* 2010; 9: Doc08.
5. Keck T, Rozsasi A, Gruen PM. Nasal-airconditioning. *HNO* 2011; 59: 40-4.
6. Pallanch FJ, McCaffret TV, Kern EB. Assessment of Nasal Function. In: Flint P, Haughey B, Lund V, Niparko J, Robbins K, Thomas JR, et al. *Cummings Otolaryngology*. Canada: Saunders; 2014.p.644-57.e4.
7. Saunte C. Quantification of salivation, nasal secretion and tearing in man. *Cephalalgia* 1983; 3: 159-73. [\[CrossRef\]](#)
8. Lindemann J, Tsakiropoulou E, Rettinger G, Gutter C, Scheithauer MO, Picavet V et al. The intranasal Schirmer test: a preliminary study to quantify nasal secretion. *Eur Arch Otorhinolaryngol* 2014; 271: 2963-7. [\[CrossRef\]](#)
9. Server EA, Kirgezen T, Celebi OO, Yildiz M, Yigit O, Cermik TF. How does radioactive iodine affect the nose? *Laryngoscope* 2017; 127: 2698-702. [\[CrossRef\]](#)
10. Hildenbrand T, Weber RK, Brehmer D. Rhinitis sicca, dry nose and atrophic rhinitis: a review of the literature. *Eur Arch Otorhinolaryngol* 2011; 268: 17-26. [\[CrossRef\]](#)
11. Elad D, Wolf M, Keck T. Air-conditioning in the human nasal cavity. *Respir Physiol Neurobiol* 163: 121-7. [\[CrossRef\]](#)
12. Heinrich J, Wichmann HE. Traffic related pollutants in Europe and the effect on allergic diseases. *Cur Opin Allergy Clin Immunol* 2004; 4: 341-8. [\[CrossRef\]](#)
13. Revicki DA, Leidy NK, Brennan-Diemer F, Thompson C, Togias A. Development and preliminary validation of the multi attribute Rhinitis Symptom Utility Index. *Qual Life Res* 1998; 7: 693-702. [\[CrossRef\]](#)
14. López-Jornet P, Camacho-Alonso F, Bermejo-Fenoll A. A simple test for salivary gland hypofunction using Oral Schirmer's test. *J Oral Pathol Med* 35: 244-8. [\[CrossRef\]](#)
15. Löfgren CD, Wickström C, Sonesson M, Lagunas PT, Christersson C. A systematic review of methods to diagnose oral dryness and salivary gland function. *BMC Oral Health* 2012; 12: 29. [\[CrossRef\]](#)
16. Savini G, Prabhawasat P, Kojima T, Grueterich M, Espana E, Goto E. The challenge of dry eye diagnosis. *Clin Ophthalmol* 2008; 2: 31-55. [\[CrossRef\]](#)
17. Beule AG. Physiology and pathophysiology of respiratory mucosa of the nose and the paranasal sinuses. *Laryngorhinotologie* 2010; 89: 15-34. [\[CrossRef\]](#)
18. Nappi C, Di Spiezio Sardo A, Guerra G, Di Carlo C, Bifulco G, Acunzo G, et al. Comparison of intranasal and transdermal estradiol on nasal mucosa in postmenopausal women. *Menopause* 2004; 11: 447-55. [\[CrossRef\]](#)
19. Paulsson B, Gredmark T, Burian P, Bende M. Nasal mucosal congestion during the menstrual cycle. *J Laryngol Otol* 1997; 111: 337-9. [\[CrossRef\]](#)

**Cite this article as:** Server EA, Çelebi ÖÖ, Longur ES, Yiğit Ö. Applicability Of Nasal Schirmer Test On Turkish Population And Identifying Its Normal Range Values. *Istanbul Med J* 2018; 19 (3): 231-4.