

# Relationship between smoking and otorhinolaryngological symptoms

## Sigara ve otorinolarenolojik semptomlar arasındaki ilişki

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### ABSTRACT

**Objectives:** This study aims to investigate the possible relationship between smoking and otorhinolaryngological symptoms in smokers, non-smokers and ex-smokers.

**Patients and Methods:** Between March 01<sup>st</sup>, 2014 and March 31<sup>st</sup>, 2014, a total of 1,840 patients (823 males, 1,017 females) over 25 years of age who were admitted to the ear nose, and throat (ENT) outpatient clinic were included in the study. The patients who were smoking at least 10 cigarettes daily for at least five years were included in the smokers group (n=514). The patients who did not smoke for at least one year following at least five years of smoking were included in the ex-smokers group (n=268). The patients who never smoked were included in the non-smokers group (n=1,058). A form containing all ENT symptoms was given to all patients and the patients were asked to fill the form with their complaints following being informed by the same doctor.

**Results:** Cough, shortness of breath, reflux, dryness of throat, irritation, taste disorder, bad breath, toothache, nasal congestion, smell disorders, snoring, and nasal discharge were found to be significantly higher in the smokers group, compared to the non-smokers group. Cough, sputum, hoarseness, dysphagia, reflux, sore throat, dryness of throat, irritation, stinging, oral aphthae, taste disorder, toothache, bleeding gums, and bad breath were significantly lower in the ex-smokers group. Nasal congestion, nosebleeds, sneezing, nasal discharge, smell disorders, headache, feeling of facial fullness, ear discharge, hearing loss, pain, fullness, dizziness, and tinnitus were statistically significantly lower in the ex-smokers group.

**Conclusion:** Our study results show that smoking causes symptoms particularly associated with upper respiratory tract and these symptoms may persist in ex-smokers.

**Keywords:** Ear; nose; smoking; symptom; throat.

### ÖZ

**Amaç:** Bu çalışmada sigara kullanan, sigara kullanmayan ve sigarayı bırakmış kişilerde sigara ve otorinolarenolojik semptomlar arasındaki muhtemel ilişki araştırıldı.

**Hastalar ve Yöntemler:** 01 Mart 2014 - 31 Mart 2014 tarihleri arasında, kulak, burun, boğaz (KBB) polikliniğine başvuran toplam 1840 hasta (823 erkek, 1017 kadın) çalışmaya alındı. En az beş yıl süreyle günde en az 10 sigara içen hastalar sigara içenler grubuna alındı (n=514). En az beş yıllık sigara kullanımından sonra en az bir yıldır sigara içmeyen hastalar sigarayı bırakanlar grubuna alındı (n=268). Hiç sigara içmemiş hastalar ise sigara içmeyenler grubuna alındı (n=1058). Hastaların tümüne KBB semptomlarını kapsayan bir form verildi ve hastalardan aynı hekim tarafından bilgilendirildikten sonra bu formu yakınmaları doğrultusunda doldurmaları istendi.

**Bulgular:** Öksürük, nefes darlığı, reflü, boğaz kuruluğu, tahriş, tat alma bozukluğu, kötü ağız kokusu, diş ağrısı, burun tıkanıklığı, koku alma bozuklukları, horlama ve burun akıntısı hiç sigara içmemiş gruba kıyasla, sigara içen grupta anlamlı düzeyde yüksek bulundu. Öksürük, balgam, ses kısıklığı, disfaji, reflü, boğaz ağrısı, boğaz kuruluğu, tahriş, batma, oral aftlar, tat alma bozukluğu, diş ağrısı, diş etlerinde kanama ve kötü ağız kokusu hiç sigara içmeyen grupta anlamlı düzeyde daha düşüktü. Burun tıkanıklığı, burun kanaması, aksırma, burun akıntısı, koku alma bozuklukları, baş ağrısı, yüzde dolgunluk hissi, kulak akıntısı, işitme kaybı, ağrı, dolgunluk, baş dönmesi ve tinnitus sigarayı bırakan grupta istatistiksel olarak anlamlı düzeyde daha düşüktü.

**Sonuç:** Çalışma bulgularımız sigaranın özellikle üst solunum yolu ile ilişkili semptomlara neden olduğunu ve bu semptomların sigarayı bırakanlarda devam edebileceğini göstermektedir.

**Anahtar Sözcükler:** Kulak; burun; sigara; semptom; boğaz.



Smoking is known to have harmful effects on health<sup>[1]</sup> and cigarette smoking and passive smoking are widespread in the world. However, associated diseases are not considered important enough as consequences arise indirectly and after a long period of time. Inhalation of tobacco smoke causes chronic irritation in the nose and oropharynx of both active and passive smokers. Four thousand harmful components such as acrolein, formaldehyde, carbon monoxide, nicotine, acetaldehyde, phenol, potassium cyanide that are present in cigarette smoke, are toxic to respiratory epithelium.<sup>[2]</sup>

This study aimed to demonstrate whether there is a statistically significant difference between smokers, ex-smokers and controls regarding symptoms of ENT diseases. We applied a questionnaire including symptoms of ENT disorders on randomly selected patients.

#### PATIENTS AND METHODS

This is a randomized-controlled prevalence and incidence study which included 1,840 randomly selected patients (823 males, 1,017 females) over 25 years of age who were admitted to the ear, nose, and throat (ENT) outpatient clinic between March 01<sup>st</sup>, 2014 and March 31<sup>st</sup>, 2014. The study protocol was approved by the Dr. Lütü Kırda Kartal Training and Research Hospital Ethics Committee. Written informed consent was obtained from each patient, and the study was conducted in accordance with the principles of the Declaration of Helsinki. The same doctors filled forms containing the symptoms of ENT diseases. Patients who had been smoking at least 10 cigarettes daily for at least five years were included in the smokers group (n=514). Patients who did not smoke for at least one year after at least five years of smoking were included in the ex-smokers group (n=268). Patients who never smoked were included in the non-smokers control group (n=1,058). Patients with obvious pathology that explained the symptoms or with acute infection were excluded from the study. Passive smokers were excluded from the study. Statistical evaluation of the data analysis was performed with Fischer's chi-square test ( $p < 0.05$ ).

#### RESULTS

Patient demographics are shown in Table 1. Laryngopharyngeal symptoms are summarized in Table 2: cough, shortness of breath, and

reflux were found to be significantly increased in smokers compared to the control group, and cough, sputum, hoarseness, dysphagia, and reflux were significantly lower among ex-smokers.

Oral cavity symptoms are summarized in Table 3: dryness of throat, irritation, taste disorder, bad breath and toothache were significantly increased in smokers compared to the control group but mouth sores were found to be lower. There were no significant differences among other symptoms. Sore throat, dryness of throat, irritation, sore throat, stinging, mouth sores (oral aphthae), taste disorders, toothache and bleeding gums and bad breath were found to be significantly lower among ex-smokers.

Sinonasal symptoms are listed in Table 4: nasal congestion, smell disorders and snoring were significantly higher among smokers compared to the control group, while nasal congestion, runny nose, nosebleeds, sneezing, nasal discharge, smell disorders, headache, and facial fullness were statistically significantly lower in ex-smokers.

Ear symptoms are listed in Table 5: discharge was higher among smokers compared to the control group, whereas ear pain was significantly lower. There were no significant differences among other symptoms. Ear discharge, hearing loss, pain, fullness, dizziness and tinnitus were significantly lower among ex-smokers.

#### DISCUSSION

Laryngopharyngeal reflux may be related to smoking. In a study on effects of acute and chronic smoking on upper esophageal contractile reflex and pharyngeal swallowing, smoking was recorded to have reverse effects on this reflex and to cause reflux.<sup>[3]</sup> We also found a significantly higher rate of reflux in smokers. Although difficulty in swallowing was higher in smokers, there was no statistical difference compared to the control group.

**Table 1.** Distribution by gender

	Male		Female	
	n	%	n	%
Smokers	326	17.7	188	10.2
Non-smokers	347	18.9	711	38.6
Ex-smokers	150	8.2	118	6.4
<i>Total</i>	823	44.8	1,017	55.2

**Table 2.** Distribution of upper respiratory tract symptoms

	Smokers		Non-smokers		Ex-smokers	
	n	%	n	%	n	%
Cough	188	36.5	271	25.6	44	16.4
Sputum	262	51	312	29.4	55	20.6
Hoarseness	120	23.3	210	19.8	37	13.8
Shortness of breath	90	17.5	125	11.8	24	8.9
Reflux	123	23.9	180	17	29	10.8
Dysphagia	110	21.4	185	17.4	30	11.1
Snore	197	38.3	314	29.6	68	25.3
Apnea-hypopnea	37	7.1	41	3.8	14	5.2
Neck pain	162	31.5	326	30.8	42	15.6
Swelling in the neck	46	8.9	56	5.2	11	4.1
Pruritus	106	20.6	276	26	25	9.3

Cigarette smoke causes reflex changes in the upper airways during breathing.<sup>[4]</sup> Chronic smoking causes metaplasia in respiratory mucosa, increase of goblet cells and increase in upper respiratory tract secretions.<sup>[2,5]</sup>

In our study, sputum symptoms were found in 29.4% of non-smokers and in 51% of smokers ( $p>0.19$ ; not significant). Sputum complaints were significantly lower in ex-smokers (20.5%).

Smoking has been shown to be associated with structural changes besides functional changes in the respiratory epithelium. Different studies have showed that cigarette smoke decreases the vital functions of the cells, induces apoptosis in the respiratory epithelium,<sup>[6]</sup> reduces mitogenic effect and that proapoptotic activity is found to be dependent on cigarette smoke concentration

or cause significant decreases in the regeneration of damaged epithelium.<sup>[7]</sup> In a study conducted on dogs, cigarette smoke has been shown to cause bradypnea and that the respiratory reflex is carried by afferent sensory pathways.<sup>[8]</sup> These studies illustrate the shortness of breath due to smoking. In our study, shortness of breath was significantly higher in smokers. In one study, lung functions were significantly improved and cough had been shown to decrease after implementation of a 12-month ban among chronic cigarette smokers.<sup>[9]</sup>

Alcohol use together with smoking increases laryngeal disease risk even more in future years.<sup>[10]</sup> Although smoking and alcohol use did not independently increase the likelihood of chronic voice disorders in a large incidence

**Table 3.** Distribution of oral cavity symptoms

	Smokers		Non-smokers		Ex-smokers	
	n	%	n	%	n	%
Tickling	198	38.5	333	31.4	53	19.7
Dryness of throat	231	44.9	361	34.1	56	20.8
Sore throat	174	33.8	336	31.7	39	14.5
Stinging	94	18.2	166	15.6	28	10.4
Mouth sores	56	10.8	282	26.6	20	7.4
Pain sensation in tongue	120	23.3	147	13.6	23	8.5
Halitosis	194	37.7	237	22.4	42	15.6
Taste disorders	92	17.8	105	9.9	13	4.8
Toothache	142	27.6	201	18.9	30	11.1
Gingival bleeding	126	24.5	235	22.2	28	10.4

**Table 4.** Distribution of sinonasal symptoms

	Smokers		Non-smokers		Ex-smokers	
	n	%	n	%	n	%
Runny nose	122	23.7	215	20.3	19	7
Nasal bleeding	37	7.1	97	9.1	6	2.2
Sneeze	183	35.6	358	33.8	47	17.5
Post nasal drainage	139	27	289	27.3	34	12.6
Smell disorders	93	18	140	13.2	22	8.2
Headache	258	50.1	524	49.5	61	22.7
Facial fullness	51	9.9	91	8.6	13	4.8
Nausea	101	19.6	259	24.4	24	8.9
Anorexia	89	17.3	146	13.7	18	6.7

study, female gender, age (40-59), voice usage, esophageal reflux, chemical exposure, frequent sinonasal infections increases laryngeal symptoms.<sup>[11]</sup>

Cigarette smoking can cause oral fibrosis. Nicotine can directly increase the production of collagen in gingival fibroblasts and develop periodontal fibrosis.<sup>[12]</sup> We also found higher dryness of throat due to oral fibrosis, irritability, toothache and bad breath due to gingivitis among smokers in our study. In another survey, current or past smoking has been identified as an important factor in bad breath as well as poor oral hygiene.<sup>[13]</sup> Cigarette smoking is a leading cause of oral malodor.<sup>[14]</sup>

Oral and nasopharyngeal flora of smokers contain fewer aerobic and anaerobic microorganisms and contain more potential pathogens. This would explain the pharyngitis symptoms in smokers (burning in the throat, dryness, irritation, pain, etc.). The flora returns to normal when smoking is ceased.<sup>[15]</sup> Likewise subgingival flora changes highly.<sup>[16]</sup> Interestingly,

we found significantly lower oral cavity symptoms in ex-smokers compared to the control group. We think that this situation is due to patients better realizing improvement of their symptoms as they feel their symptoms more during smoking.

Smokers and non-smokers with chronic tonsillitis were compared and a longer history of recurrent tonsillitis and marked morphological changes were identified in smokers.<sup>[17]</sup> In our study, sore throat due to tonsillitis and pharyngitis was found to be lower in ex-smokers, whereas there was no difference in smokers.

Smoking is a risk factor for infectious diseases affecting the respiratory tract.<sup>[18]</sup> Bacteria obtained from patients with cigarette smoke exposure return to the bacteria phenotype that does not form biofilm when smoke is interrupted. These observations support the hypothesis of sinonasal biofilm formation, and thus persistent infections are observed although these infections can be treated medically.<sup>[19]</sup> Headache, runny nose, dysphagia, odynophagia, pharyngeal

**Table 5.** Distribution of ear symptoms

	Smokers		Non-smokers		Ex-smokers	
	n	%	n	%	n	%
Hearing loss	158	30.7	281	26.5	49	18.2
Dizziness	152	29.5	277	26.1	38	14.1
Ear discharge	167	32.4	112	10.5	17	6.3
Ear fullness	86	16.7	166	15.6	20	7.4
Tinnitus	157	30.5	209	19.7	42	15.6
Acoustic trauma	22	4.2	40	3.7	11	4.1

irritation, dryness of the throat and chronic pharyngitis symptoms occur more frequently in these patients. In our study, while nasal congestion, smell disorders and snoring were significantly higher in smokers; symptoms such as runny nose, sneezing, nasal discharge and headache were close to the control group. All symptoms were found to be significantly lower in ex-smokers. In a study, application of tobacco smoke for 30 minutes to healthy non-smokers was observed to increase nasal congestion, and rhinitis symptoms and nasal congestion were found in the results of the survey.<sup>[20]</sup> Sinusitis patients and patients smoking more than one pack of cigarettes a day for more than five years were shown to have a prolonged mucociliary transit time compared to the normal control group.<sup>[21]</sup> A study in North America showed a significant increase in the incidence of chronic and recurrent rhinosinusitis in patients who smoke at least 10 cigarettes a day compared to non-smokers and ex-smokers.<sup>[2]</sup> We also considered smoking addiction as smoking at least 10 cigarettes a day for at least five years. Regarding the literature, nasal polyp in smokers did not differ significantly compared to the control group.<sup>[22]</sup> In a prevalence study in Korea, smoking was reported to have very little effect on the prevalence of allergic rhinitis.<sup>[23]</sup> In our study, allergic rhinitis symptoms were also not statistically significantly different compared to the control group and was lower in ex-smokers.

A survey showed that body aches such as fibromyalgia, neck pain, and headache appeared to be higher in female smokers.<sup>[24]</sup> A study in which 204 articles were scanned revealed definite evidences that active smoking or passive exposure contributes to the formation of chronic rhinosinusitis.<sup>[25]</sup>

Although cochlear dysfunction and tinnitus are seen more often in smokers, the relationship between smoking and ear pathology is not certain.<sup>[26]</sup> Smoking is not associated with a significant increase in the risk of hearing loss.<sup>[27]</sup> In a study conducted on 13,308 male patients, hearing loss incidence was significantly higher in smokers compared to nonsmokers and this effect was more prominent in youth.<sup>[28]</sup> In our study, the incidence of hearing loss was not significant in smokers. It was significantly lower in ex-smokers. In an incidence study similar to our study; although ear discharge, ear pain, hearing

loss, dizziness and tinnitus were more common in smokers, there was no statistical significance except for dizziness and tinnitus.<sup>[29]</sup> In a study of factors affecting tinnitus prevalence, smoking has been shown not to have an important role among other factors.<sup>[30]</sup>

In conclusion, our study showed that although the majority of laryngopharyngeal and oral cavity symptoms were significantly higher in smokers compared to nonsmokers, sinonasal and ear symptoms were generally not significantly higher in smokers. The majority of symptoms of ENT diseases were significantly lower in ex-smokers compared to the control group. We believe that some discordance with the literature is due to low socioeconomic status of our patient population, ignorance of present symptoms by smokers, and ex-smokers being more aware of post-smoking symptom changes.

#### Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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#### REFERENCES

1. Shafey O, Eriksen M, Ross H, Mackay J, The Tobacco Atlas. 3rd ed. Atlanta: American Cancer Society; 2009.
2. Tamashiro E, Cohen NA, Palmer JN, Lima WT. Effects of cigarette smoking on the respiratory epithelium and its role in the pathogenesis of chronic rhinosinusitis. *Braz J Otorhinolaryngol* 2009;75:903-7.
3. Dua K, Bardan E, Ren J, Sui Z, Shaker R. Effect of chronic and acute cigarette smoking on the pharyngo-upper oesophageal sphincter contractile reflex and reflexive pharyngeal swallow. *Gut* 1998;43:537-41.
4. Lee LY, Sant'Ambrogio FB, Mathew OP, Sant'Ambrogio G. Acute effect of cigarette smoke on laryngeal receptors. *J Appl Physiol* (1985) 1987;62:1575-81.
5. Eriksson J, Ekerljung L, Sundblad BM, Lötvall J, Torén K, Rönmark E, et al. Cigarette smoking is associated with high prevalence of chronic rhinitis and low prevalence of allergic rhinitis in men. *Allergy* 2013;68:347-54.
6. Luppi F, Aarbiou J, van Wetering S, Rahman I, de Boer WI, Rabe KF, et al. Effects of cigarette smoke condensate on proliferation and wound closure of bronchial epithelial cells in vitro: role of glutathione. *Respir Res* 2005;6:140.
7. Van Winkle LS, Evans MJ, Brown CD, Willits NH, Pinkerton KE, Plopper CG. Prior exposure to aged and diluted sidestream cigarette smoke impairs bronchiolar injury and repair. *Toxicol Sci* 2001;60:152-64.

8. Mathew OP, Sant'Ambrogio FB, Sant'Ambrogio G. Laryngeal paralysis on receptor and reflex responses to negative pressure in the upper airway. *Respir Physiol* 1988;74:25-34.
9. Rajkumar S, Stolz D, Hammer J, Moeller A, Bauer GF, Huynh CK, et al. Effect of a smoking ban on respiratory health in nonsmoking hospitality workers: a prospective cohort study. *J Occup Environ Med* 2014;56:86-91.
10. Byeon H, Lee Y. Laryngeal pathologies in older Korean adults and their association with smoking and alcohol consumption. *Laryngoscope* 2013;123:429-33.
11. Roy N, Merrill RM, Gray SD, Smith EM. Voice disorders in the general population: prevalence, risk factors, and occupational impact. *Laryngoscope* 2005;115:1988-95.
12. Leask A. When there's smoke there's.....CCN2. *J Cell Commun Signal* 2010;4:157-8.
13. Al-Ansari JM, Boodai H, Al-Sumait N, Al-Khabbaz AK, Al-Shammari KF, Salako N. Factors associated with self-reported halitosis in Kuwaiti patients. *J Dent* 2006;34:444-9.
14. Lang B, Filippi A. Halitosis--Part 1: epidemiology and pathogenesis. *Schweiz Monatsschr Zahnmed* 2004;114:1037-50.
15. Brook I. The impact of smoking on oral and nasopharyngeal bacterial flora. *J Dent Res* 2011;90:704-10.
16. Haffajee AD, Socransky SS. Relationship of cigarette smoking to the subgingival microbiota. *J Clin Periodontol* 2001;28:377-88.
17. Torre V, Bucolo S, Giordano C, Ciccirello R, Cavallari V, Garofalo L, et al. Palatine tonsils in smoker and non-smoker patients: a pilot clinicopathological and ultrastructural study. *J Oral Pathol Med* 2005;34:390-6.
18. Charlson ES, Chen J, Custers-Allen R, Bittinger K, Li H, Sinha R, et al. Disordered microbial communities in the upper respiratory tract of cigarette smokers. *PLoS One* 2010;5:15216.
19. Goldstein-Daruech N, Cope EK, Zhao KQ, Vukovic K, Kofonow JM, Doghramji L, et al. Tobacco smoke mediated induction of sinonasal microbial biofilms. *PLoS One* 2011;6:15700.
20. Schick SF, van den Vossenberg G, Luo A, Whitlatch A, Jacob P, Balmes J, et al. Thirty minute-exposure to aged cigarette smoke increases nasal congestion in nonsmokers. *J Toxicol Environ Health A* 2013;76:601-13.
21. Mahakit P, Pumhirun P. A preliminary study of nasal mucociliary clearance in smokers, sinusitis and allergic rhinitis patients. *Asian Pac J Allergy Immunol* 1995;13:119-21.
22. Görgülü O, Ozdemir S, Canbolat EP, Sayar C, Olgun MK, Akbaş Y. Analysis of the roles of smoking and allergy in nasal polyposis. *Ann Otol Rhinol Laryngol* 2012;121:615-9.
23. Min YG, Jung HW, Kim HS, Park SK, Yoo KY. Prevalence and risk factors for perennial allergic rhinitis in Korea: results of a nationwide survey. *Clin Otolaryngol Allied Sci* 1997;22:139-44.
24. Mitchell MD, Mannino DM, Steinke DT, Kryscio RJ, Bush HM, Crofford LJ. Association of smoking and chronic pain syndromes in Kentucky women. *J Pain* 2011;12:892-9.
25. Reh DD, Higgins TS, Smith TL. Impact of tobacco smoke on chronic rhinosinusitis: a review of the literature. *Int Forum Allergy Rhinol* 2012;2:362-9.
26. Paschoal CP, Azevedo MF. Cigarette smoking as a risk factor for auditory problems. *Braz J Otorhinolaryngol* 2009;75:893-902.
27. Linke R, Matschke RG. Is there a correlation between sudden deafness and smoking?. *Laryngorhinootologie* 1998;77:48-51.
28. Sharabi Y, Reshef-Haran I, Burstein M, Eldad A. Cigarette smoking and hearing loss: lessons from the young adult periodic examinations in Israel (YAPEIS) database. *Isr Med Assoc J* 2002;4:1118-20.
29. Kiran G, Neeraj K, Rajeew G. Association of smoking or tobacco use with ear diseases among men: a retrospective study *Tobacco Induced Diseases* 2012;10:1-4.
30. Chung DY, Gannon RP, Mason K. Factors affecting the prevalence of tinnitus. *Audiology* 1984;23:441-52.