



Evaluation of Olfactory Functions in Cancer Patients Before Radiotherapy

Hatice ÖNDER,¹ Gül KANYILMAZ,² Mustafa AÇIKGÖZ,³ Esra ACIMAN DEMİREL³

¹Department of Radiation Oncology, Aydın City Hospital, Aydın-Türkiye

²Department of Radiation Oncology, Necmettin Erbakan University, Meram Faculty of Medicine, Konya-Türkiye

³Department of Neurology, Bülent Ecevit University Faculty of Medicine, Zonguldak-Türkiye

OBJECTIVE

In this study, we aimed to detect olfactory functions of patients with objective method and the factors which can affect these, who referred to our department for definitive radiation therapy.

METHODS

This study included the patients without head and neck cancer. All patients functions of odor threshold, discrimination and identification were assessed with 'Sniffin Sticks' test before radiation therapy. The overall score is called composite threshold-discrimination-identification score. As these scores, ≤ 16 was evaluated as anosmia, 16-30 as hyposmia and >30 normal smell function.

RESULTS

This study included 48 patients with a median age of 59 years (30-76 years). With patients who had chemotherapy before radiation therapy, statistically significant olfactory disfunction (hyposmia+anosmia) was determined. 26 of 29 patients (90%) who had chemotherapy, had olfactory disfunction ($p=0.02$) and 7 of 10 patients (70%) who had normal smell functions had no prior chemotherapy ($p=0.04$). As multivariate analysis, increased age (OR:1.33, 95% CI 1.08-1.64; $p=0.007$) and to be treated with chemotherapy (OR:32.95, 95% CI 1.35-801.45; $p=0.032$) were significant factors in terms of olfactory disfunction.

CONCLUSION

In this study, we established olfactory disfunction at 79% patients who were planned definitive radiotherapy. As multivariate analysis; increasing age and to be treated with chemotherapy were statistically significant parameters as to olfactory disfunction. The patients with cancer, smell and taste disfunctions can occur frequently and to be aware of these pathologies is important for providing required treatment support.

Keywords: Chemotherapy; olfactory disfunction; radiotherapy.

Copyright © 2026, Turkish Society for Radiation Oncology

INTRODUCTION

The senses of smell and taste are vitally important for life. These senses awaken us to dangers such as gas, fire, spoiled nutrients and support oral nutrition.[1] Olfactory disfunction is seen frequently in cancer patients,

these changes attract appetite and affect nutrition status adversely and cause malnutrition.[2,3] Malnutrition occurs in great majority of cancer patients and is one of the most important cause of morbidity and mortality.[4] Thus, it's important to apply appropriate dietary support for cancer patients.

Received: June 22, 2026

Accepted: August 05, 2026

Online: September 10, 2026

Accessible online at:

www.onkder.org

Dr. Hatice ÖNDER

Aydın Şehir Hastanesi,

Radyasyon Onkolojisi Kliniği,

Aydın-Türkiye

E-mail: dr.haticeyildiz@hotmail.com



Olfactory dysfunction can occur as the reason of oncological treatments or mechanical or neurological damages of olfactory sites and metabolic reason as increased salivary urea concentration due to tissue catabolism.[5] The changes in smell sense can occur as change in sensitivity, distorted perception or hallucination.[1,6] Although smell and taste alterations are associated with chemotherapy and head and neck radiotherapy, they have been reported at diagnosis and in palliative phases.[7] In the studies about olfactory dysfunction in cancer patients subjective methods were often used as self reported questionnaires or patients declaration.[8] Studies which used objective methods as sniffin sticks test were limited and contained complicated results.[9]

In our study, we aimed to evaluate olfactory dysfunctions before radiotherapy (RT) in cancer patients, by using objective technique as sniffin sticks test and determine the factors which can affect olfactory functions such as chemotherapy (CT), smoking, chronic disease status, using alcohol and age.

MATERIALS AND METHODS

This study included 48 cancer patients except head and neck region. All patients had locally or locally advanced disease and referred to our department for definitive RT. The patients with head and neck tumor, brain tumor or brain metastases, who had major head and neck trauma or surgery, allergic rhinitis were not included in this study. All patients functions of odor threshold, discrimination and identification were assessed with 'Sniffin Sticks' test before RT. For all test, the same well ventilated and silent room was used. The patients were advised for not to eat or drink something, smoking or chewing gum 15 minutes prior to the test. The sniffin sticks test was performed in three phases. At odor threshold phase, sticks which contains different dilutions of n-butanol were used and the lowest level of odor which patient can specify was determined. For discrimination phase, 16 triplets of odorants were used, every triplets contained two same and one different odorant. Patients were asked to identify different odor and got point as total odor number which they determined truly. Odor identification was assessed by means of 16 common odors, with the patients were asked to identify the odor among four possible answers presented by examiner. Patients got point as right answers number. The overall score is called 'composite threshold-discrimination-identification (TDI) 'score. As TDI scores, the patients olfactory status who had ≤ 16 TDI score was evaluated

as anosmia, 16–30 as hyposmia and >30 normosmia. We determined the olfactory status of patients and investigated the factors which might be related to olfactory dysfunction such as chemotherapy (CT), smoking, chronic disease status, using alcohol and age.

Ethics

This research was approved by the institutional ethic board of the Zonguldak University at 19/12/2018 (No: 2018/24) and conducted according to the ethical principles of the Declaration of Helsinki.

Statistics

Statistical Package for Social Sciences for Windows version 13 (SPSS. Inc. Chicago. IL) was used for all statistical analyses. The descriptive statistics were carried out to calculate the median value, the mean value, the range, the proportion and the standard deviation values. Categorical variables were compared using the Pearson Chi-square test. Continuous variables were compared using independent sample t-test and ANOVA test. The correlations were measured using Spearman's rho correlations. A two-sided p value <0.05 was considered as statistically significant.

RESULTS

This study included 48 patients with a median age of 59 years (30–76 years). The demographical characteristics of patients are presented in Table 1. Odor threshold scores were mean 4.5 (0–15), discrimination scores were mean 9 (4–14), identification scores were mean 9.3 (3–14) and TDI scores were mean 22.8 (9.5–37.8). 27 patients olfactory status (56%) were evaluated as hyposmia, 11 patients (23%) as anosmia and 10 patients (21%) as normal smell functions. The patient related factors which might affect olfactory functions such as smoking, chronic disease status, using alcohol and age were examined with univariate analysis and there was no statistically significant relationship between olfactory functions. With patients who had chemotherapy before RT, statistically significant olfactory dysfunction (hyposmia+anosmia) was determined. 26 of 29 patients (90%) who had chemotherapy, had olfactory dysfunction ($p=0.02$) and 7 of 10 patients (70%) who had normal smell functions had no prior chemotherapy ($p=0.04$) (Fig. 1). As multivariate analysis, increased age (OR:1.33, 95% CI 1.08–1.64; $p=0.007$) and to be treated with chemotherapy (OR:32.95, 95% CI 1.35–801.45; $p=0.032$) were significant factors in terms of olfactory dysfunction.

Table 1 Demographics of patients

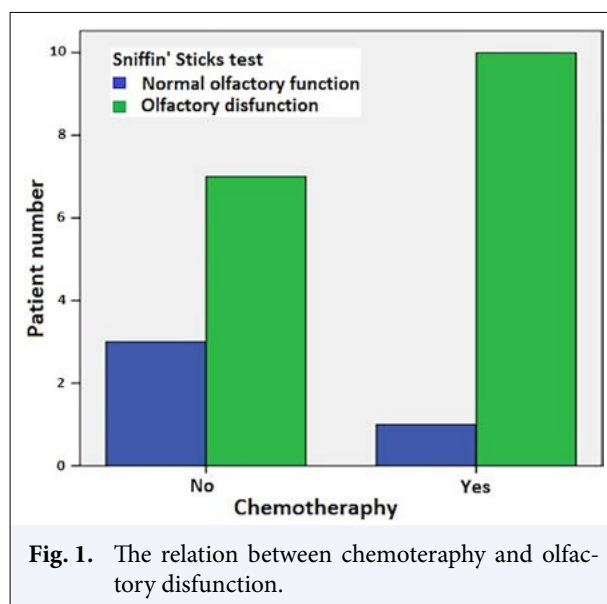
Demographics	n	%
Age, mean	59 (30–76)	
Gender		
Female	29	60.4
Male	19	30.6
HT		
Yes	14	29.2
No	34	70.8
DM		
Yes	9	18.8
No	39	81.2
CT		
Yes	29	60.4
No	19	30.6
Smoking		
Yes	14	29.2
No	34	70.8
Alcohol		
Yes	2	4.2
No	46	95.8

HT: Hypertension; DM: Diabetes mellitus; CT: Chemotherapy.

DISCUSSION

Taste and smell changes frequently occur in oncological patients but patients can not recognize until they reach anosmia levels.[10] The patients are unable to signify these changes and due to the thought of they are not treatable, stuff and patients don't communicate about olfactory symptoms sufficiently.[9] Olfactory dysfunctions are related to taste dysfunctions, decrease to enjoy eating and they may be seen as symptom clusters with dry mouth, weight loss, anorexia and fatigue.[11] To treat one symptom can cure other symptoms.[12] Olfactory dysfunctions affect negatively nutritional status and can cause malnutrition. It's important to determine taste and smell changes for preventing malnutrition.

In this study, 48 patients olfactory functions were evaluated before RT. 27 patients (56%) had hyposmia, 11 patients (23%) had anosmia. Olfactory dysfunction frequency was 79% in our study. As the studies using self reported methods, olfactory dysfunction in oncological patients was seen 5–60% after chemotherapy. As our results, 90% of patients who had chemotherapy had olfactory dysfunction. Objective methods are probably more efficient to assess olfactory functions. There are different results about the relation between



olfactory functions and CT. Riga et al.[10] evaluated the relation between olfactory functions and different CT drugs by using Sniffin Sticks test and they reported that, CT effects olfactory functions adversely even though they did not analyse the difference in CT regime groups. Although studies which searched different CT agents did not find any difference of effect on smell functions,[13] a recent study reported lower smell threshold after CT with 5-FU and capecitabine as compared with cisplatin and carboplatin. [10] Yakirevitch et al.[14] established any olfactory function alterations during CT or 3 weeks after cisplatin-based CT in 21 patients. Conversely, Steinbach et al.[15] reported decrease in TDI scores during carboplatinum+paclitaxel CT in 12 ovarian cancer patients, especially in threshold scores. To parallel this study we determined lower threshold scores as compared with other scores.

Many studies investigated the effect of age, gender and smoking status on smell and taste functions. Most of them reported no relation between smoking and taste and smell changes, while one smaller study disagreed.[16,17] Also, we did not find a significant relation between smoking and olfactory dysfunction.

In general population, taste and smell are affected by age. Steinbach et al.[13] reported more sensitivity to olfactory dysfunction with older patients after CT. Reduction of olfactory receptor cells and their regeneration capacities, mucus secretion and epithelial thickness with older age cause smell changes. [10] According to some studies in elder patients smell changes were more severe after CT.[10,13,18] There

are studies showed that in younger patients olfactory function was affected more severely, it might be due to their higher initial olfactory scores[19] and because of elder patients initial lower olfactory scores the reduction after CT was lesser. In this study, we determined that increased age was significant factor in terms of olfactory disfunction but we did not evaluate the initial olfactory scores before CT.

As literature, 80 % of treatment naive oncological patients had olfactory disfunction[20] and also after localize treatments such as stereotactic body radiation therapy or surgery taste and smell changes could be seen.[7] Olfactory changes in cancer patients can occur by influencing of chemoreceptor sites for mechanical, metabolic and neurological reasons or as the result of oncological treatments. We reported olfactory disfunction with treatment naive patients correspondingly with literature.

Olfactory and taste alterations are frequently observed in patients with cancer and can adversely affect food intake and nutritional status.[21]

CONCLUSION

We reported olfactory disfunction at 79% of patients who were planned definitive radiation therapy. These changes affect nutritional status by reducing appetite and food intake. Furthermore, smell sensation warn us against dangers such as gas, fire and spoiled food. To be aware of these pathologies before and during treatment is important for providing required supportive treatment.

Ethics Committee Approval: The study was approved by the Zonguldak University Ethics Committee (no: 2018/24, date: 19/12/2018).

Informed Consent: Written consent was obtained from the patients.

Conflict of Interest Statement: There is no conflict of interest.

Funding: There is no institutional and financial support.

Use of AI for Writing Assistance: No AI technologies utilized.

Author Contributions: Concept – G.K., M.A.; Design – G.K., H.Ö.; Supervision – H.Ö., E.A.D.; Materials – H.Ö.; Data collection and/or processing – H.Ö., M.A.; Data analysis and/or interpretation – G.K.; Literature search – H.Ö.; Writing – G.K., H.Ö.; Critical review – G.K.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Brisbois TD, Hutton JL, Baracos VE, Wismer WV. Taste and smell abnormalities as an independent cause of failure of food intake in patients with advanced cancer—an argument for the application of sensory science. *J Palliat Care* 2006;22(2):111–4.
2. Epstein JB, Barasch A. Taste disorders in cancer patients: Pathogenesis, and approach to assessment and management. *Oral Oncol* 2010;46(2):77–81.
3. McLaughlin L, Mahon SM. Understanding taste dysfunction in patients with cancer. *Clin J Oncol Nurs* 2012;16(2):171–8.
4. Van Cutsem E, Arends J. The causes and consequences of cancer-associated malnutrition. *Eur J Oncol Nurs* 2005;9(Suppl 2):S51–63.
5. Kamath S, Booth P, Lad TE, Kohrs MB, McGuire WP. Taste thresholds of patients with cancer of the esophagus. *Cancer* 1983;52(2):386–9.
6. Hong JH, Omur-Ozbek P, Stanek BT, Dietrich AM, Duncan SE, Lee YW, et al. Taste and odor abnormalities in cancer patients. *J Support Oncol* 2009;7(2):58–65.
7. Belqaid K, Tishelman C, McGreevy J, Manson-Brahme E, Orrevall Y, Wismer W, et al. A longitudinal study of changing characteristics of self-reported taste and smell alterations in patients treated for lung cancer. *Eur J Oncol Nurs* 2016;21:232–41.
8. Jouslain P, Giboreau A, Fontas M, Laville M, Hummel T, Souquet PJ, et al. Cisplatin chemotherapy induces odor perception changes in bronchial cancer patients. *Lung Cancer* 2013;82(1):168–70.
9. Bernhardson BM, Tishelman C, Rutqvist LE. Chemosensory changes experienced by patients undergoing cancer chemotherapy: A qualitative interview study. *J Pain Symptom Manage* 2007;34(4):403–12.
10. Riga M, Chelis L, Papazi T, Danielides V, Katotomichelakis M, Kakolyris S. Hyposmia: An underestimated and frequent adverse effect of chemotherapy. *Support Care Cancer* 2015;23(10):3053–8.
11. Chen ML, Lin CC. Cancer symptom clusters: A validation study. *J Pain Symptom Manage* 2007;34(6):590–9.
12. Komurcu S, Nelson KA, Walsh D, Donnelly SM, Homsi J, Abdullah O. Common symptoms in advanced cancer. *Semin Oncol* 2000;27(1):24–33.
13. Steinbach S, Hummel T, Böhner C, Berkthold S, Hundt W, Kriner M, et al. Qualitative and quantitative assessment of taste and smell changes in patients undergoing chemotherapy for breast cancer or gynecologic malignancies. *J Clin Oncol* 2009;27(11):1899–905.
14. Yakirevitch A, Talmi YP, Baram Y, Weitzen R, Pfeffer MR. Effects of cisplatin on olfactory function in cancer patients. *Br J Cancer* 2005;92(9):1611–3.
15. Steinbach S, Hundt W, Schmalefeldt B, Böhner C, Bek-

- told S, Wolf P, et al. Effect of platinum-containing chemotherapy on olfactory, gustatory, and hearing function in ovarian cancer patients. *Arch Gynecol Obstet* 2012;286(2):473–80.
16. Konstantinidis I, Chatziavramidis A, Printza A, Metaxas S, Constantinidis J. Effects of smoking on taste: Assessment with contact endoscopy and taste strips. *Laryngoscope* 2010;120(10):1958–63.
17. McGreevy J, Orrevall Y, Belqaid K, Wismer W, Tishelman C, Bernhardson BM. Characteristics of taste and smell alterations reported by patients after starting treatment for lung cancer. *Support Care Cancer* 2014;22(10):2635–44.
18. Haxel BR, Berg S, Boessert P, Mann WJ, Fruth K. Olfaction in chemotherapy for head and neck malignancies. *Auris Nasus Larynx* 2016;43(1):74–8.
19. Eravcı FC, Ucar G, Ozcan KM, Colak M, Ergun Y, Acikgoz Y, et al. The effect of chemotherapy on olfactory function and mucociliary clearance. *Support Care Cancer* 2021;29(3):1635–41.
20. Spotten L, Corish C, Lorton C, Dhuibhir PU, O'Donoghue N, O'Connor B, et al. Subjective taste and smell changes in treatment-naïve people with solid tumours. *Support Care Cancer* 2016;24(7):3201–8.
21. O'Donoghue A, Barrett M, Dhuibhir PU, Kennedy A, O'Leary N, Walsh D. Taste and smell abnormalities in advanced cancer: Negative impact on subjective food intake. *Nutr Clin Pract* 2023;38:807–16.