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Evaluation of smell and taste dysfunctions concurrent otolaryngological symptoms in SARS-CoV-2 positive patients

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Abstract

Olfactory dysfunction can develop at any time interval of the disease, however mostly emerged earlier phases of the COVID-19. In this present study our aim was to evaluate the smell and taste dysfunctions concurrent otolaryngological symptoms in COVID-19 positive patients. We conducted this prospective study at xxxx Training and Research Hospital between December 2020 and January 2021. 197 patients were participated to the study. Patients who had been confirmed as COVID-19 positive by real- time polymerase chain reaction and with taste and /or smell dysfunction symptoms were included. We divided participants into four groups according to their ages. Ages between 18-30 was determined as Group1, 31-40 as Group 2, 41-50 as Group 3, ages 51 and more than as Group 4. A questionnaire was prepared including questions about age, gender, otorhinolaryngological symptoms, chronic illness, previous head injury, smoking, the olfactory and taste dysfunctions during COVID-19. A statistically significant difference was found between smell dysfunction scores and gender ($z= 2.100$; $p = 0.036$). The severity of smell dysfunction was higher in females. Hospitalized patients had higher smell dysfunction onset day than those who were not hospitalized. Both smell and taste dysfunctions were more often and the average duration of both disturbances were high in Group 2. The severity of the smell dysfunction was higher in females and appeared as a later symptom in hospitalized patients and continued longer in patients with nasal obstruction. Taste dysfunction continued longer in patients with nasal obstruction, nasal congestion, and sore throat.

Keywords: Olfactory dysfunctions, gustatory dysfunctions, COVID-19

Introduction

In December 2019, the world began its fight with a new type of corona virus. Called SARS-CoV-2 by the World Health Organization (WHO), the name of the illness caused by this virus is corona virus disease 2019 (COVID-19). In some cases, smell or taste dysfunction can be the initial or even the single symptom of the disease. The Centers for Disease Control and Prevention (CDC) reported that "new loss of taste or smell" can take place within 2 to 14 days of contact [1]. Influenza A virus, herpesviruses, poliovirus, rabies virus, parainfluenza virus, adenoviruses, and Japanese encephalitis virus are all able to use the olfactory nerve as a means of reaching the central nervous system. Olfactory nerve damage caused by SARS-CoV-2 results in anosmia, with hyposmia in the early period of COVID-19. The SARS-CoV-2 virus uses the angiotensin-converting enzyme 2 (the ACE2 receptor) to enter human cells. The ACE2 receptor is widely expressed on the epithelial cells of the oral mucosa. Mucosal epithelial cell damage in the oral cavity explains the ageusia seen in the early period of COVID-19 [2]. Foster's study of the phylogenetic analysis of SARS-CoV-2 genomes found 3 different kinds of genotype of the virus: A, B, and C. Although types A and C are blamed for olfactory dysfunctions in Europe and America, the exact mechanism of the olfactory dysfunction remains unknown [3,4]. Our aim in this present study was to evaluate the smell and taste dysfunctions that are concurrent with the otolaryngological symptoms in COVID-19 positive patients.

Materials and Methods

We conducted this prospective study at Malatya Training and Research Hospital. We obtained ethical approval from the Malatya Ethics Committee and prior permission from the Turkey Ministry of Health (Ethical number 2020/174). We included patients who had been confirmed as COVID-19 positive by real-time polymerase chain reaction (RT-PCR) and with taste and/or smell dysfunction symptoms between December 2020 and January 2021. A total of 197 patients participated in the present study. They all provided their consent to participate. The study questionnaire was prepared to include questions about age, gender, and otorhinolaryngological symptoms, including epistaxis, runny nose, nasal congestion, nasal obstruction, headache, cough, sore throat, sputum, tinnitus, otalgia, additional chronic illness,

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sinusitis, allergy, asthma, chronic obstructive pulmonary disease, cancer, diabetes, sleep apnea, cardiac disease, hypertension, previous head injury, smoking, and smell and taste dysfunctions during COVID-19. The degree of smell disorder (no smell or decreased smell were scored between one and 9 points), the smell dysfunction onset day during COVID-19, whether it improved, whether the olfactory dysfunction improved, and how many days it took were all questioned. The same questions were prepared for taste dysfunctions (0 – normal sense of smell/taste; 10 – no sense of smell/taste) with scores from one to 9 indicating progressively increasing severity of smell and taste dysfunctions. We divided the participants into 4 groups according to their ages. Participants with ages between 18 and 30 were in Group 1. Group 2 included the ages between 31 and 40. Group 3 included ages 41 to 50, and ages 51 and above were in Group 4. We excluded patients who had mental or physical defects, a previous history of nasal, oropharyngeal, or laryngeal surgery, serious neurological deficits, and who used drugs such as sedatives, hypnotics, and anticonvulsants. Patients who were younger than age 18, individuals who did not have any symptoms of taste and smell, and patients in intensive care units or in severe circumstances due to lack of communication were also excluded. We sent the questionnaire (via email, WhatsApp, or face-to-face) to the subjects who tested COVID-19 positive and had at least one symptom of olfactory and/or taste dysfunction at least 21 days after their COVID-19 disease.

Statistical analysis

To show the distribution of the individuals in the answers given to the questions regarding demographics, otolaryngological complaints, chronic illness, and smell and taste dysfunctions, we used number (n) and percentage (%) values. We evaluated both graphically and with the Shapiro-Wilks test to examine the compatibility of continuous variables such as age, the smell and taste dysfunction score, the smell and taste dysfunction onset days, and the duration and improvement of both dysfunctions. Since we determined that none of the continuous variables were compatible with the normal distribution, we used Median (Interquartile Range = IQR) values in the representation of descriptive statistics and Mean ± Standard Deviation values in the descriptive statistics. We used the Mann-Whitney U test to compare 2-group variables such as gender, otolaryngological complaints, chronic illness, smell and taste dysfunction scores, duration, and onset day. To compare smell and taste dysfunction scores, onset day, duration, and the recovery day by age grouping, we used the Kruskal-Wallis non-parametric variance analysis. We provided the Mann-Whitney U test analysis results in paired comparisons. We created cross tables to show the distribution of the individual complaint responses by age grouping—providing chi-square (χ^2) test statistics, number (n), and percentage (%) values. The Spearman's non-parametric correlation coefficient was given in the correlation analysis between age and score, onset day, duration, and the recovery day of the smell and taste dysfunctions. We used the IBM SPSS Statistics 21.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) and MS-Excel 2007 programs for statistical analyses and calculations. We accepted the statistical significance level as $p < 0.05$.

Results

Of the participants, 70.6% (n = 139) were female and 29.4 % (n = 58) were male. Headache was their most common complaint, with 69.0% (Table 1).

Of the individual participants, 97.0% (n = 191) noted smell dysfunction: 77.0% (n = 147) had no sense of smell, 21.5% (n = 41) had hyposmia, and 1.5% (n = 3) expressed parosmia. Regarding taste, 89.3% (n = 176) of the participants reported taste dysfunctions. Of the individuals with taste dysfunctions, 61.9% (n = 109) said, "I had no sense of taste," 29.5% (n = 52) said, "I had hypogeusia," and 8.6% (n = 15) had parageusia. Regarding the question, "Has your smell dysfunction improved?" 71.2% (n = 136) of the participants answered "yes," 19.9% (n = 38) said "no," and 8.9% (n = 17) replied as "partially improved." Regarding the question, "Has your taste dysfunction improved?" 85.7% (n = 150) of the individual participants answered "yes," and 14.3% (n = 25) answered "no." There were 21 individuals with only a smell dysfunction and 6 with only a taste dysfunction. The average age of the participants in the study was 36.47 ± 11.63 years. The minimum participant age was 20.0 years, and the maximum was 75.0. The average smell dysfunction onset day was 3.65 ± 2.26, and the average taste dysfunction onset day was 3.71 ± 2.26. The average duration of smell dysfunction was 33.67 ± 43.46 days; the longest duration of smell dysfunction was 210 days, and the average duration of taste dysfunction was 25.71 ± 42.07. The longest duration of taste disturbance was determined to be 210 days. There was no statistical significance between the age and smell and the taste dysfunction score or the onset day and the duration of both disturbances ($p > 0.05$). The median smell dysfunction score was 10.0 (IQR = 2.0) for the female participants and 9.0 (IQR = 5.0) for the male. A statistically significant difference was found between the smell dysfunction scores of individuals and gender ($z = 2.100$; $p = 0.036$). Participants with a sputum complaint had a median of 3.0 smell dysfunction onset day (IQR = 3.0), and individuals without sputum complaints had a median of 4.0 smell dysfunction onset day (IQR = 5.0). Participants with a sputum complaint had a median of 3.0 smell dysfunction onset day (IQR = 3.0), and individuals without sputum complaints had a median of 4.0 smell dysfunction onset day (IQR = 5.0). A statistically significant difference was found between the smell dysfunction onset day and the sputum complaints ($z = 2.145$; $p = 0.032$). A statistically significant difference was found between the smell dysfunction onset day and the hospitalized patients (a median of 4.0 smell dysfunction onset day [IQR = 5.0], $z = 2.064$; $p = 0.039$). Patients hospitalized during the COVID-19 course had a higher smell dysfunction onset day than those who were not. In our study, smell dysfunction appeared as a later symptom in hospitalized patients. A statistically significant difference was found between the duration of the patients' smell dysfunction and stuffiness ($z = 2.098$; $p = 0.036$). The median value of the duration of the smell dysfunction of the individuals without stuffiness was 14.0 (IQR = 19.2), while the median value of the duration of the smell dysfunction of the patients with stuffiness was 31.5 (IQR = 29.2).

Individuals without headache complaints had a mean of 2.80 ± 1.70, while patients with headache complaints had an average 4.03 ± 2.35 taste dysfunction onset day. A statistically significant difference was found between the taste dysfunction onset day and the status of the headache complaint ($z = 2.919$; $p = 0.004$). Participants with sore throat had a mean 4.13 ± 2.36 taste dysfunction onset day, in comparison, the average value on the without sore throat was 3.25

± 2.08. A statistically significant difference was found between the taste dysfunction onset day and sore throat (z = 2.557; p = 0.011).

The median duration of the taste dysfunctions of the individuals without nasal congestion complaints was 7.0 (IQR = 7.0), and it was 25.5 (IQR = 28.0) with them. Regarding the complaint of nasal congestion, a statistically significant difference was found between the duration of the taste dysfunctions of individuals (z = 2.611; p = 0.007). The median duration of the taste dysfunctions of individuals without nasal obstruction complaints was 7.0 (IQR = 9.0), and it was 25.5 (IQR = 28.0) with them. In comparison, a statistically significant difference was found between the duration of the taste dysfunctions and nasal obstruction (z = 2.699; p = 0.006). The median duration of the taste dysfunctions of the participants without sore throat was 8.5 (IQR = 6.0); with sore throat, the evaluated result was 25.5 (IQR = 26.0). A statistically significant difference was found between the duration of the taste dysfunctions and sore throat (z = 2.083; p = 0.039) (Table 2).

Table 1. Demographics

		n (%)
Gender	**Female**	139 (70.6)
	Male	58 (29.4)
Epistaxis	**No**	192 (97.5)
	Yes	5 (2.5)
Runny nose	**No**	130 (66.0)
	Yes	67 (34.0)
Stuffiness	**No**	94 (47.7)
	Yes	103 (52.3)
Nasal congestion	**No**	104 (52.8)
	Yes	93 (47.2)
Headache	**No**	61 (31.0)
	Yes	136 (69.0)
Cough	**No**	110 (55.8)
	Yes	87 (44.2)
Sore-throat	**No**	98 (49.7)
	Yes	99 (50.3)
Sputum	**No**	142 (72.1)
	Yes	55 (27.9)
Tinnitus	**No**	174 (88.3)
	Yes	23 (11.7)
Smoking	**No**	167 (84.8)
	Yes	30 (15.2)
Sinusitis, Allergy	**No**	142 (72.1)
	Yes	55 (27.9)
Asthma	**No**	188 (95.4)
	Yes	9 (4.6)
COPD	**No**	196 (99.5)
	Yes	1 (0.5)
Diabetes	**No**	189 (95.9)
	Yes	8 (4.1)
Apnea	**No**	196 (99.5)
	Yes	1 (0.5)
Heart Disease	**No**	188 (95.4)
	Yes	9 (4.6)
Hypertension	**No**	186 (94.4)
	Yes	11 (5.6)

Table 3 provides a summary of the distributions of the smell and taste dysfunctions by age group. Table 4 shows the comparisons of the smell and taste dysfunctions between the age groups. We found a statistically significant difference between the age groups in terms of the duration of the smell dysfunction (χ^2 = 10.167; p = 0.017). The median duration of the smell dysfunction in Group 1 was 10.0 (IQR = 23.0); it was 33.0 (IQR = 47.0) in Group 2, and 11.5 (IQR = 7.2) in Group 3. We found a statistically significant difference between Groups 2 and 3 in terms of the duration of the smell dysfunction (p = 0.017).

The durations of the smell and taste dysfunction improvement day between the age groups are shown in Table 5. A statistically significant difference was found between Group 4 – Group 1 and Group 1 – Group 2 in terms of the days of improvement in taste dysfunction (p = 0.018; p = 0.001). Table 6 provides the distribution of the responses given to the complaints according to age group. We found a statistically significant difference in the comparison of the runny nose, nasal congestion, nasal obstruction, sore throat, sputum, tinnitus, and otalgia complaints and the age group of the participants (χ^2 = 16.502; p = 0.001).

Table 2. Comparison of individuals in the specified variable groups with duration of taste dysfunction

		Duration of Taste Dysfunction		Test Statistic	
		Mean±Std	Median (IQR)	Z	p
Gender	**Female**	27.35±45.52	11.5 (25.0)	z=0.272	0.794
	Male	17.50±18.43	9.0 (30.0)		
Epistaxis	**No**	25.71±42.07	11.0 (25.0)	*	*
	Yes	N/A	N/A		
Runny nose	**No**	25.00±47.67	10.5 (18.0)	z=1.470	0.156
	Yes	27.83±20.25	25.5 (33.0)		
Stuffiness	**No**	9.20±6.37	7.0 (9.0)	z=2.699	0.006
	Yes	37.50±52.39	25.5 (28.0)		
Nasal congestion	**No**	9.40±6.22	7.0 (7.0)	z=2.611	0.007
	Yes	37.36±52.48	25.5 (28.0)		
Headache	**No**	10.43±7.04	7.0 (11.0)	z=1.655	0.099
	Yes	32.00±48.81	12.0 (26.0)		
Cough	**No**	11.14±6.59	10.0 (12.0)	z=1.273	0.209
	Yes	31.71±48.96	12.0 (27.0)		
Sore throat	**No**	12.00±11.56	8.5 (6.0)	z=2.083	0.039
	Yes	39.42±56.19	25.5 (26.0)		
Sputum	**No**	27.35±48.70	11.0 (25.0)	z=0.382	0.710
	Yes	21.71±20.86	10.0 (27.0)		
Tinnitus	**No**	25.52±43.01	11.0 (26.0)	z=0.796	0.583
	Yes	N/A	N/A		
Otalgia	**No**	25.52±43.01	11.0 (26.0)	z=0.796	0.583
	Yes	N/A	N/A		

(IQR) : interquartile range

Table 3. Distribution of smell and taste dysfunctions in age groups

	Age Groups			
	Group 1 n (%)	Group 2 n (%)	Group 3 n (%)	Group 4 n (%)
SD				
No	0 (0.0)	4 (66.7)	0 (0.0)	2 (33.3)
Yes	65 (34.0)	69 (36.1)	37 (19.4)	20 (10.5)
TD				
No	7 (33.4)	10 (47.6)	2 (9.5)	2 (9.5)
Yes	58 (33.0)	63 (35.8)	35 (19.8)	20 (11.4)

SD:smell dysfunction TD:taste dysfunctio

Table 4. Comparison of smell and taste dysfunctions between age groups

	Group 1 Mean±Std Median (IQR)	Group 2 Mean±Std Median (IQR)	Group 3 Mean±Std Median (IQR)	Group 4 Mean±Std Median (IQR)	Test Statistic	
					χ^2	p
SD score	8.05±2.30 9.0 (3.0)	8.87±2.01 10.0 (2.0)	8.76±1.89 10.0 (2.0)	7.95±2.44 9.5 (4.0)	χ^2=7.517	0.057
SD Duration	17.90±14.37 10.0 (23.0)	45.69±51.66 33.0 (47.0)	12.80±5.67 11.5 (7.2)	N/A N/A	χ^2=10.167	0.017
SD improvement day	13.02±12.99 10.0 (7.0)	13.86±6.59 13.0 (12.0)	14.48±9.66 11.0 (14.0)	11.79±3.29 11.0 (5.0)	χ^2=4.036	0.258
TD score	7.53±2.43 8.0 (5.0)	7.98±2.24 9.0 (4.0)	8.51±2.06 10.0 (3.0)	7.90±2.38 8.5 (4.0)	χ^2=5.207	0.157
TD Duration	14.25±14.34 10.0 (25.0)	35.79±53.02 21.5 (29.0)	9.83±4.26 8.0 (6.0)	N/A N/A	χ^2=2.324	0.313
TD improvement day	9.73±4.71 8.0 (6.0)	18.02±18.96 13.0 (10.2)	13.03±8.72 9.0 (13.0)	12.65±4.43 10.5 (8.0)	χ^2=13.395	0.004

χ^2=Kruskal Wallis Test statistic (IQR) : interquartile range SD:smell dysfunction TD:taste dysfunction

Table 5. Comparison of duration of smell dysfunction and taste dysfunction improvement day between age groups

SD Duration	p	TD Recovery Day	p
Group 4- Group 3	0.318	**Group 4- Group 3**	0.315
Group 4- Group 1	0.239	**Group 4- Group 1**	0.018
Group 4- Group 2	0.060	**Group 4- Group 2**	0.827
Group 3- Group 1	0.675	**Group 3- Group 1**	0.160
Group 3- Group 2	0.017	**Group 3- Group 2**	0.136
Group 1- Group 2	0.061	**Group 1- Group 2**	0.001

SD:smell dysfunction TD:taste dysfunction

Table 6. Distribution of the responses given to the complaints according to the age groups of the individuals

	Age Groups				Test Statistic	
	Group 1 n (%)	**Group 2 n (%)**	**Group 3 n (%)**	**Group 4 n (%)**	χ^2	**p**
Epistaxis						
No	62 (32.3)	73 (38.0)	36 (18.8)	21 (10.9)	*	*
Yes	3 (60.0)	0 (0.0)	1 (20.0)	1 (20.0)		
Runny nose						
No	33 (25.4)	57 (43.8)	29 (22.3)	11 (8.5)	16.502	0.001
Yes	32 (47.8)	16 (23.9)	8 (11.9)	11 (16.4)		
Stuffiness						
No	28 (29.8)	34 (36.2)	24 (25.5)	8 (8.5)	6.097	0.107
Yes	37 (35.9)	39 (37.9)	13 (12.6)	14 (13.6)		
Nasal congestion						
No	27 (26.0)	37 (35.6)	27 (26.0)	13 (12.5)	9.830	0.020
Yes	38 (40.9)	36 (38.7)	10 (10.8)	9 (9.7)		
Headache						
No	17 (27.9)	22 (36.1)	16 (26.2)	6 (9.8)	3.477	0.324
Yes	48 (35.3)	51 (37.5)	21 (15.4)	16 (11.8)		
Cough						
No	39 (35.5)	44 (40.0)	18 (16.4)	9 (8.2)	3.803	0.284
Yes	26 (29.9)	29 (33.3)	19 (21.8)	13 (14.9)		
Sore throat						
No	26 (26.5)	41 (41.8)	25 (25.5)	6 (6.1)	12.818	0.005
Yes	39 (39.4)	32 (32.3)	12 (12.1)	16 (16.2)		
Sputum						
No	42 (29.6)	58 (40.8)	32 (22.5)	10 (7.0)	15.337	0.002
Yes	23 (41.8)	15 (27.3)	5 (9.1)	12 (21.8)		
Tinnitus						
No	55 (31.6)	68 (39.1)	35 (20.1)	16 (9.2)	9.117	0.028
Yes	10 (43.5)	5 (21.7)	2 (8.7)	6 (26.1)		
Otalgia						
No	53 (31.0)	64 (37.4)	37 (21.6)	17 (9.9)	8.990	0.029
Yes	12 (46.2)	9 (34.6)	0 (0.0)	5 (19.2)		

χ^2: Chi-square Test Statistics * Since the number of subjects is insufficient, the test result cannot be given

Discussion

It is known that upper respiratory tract infections may cause smell impairments, often hyposmia. Direct viral exposure of the chemosensory system may result in smell impairments. Upper respiratory tract infections are a known cause of smell impairments. The upper respiratory tract is the first entry gate of the virus [5]. However, there is insufficient knowledge regarding the mechanism of smell and taste impairment in COVID-19. There are currently 2 theories about the mechanism. One theory is the detriment of the olfactory epithelium by the virus via angiotensin converting enzyme 2 receptors, the cell entry instrument of the virus, and the second is the direct invasion of the olfactory bulb cells. It appears that epithelial damage heals faster and the patients "sense of smell and taste recover rapidly for the first theory" [6]. The authors showed that the virus antigen was first determined

at 60 to 66 hours post-infection and that the olfactory bulb was overloaded with virus. The cortex, basal ganglia, and midbrain, which are close to the olfactory bulb, were also infected [7].

In their study, Vaira et al. [8] reported that 34% of the patients had smell impairment, and 19% had both taste and smell disorders. In their study, Korkmaz et al. [5] found that the loss of smell and taste were the most common otolaryngological symptoms and that the incidence and severity of the symptoms were higher in the under 60 age group.

Of the participants in our study, 97.0% (n = 191) noted smell dysfunction and 77.0% (n = 147) had no sense of smell. In addition, 89.3% (n = 176) of the participants had taste dysfunctions, and a large part of them, 61.9% (n = 109), had no sense of taste. The most common complaint of participants was headache with 69.0 %.

A study in Wuhan, China, showed that 5.1% of hospitalized COVID-19 patients experienced smell changes [9]. In contrast, a study from Europe pointed out that 85.6% of the patients had sudden mild to moderate olfactory dysfunctions,while a study in Iran reported that a very high percentage, 98% had OD in their COVID-19 patients [7,10]. In their large series of COVID-19 positive patients, Lee et al. [2] found the incidence of anosmia or ageusia as 15%. The symptoms were more common among females and younger patients. In our study, the predominance of participants, 70.6% (n = 139), were female. The median smell dysfunction score was 10.0 (IQR = 2.0) for females and 9.0 (IQR = 5.0) for males. A statistically significant difference was found between the smell dysfunction scores of individuals and gender (z = 2.100; p = 0.036). Similar to the Lee et al. [2] study, we found that the severity of the smell dysfunction was higher in younger females.

In a 417-patient multicenter study in Europe, the subjects declared smell impairment at 85.6% and taste impairment at 88%; anosmia was reported as the initial symptom in 11.8% of these patients [7]. Speth et al. [11] found that the prevalence of olfactory dysfunctions was 61.2% and the average beginning day was 3.4 after the symptoms of COVID-19 first occurred; 8.7% of these patients stated that smell dysfunction appeared on the first day of their COVID-19 diagnosis. Smell dysfunction was the single complaint on the first day of their illness in 2.9% of the patients. These authors found a 30 to 50% incidence of nasal obstruction or rhinorrhea complaints in their patients and that the incidence of smell dysfunction was low in older age and higher in female patients.

Similar to the literature, in our study, the average smell dysfunction onset day was 3.6, and the average taste dysfunction onset day was 3.7. The mean duration of smell dysfunction was 33.67 days; the longest duration of smell dysfunction was 210 days, and the average duration of taste dysfunction was 25.7 days. The longest duration of taste disturbance was determined to be 210 days for one patient; 71.2% of the patients' smell dysfunctions and 85.7% of the participants' taste dysfunctions improved completely. In our study, the severity of both smell and taste dysfunctions were high in younger females, as compared with the older patients.

A significant number of viruses may cause olfactory impairment via an inflammatory process that takes place in the nasal mucosa and results in rhinorrhea, such as rhinovirus, parainfluenza, and Epstein-Barr virus. SARS-CoV-2 may cause olfactory dysfunctions that are not associated with rhinorrhea. Lechien et al. [12] found that approximately 79.7% of the patients had hyposmia or anosmia, without nasal obstruction and/or rhinorrhea. Yan et al. [13] reported their respondents as consisting of a relatively mild subset of COVID-19. However, according to hospital-based studies, chemosensory loss due to COVID-19 is low. They explained the difference by the possibility of more pulmonary-centric viral infection of patients requiring hospitalization; however, ambulatory cases had nasal-centric viral spread. Anosmia complaints were most common in mild COVID-19 outpatients not requiring hospitalization, according to studies in the literature [7,12,14-17]. We observed that the patients hospitalized during the COVID-19 course had a higher smell dysfunction onset day than those who were not hospitalized (z = 2.064; p = 0.039). Similar to hospital-based studies in the literature, smell dysfunction appeared as a later symptom in the hospitalized patients in our study.

Early determination and establishment of quarantine conditions is critical way to prevent the rapid spread of the SARS-CoV-2.Loss of smell and/or taste may be the initial and/or the single symptom in some patients. This makes early detection of infected patients difficult [18]. No exact pharmacological agent exists for post-viral loss of smell, which is also true for COVID-19. Olfactory training is the most important evidence-based therapeutic method for post-viral loss of smell. Numerous studies in the literature reported that the loss of taste takes place with a similar incidence as the loss of smell, which causes doubt regarding the difference between the loss of smell and taste and the loss of real taste perceptions [19].

Apart from the smell dysfunction in COVID-19 patients, Song et al. [20] maintained that the loss of taste was more frequent (21%) than the loss of smell (11%) in hospitalized patients. The loss of taste rarely occurs as a sole symptom without the loss of smell in COVID-19. Klopfenstein et al. [21] reported only one patient with dysgeusia without anosmia in their study While there were 21 individuals with only a smell dysfunction, and 6 with only a taste dysfunction, none of the patients in our study received any additional treatment for the taste or smell disturbance.

In our study, we observed that the taste dysfunction started later in patients with headache and sore throat symptoms (p = 0.004; p = 0.011). In detailed analyses of the duration of the taste dysfunction and the otolaryngological symptoms, we found that the taste dysfunction continued longer than in patients with nasal obstruction (p = 0.006), nasal congestion (p = 0.007), and sore throat symptoms (p = 0.039). Most of the patients with runny nose, nasal congestion, nasal obstruction, sore throat, sputum, tinnitus, and otalgia were in Group 1, with ages between 18 and 30 (p = 0.001).

Gorzkowski et al.[22] found that 61.14% of the COVID-19 positive patients in their study showed a loss of the sense of smell, and they reported that the patients who did not have nasal obstruction showed more improvement in the sense of smell than the patients who had nasal obstruction symptom. Gorzkowski et al.[22] maintained that nasal congestion or sore/dry/tingling in the nose were associated with the olfactory recovery level. Blaming the nasal mucosal edema and olfactory epithelial damage

for the olfactory dysfunctions in COVID-19, they evaluated these symptoms as an indicator of a poor prognostic factor for the complete recovery of the sense of smell. They showed that approximately 95% of the patients had improved incompletely to completely in their sense of smell at the one-month period. In our study, we found that 71.2% of the patients' smell dysfunction and 85.7% of their taste dysfunction had improved in an average of 33 days. Similar to the findings of Gorzkowski et al. [22] the median value of the duration of the smell dysfunction of individuals with nasal obstruction was 14.0 (IQR = 19.2), and it was 31.5 (IQR = 29.2) without nasal obstruction symptom. There was a statistically significant difference ($z = 2.098$; $p = 0.036$). The duration of the smell dysfunction was longer with nasal obstruction symptom.

Olfactory dysfunctions influence the quality of life negatively. Olfactory reeducation can be recommended to take advantage of the regeneration feature of the olfactory nerve [4].

In conclusion, we found that the severity of the smell dysfunction was higher in females. Smell dysfunction appeared as a later symptom in hospitalized patients. It continued longer than in patients with nasal obstruction, and the taste dysfunction started later in patients with headache and sore throat symptoms. We concluded that the taste dysfunction continued longer for patients with nasal obstruction, nasal congestion, and sore throat symptoms. Since our study only includes patients with smell and /or taste dysfunctions during their COVID-19 course, our main goal is to determine the severity of these two dysfunctions and their relationship with other otolaryngological complaints and concurrent chronic diseases rather than the frequency of the smell and / or taste disorders in COVID-19.

This study should be continued and strengthened by following the patients whose smell and taste disorders have not improved yet.

Conflict of interests
The authors declare that they have no competing interests.

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Ethical approval
The study was conducted after obtaining approval of the Ministry of Health in Turkey and approval of the ethics committee in Malatya Clinical Research Ethics (Ethical number 2020/174).

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