THE EFFECT OF STARTING A MEAL WITH SALT AND DATE PALM ON TASTE IMPAIRMENT CAUSED BY COVID-19

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Background and purpose – This study was conducted to examine the effect of starting a meal with salt and date palm on the sense of taste in COVID-19 patients.
Methods – This study was conducted using a randomized controlled method. Patient and disease information forms and Visual Analog Scale were used for data collection. Salt and date palm were used to stimulate the sense of taste in two different experimental groups. No procedure was made in the control group except for the practice of the clinic. The results were analyzed using SPSS version 25.
Results – The mean ages of all groups were between 43.42 ± 8.60 and 47.22 ± 12.04 years. Fever, sore throat, dry mouth, cough, muscle weakness, and similar symptoms were present in all groups. Significant improvements were found in patients with hypoageusia and ageusia after date palm and salt application ($p<0.01$).
Conclusion – For taste impairment caused by COVID-19, consumption of date palm and tasting very little salt for therapeutic purposes may help to alleviate taste impairment. Based on the data obtained from this study, the pathophysiology of the effects of date palm and salt on taste complications should be investigated.

Keywords: *ageusia, COVID-19, date palm, salt, taste impairment*

A DATOLYA- ÉS SÓTARTALMÚ DIÉTA HATÁSA A COVID-19 KÖVETKEZTÉBEN KIALAKULT ÍZÉRZÉKELÉSI ZAVAROKRA
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Háttér és cél – Ezt a vizsgálatot azért végezték, hogy megvizsgálják a só- és datolyafogyasztás hatását Covid-19-betegek ízérzékelésére.
Módszerek – Ezt a vizsgálatot randomizált, kontrollált módszerrel végezték. Az adatgyűjtéshez beteg- és betegséginformációs rlapokat, valamint vizuális analóg skálát használtak. Két különböző kísérleti csoportban sót és datolyát használtak az ízérzékelés stimulálására. A kontrollcsoportban a klinikai betegellátás gyakorlatán kívül más eljárást nem végeztek. Az eredményeket az SPSS 25-ös verziójával elemezték.
Eredmények – Minden csoport átlagéletkora 43,42 ± 8,60 és 47,22 ± 12,04 év között volt. Láz, torokfájás, szájszárazság, köhögés, izomgyengeség és hasonló tünetek minden csoportban jelen voltak. A hypoageusia és az ageusia a datolya és a só alkalmazása után szignifikánsan javult ($p < 0,01$).
Következtetés – Covid-19 okozta ízérzékelési károsodás esetén a datolya és nagyon kevés só terápiás célú fogyasztása segíthet az ízérzés javításában. A tanulmány eredménye arra utal, hogy meg kell vizsgálni a datolya- és a sófogyasztás ízérzékelési komplikációkra gyakorolt hatásának patofiziológiáját.

Kulcsszavak: *ageusia, Covid-19, datolyapálma, só, ízkárosodás*

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There are two chemosensors that control salt intake in humans. The first mechanism of these is when the extracellular sodium concentration decreases and this sodium loss is felt with the Renin-Angiotensin-Aldosterone System (RAAS); the result is the need for salty taste in the sense of taste in order to ensure the stability of blood pressure[1, 2]. In this system, there is a tendency to eat foods with low to moderate sodium concentrations[3].

Angiotensin Converting Enzyme (ACE) provides the conversion from angiotensin I to angiotensin II. However, it is known that there are non-ACE pathways and angiotensin II formation continues in tissues despite the use of ACE inhibitors[4]. Additionally, both ACE and angiotensin receptors have effects on plasma renin activity.

Peripheral nerve involvement is common in COVID-19 patients. In the nasal cavity, which is the entrance gate of respiratory viruses, there are three types of mucosa: squamous, respiratory, and olfactory mucosa. The ACE-2 receptor is expressed especially in the olfactory mucosa[5]. The entry of COVID-19 into the cell is through ACE-2 receptors. The virus attaches to the ACE-2 receptor and replicates. ACE-2 receptors are more concentrated in the tongue than in the buccal and gingival mucosa. The virus binds to the receptor, enters the cell, replicates, and causes local inflammation. There are several studies that show that the coronavirus infection results in the loss of the sense of taste[6]. In the literature reviews, it have been reported that the loss of taste varies between 3.4% and 49.8% of COVID-19 patients[7, 8].

The second chemosensory pathway that controls salt intake in humans is the rejection of salt intake behavior in the body with hyperosmotic salt intake, which would challenge the osmolality of the extracellular fluid[1]. Two chemosensors that control sodium intake and withdrawal behaviors constitute two mechanisms that control salt intake into our body. Oral salt supplementation is dissolved by saliva and contacts the taste buds. In this process, taste signals create an action potential towards the brain and sensory transmission is provided through synapses[9, 10].

The perception of salt taste begins with the activation of sodium channels on taste receptors by sodium, and the resulting signals are transmitted to the taste sensation center in the brain[11, 12]. At low sodium concentrations, the incoming signal can be very weak and the difference with a similar sodium-free solution may not be noticeable. As the sodium concentration increases, the resulting signal increases and the body is able to distinguish sodium containing solutions from those that do not[1]. This suggests that sodium may have a stimulating effect on the sense of taste.

Date palm plant, which is part of both Christian and Islamic culture in the Middle East and North Africa, is known for its rich nutrient content. In Muslim culture[13, 14], the evening meal starts with date palm after fasting for hours during the holy month of Ramadan. It is thought that the sodium content of date palm, although not salty in taste, has a stimulating effect on the sense of taste. Therefore, both date palm and salt are likely to be effective in eliminating alkaline taste and deterioration in taste. In this randomized controlled study, the aim was to examine the effect of starting a meal with salt and date palm on the sense of taste in COVID-19 patients.

Materials and methods

RESEARCH DESIGN AND PARTICIPANTS

This study was carried out in randomized controlled manner in Adıyaman Training and Research Hospital COVID-19 Clinic between 2-11 December 2020. The population of the study was the patients treated in the COVID-19 clinic. The research sample was calculated as 40 patients for each group, at 0.05 margin of error and 95% confidence interval, after the power analysis. It was completed using the stratified sampling and simple random method for each group with patients who met the inclusion criteria and accepted the study (n=120) **(Figure 1)**. The data were collected by the researcher using face-to-face interviews in the patient rooms. During data collection, all isolation, social distance, use of N95 masks and protective measures were taken.

Inclusion criteria were as follows: i. A positive COVID-19 Test and therefore being treated, ii. 18 years old or older, iii. No communication problem and/or no psychiatric illness, iv. Agree to participate in the research, v. No hypertension, renal failure, and/or salt intake problems, vi. No diabetes, vii. Not smoking. Exclusion Criteria were as follows: i. Negative COVID-19 Test, ii. Hypertension, cardiovascular, and/or renal problems, iii. Normal sense of taste, iv. Not volunteering to participate in research, v. Under the age of 18, vi. Diabetes patients, vii. Smokers.

DATA COLLECTION TOOLS

Patient and Disease Information Forms and Visual Analog Scale (VAS), which were created by scanning the literature and obtaining expert opinion, were used as data collection tools in the study. Information on Data Collection Tools is listed below.

Patient and Disease Information Form

In the first part of the form, there are questions asking patients' sociodemographic information such as age, gender, occupation, and marital status. In the second part, there are items that question the symptoms and current problems of COVID-19.

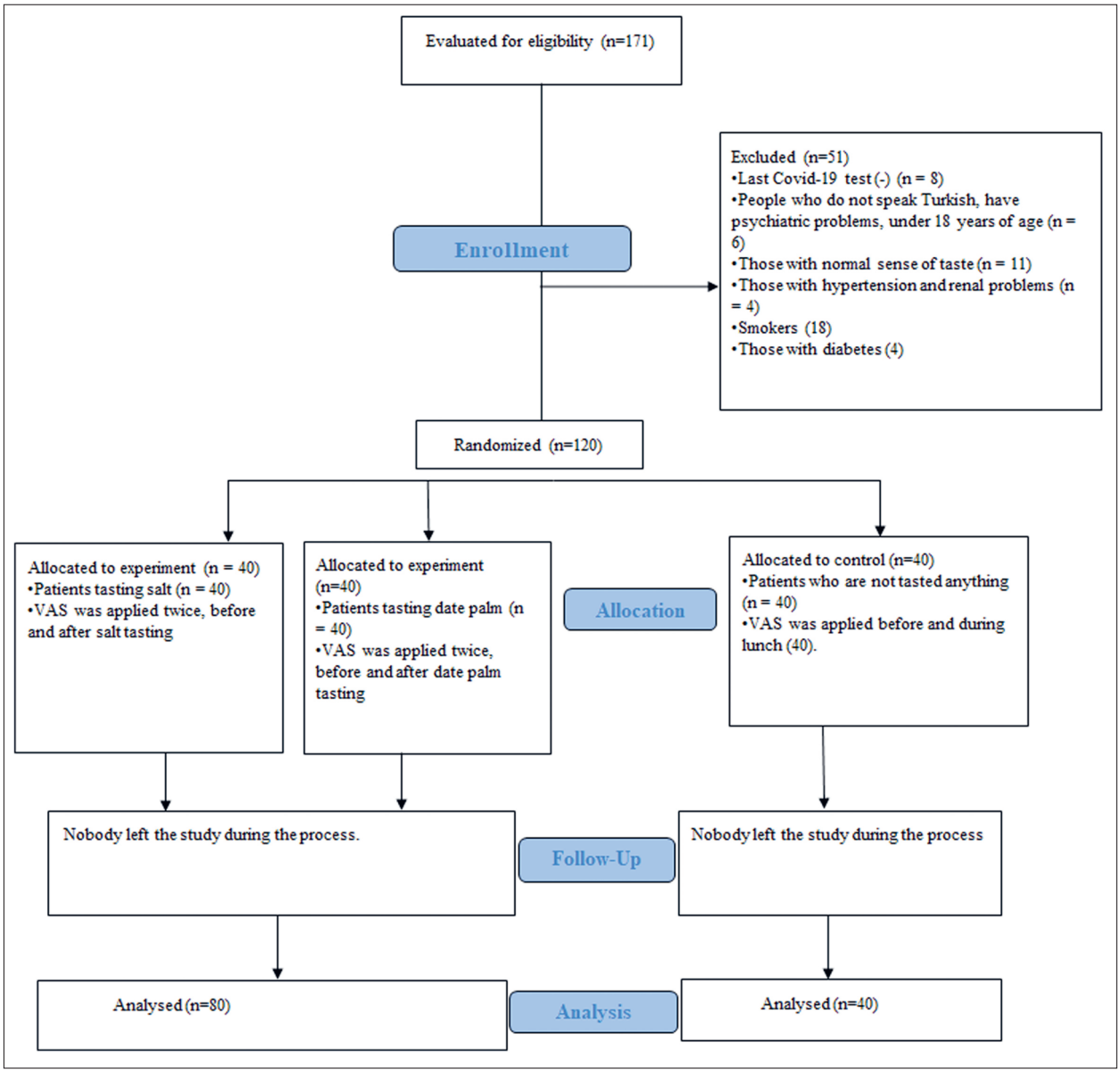

Figure 1. *Sample Group and Patient Selection Diagram*

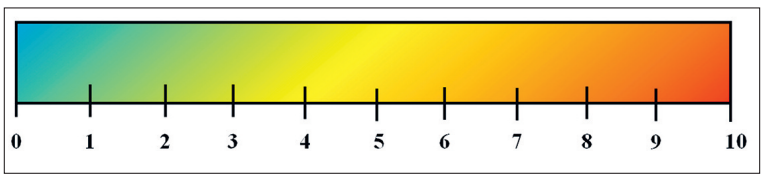

Figure 2. *Visual Analog Scale*

Visual Analog Scale

VAS is a scale that subjective scoring for taste that was used to the method to determine the level of taste sensation impairment. For example, it is applied respectively as interpreting sweet, salty, sour taste, bitter, and gives points to the ability to taste. The scale consists of one 10 cm continuous horizontal line. The participant chose the most suitable point for himself/herself following the tasting process to evaluate his/her sense of taste. The measurement in millimeters from the last point of the line to the marked place is determined as follows with VAS **(Figure 1)**[15]. Choices for VAS to taste are classified as follows: i. Almost no taste (0), ii. Light taste (1-3), iii. Moderate taste (4-5), iv. Good taste (6-7), v. Very good taste (8-9), vi. Excellent taste (10).

Table 1. *Distribution of patients by sociodemographic characteristics and COVID-19 symptoms (n = 120)*

Variables	Control n=40	First experiment n=40	Second experiment n=40	Test of significance
Age (years)	47.22±12.04 (Range 24-66)	43.57±10.82 (Range 26-65)	43.42±8.60 (Range 25-65)	χ^2=1.600 p=0.741 t=1.478
Gender				
Female	21 (52.5%)	21 (52.5%)	19 (47.5%)	χ^2= 3.201 p=0.074
Male	19 (47.5%)	19 (47.5%)	21 (52.5%)	
Days after onset of COVID-19 symptoms	6.27±2.58 (Range 3-14)	5.95±2.24 (Range 3-14)	5.75±1.72 (Range 3-11)	χ^2=35.603 p=0.92 t=44.137
Days after a positive swab COVID-19 Symptoms	5.02±2.29 (Range 2-11)	4.95±2.24 (Range 2-13)	5.02±1.59 (Range 1-10)	χ^2=29.700 p=0.126 t=1.978
Fever	20 (50%)	19 (47.5%)	20 (50%)	χ^2=1.133 p=0.933
Cough	13 (32.5%)	14 (35%)	17 (42.5%)	χ^2=1.833 p=0.40
Dry mouth	10 (25%)	11 (27.5%)	8 (20%)	χ^2=1.584 p=1.453
Nasal congestion	14 (35%)	21 (52.5%)	17 (42.5%)	χ^2=3.727 p=0.15
Nose bleeding	12 (30%)	13 (32.5%)	7 (17.5%)	χ^2=6.585 p=0.37
Throat ache	18 (45%)	19 (47.5%)	19 (47.5%)	χ^2=1.684 p=0.710
Tearing	14 (35%)	12 (30%)	21 (52.5%)	χ^2=10.958 p=0.086
GIS symptoms	9 (22.5%)	8 (20%)	10 (25%)	χ^2=1.284 p=0.807
Pneumonia	8 (20%)	7 (17.5%)	7 (17.5%)	χ^2=1.142 p=0.932
Muscle weakness	22 (55%)	16 (40%)	25 (62.5%)	χ^2=3.004 p=0.083
Neurological symptoms	19 (47.5%)	11 (27.5%)	18 (45%)	χ^2=7.405 p=0.55
KVC symptoms	9 (22.5%)	13 (3.5%)	9 (22.5%)	χ^2=2.784 p=.249
Chemosensory dysfunction				
Odor and taste disorders	22 (55%)	9 (22.5%)	22 (55%)	χ^2=2.275 p=0.131
Taste disturbances only	18 (45%)	31 (77.5%)	18 (45%)	χ^2=1.214 p=0.561
Total	40(100%)	40 (100%)	40 (100%)	
Chemosensory disorder				
Yes	16 (40%)	15 (37.5%)	17 (42.5%)	χ^2=1.907 p=0.16

As an application; date palm was used in first experimental group and salt in second experimental group.χ^2: Chi Square test

PROCEDURE

In this study, three groups (two experimental and one control group) were formed with patients diagnosed with COVID-19. In the first place, VAS was applied to all groups in order to determine the subjective taste perception levels and the disease information form before one hour to lunch. The eyes of the patients were covered with a black bandage. Later sweet (strawberry juice), salty (cracker, bread), sour (lemon) and bitter (coffee) tastes were tested.

In the hospital where the study was conducted, breathing exercises and nasal irrigation with 0.9% isotonic sodium chloride ($NaCl_2$) were applied to relieve nasal congestion, nasal dryness, and secretion accumulation in the nose of COVID-19 patients. In order to maintain oral hygiene in patients, tooth brushing was performed in the morning, at noon, and before going to bed. Both experimental and control groups were allowed to do the routine practice in the clinic.

The patients in the first group tasted very little salt on the tip of their forefinger before starting their lunch. The patients in the second group ate one date palm before starting their lunch. No application was made for the patients in the control group, except for the routine practices of the clinic. Patients that wanted to drink water were allowed in all three groups. After 15 minutes, VAS was app-

lied to both experimental and control groups during lunch to determine their taste level for a second time.

STATISTICAL ANALYSIS

All records were transferred to the computer environment. Statistical Packed for the Social Sciences (SPSS) version 25 was used for statistical evaluations. A 95% confidence interval and p-value of less than 0.05 were taken into account in the evaluation of the obtained results. The general and clinical characteristics of the patients were analyzed by number, percentage, and arithmetic mean and Chi-square test were used to determine the differences between groups. Paired samples t-test and pearson correlation test were used to evaluate the difference between the first and second measurements in the control group and between the before and after the application in the experimental group.

ETHICAL ASPECT OF THE RESEARCH

Before starting the study, necessary legal permissions were obtained from Adıyaman Training and Research Hospital Chief Physician and Gaziosmanpa a University Clinical Research Ethics Committee (Decision No: 20-KAEK-272). The volunteer information form was read by the researcher after informing the patients about the study in accordance with the Helsinki declaration. Patients who volunteered to participate in the study were included after obtaining their written consents.

Results

The distribution of patients according to their sociodemographic characteristics and COVID-19 symptoms is shown in **Table 1**. The average age of the control group was 47.22 ± 12.04 and 52.5% were women. The average number of days following the onset of COVID-19 symptoms was 6.27 ± 2.58 and the average number of days after the positive swab was 5.02 ± 2.29. COVID-19 symptoms seen in the control group were fever in 50%, cough in 32.5%, sore throat in 45%, and both smell and taste disturbance in 55%.

In the first experimental group using date palm, the average age was 43.57 ± 10.82, and 52.5 percent were women. The average number of days after the onset of COVID-19 symptoms was 5.95 ± 2.24 and the average number of days after the positive swab was 4.95 ± 2.24. The COVID-19 symptoms observed in the first experimental group were found to be fever in 47.5%, nasal congestion in 52.5%, sore throat in 47.5%, and only taste disturbance in 77.5% without smell disorder. In the second experimental group using salt only, the average age was 43.42 ± 8.60, 47.5% were women, the average number of days after the onset of COVID-19 symptoms was 5.75 ± 1.72, and the average number of days after positive swab was 5.02 ± 1.59. The symptoms of COVID-19 seen in the second experimental group were fever in 50%, nasal congestion in 42.5%, muscle weakness in 62.5%, and chemosensory disorder in 42.5%. The VAS values of the control and experimental groups are shown in **Table 2**. 77.5% of the first experimental group had minimal taste sense and 22.5% of them could not taste at all based on the VAS measurement before lunch. In addition to the routine oral and nasal care of the clinic, they were allowed to eat date palm. This group continued their lunch after eating date palm and VAS was applied to this group again. At the last measurement, percentage of those with mild taste levels decreased to 2.5% and 67.5% of the first experimental group had increased taste levels. In the statistical analysis the difference was found to be statistically significant ($p<0.01$).

In the second experimental group, 15% of the patients could not taste at all and 85% had mild taste levels in the measurement before lunch. After the first measurement, the patients were asked to lick the iodized salt with the tip of their wet forefinger and distribute the salt to their mouth. Afterwards, this second group continued with lunch and VAS was applied to this group again later. It was determined that 67.5% of the second experimental group could taste very well after the application; the difference between the measurements was statistically significant ($p<0.01$). There was no significant change after the first and last measurement in the control group, which did not undergo any application other than the routine practice of the clinic.

Discussion

It has been reported that some patients who experience loss of taste and smell due to COVID-19 experience improvement after 4 weeks. Those patients who were not able to regain their sense of smell and taste during this period were found to have severely damaged olfactory neuroepithelium[16]. In our study, the average number of days following the onset of COVID-19 symptoms ranged from 5.75 ± 1.72 to 6.27 ± 2.58. Therefore, the improvement of

Table 2. *Comparison of VAS test results before and after application in control and experimental groups (n = 120)*

Variables	Control group (n=40)		First Experimental group (n=40)		Second Experimental Group (n=40)	
VAS Test	Taste	n (%)	Taste	n (%)	Taste	n (%)
Pretest	No	10 (25%)	No	9 (22.5%)	No	6 (15%)
	Light	30 (75%)	Light	31 (77.5%)	Light	34 (85%)
Posttest	No	8 (20%)	Light	1 (2.5%)	Light	-
	Light	32 (80%)	Middle	2 (5%)	Middle	-
			Good	9 (22.5%)	Good	12 (30%)
			Very good	27 (67.5%)	Very good	27 (67.5%)
			Excellent	1 (2.5%)	Excellent	1 (2.5%)
Paired sample t test	t=-1.433 p=0.16		t=-20.185 p=0.000**		t=-32.280 p=0.000**	
Independent sample t test	t=10.817 p=0.71 d=0.42		t=11.590 p=0.000** d=0.422		t=17.041 p=0.000** d=0.205	
Pearson Correlation	r=0.878 p=0.374		r=0.866 p=0.02*		r=0.145 p=0.025*	

Statistically significant difference *p<0.05, **p<0.01, d=Effect size of intervention. As an application; date palm was used in first experimental group and salt in second experimental group. χ^2: Chi Square test

the sense of taste after date palm and salt application can be associated with the interventions we have implemented.

Loss of taste and smell is not found to be significantly related to gender and age[17]. In a systematic review and meta-analysis of 18 studies involving 3,563 patients, the rate of impairment in the sense of smell or taste in COVID-19 patients was found to be 47%. It was found that the rate of severe and mild-moderate symptomatic patients was 31% and 67%, respectively[18]. It was found that 44.16% of the patients in one control and two experimental groups included in this study had both taste and smell disorders, the others had taste impairment. In our study, no relationship was found between the loss of taste and smell and the sociodemographic data. Our study results support the literature.

It has been suggested that in the pathogenesis of the olfactory dysfunction in COVID-19, it may be secondary to mucosal obstruction of the olfactory cleft[16]. The conduction system may be impaired due to obstruction, resulting in direct sensory loss. In addition to olfactory nerve dysfunction, other factors causing olfactory dysfunction are mucus accumulation or excessive dryness in the nasal cavity, chemosensory involvement, and nasal obstruction[19]. Dry mouth, nasal congestion, and cough symptoms were observed in all groups included in our study.

Taste and smell disorders can be caused by anatomical-pathological and neurological-structural changes[20]. As a matter of fact, olfactory nerve dysfunction experienced in the elderly and people with cognitive disorders can be explained by this[21]. Since this group of diseases is irreversible, it is difficult to correct taste and smell disorders. Although its physiopathology cannot be explained, it is thought that aromatherapy increases sensory stimulation and stimulates the olfactory nerve in elderly patients with dementia and may be relevant as an option in COVID-19 patients[22].

In the first experimental group, 77.5% had minimal taste and 22.5% could not taste at all at the first VAS measurement before lunch. In addition to the routine oral and nasal care of the clinic, they were allowed to eat date palm and continue their lunch after 15 minutes. The VAS was applied to them again and in the last measurement, patients with mild taste level decreased to 2.5%. In addition, 67.5% of them were able to taste very well. The difference was statistically significant (p<0.01).

Antioxidants are of great importance in minimizing and preventing many diseases[23, 24]. Date palm has a rich (65-80%) simple sugar content (i.e., glucose and fructose), fiber content, and essential minerals as well as low fat and protein content. Date palm also has high amounts of phenolic compounds with antioxidant activity and nutritional value[25]. In a previous study, it was determined that methanolic crude extracts in date palm exhibited an antibacterial effect on three gram positive and two gram negative types of bacteria[26]. In the same study, it was determined that phenolic compounds in date palm altered/disrupted the structural and functional properties of microbes within an average of 15 minutes.

In our study, the antioxidant level of the date

palm may have helped to alleviate the taste complications. In addition, methanolic crude extracts in date palm may have a therapeutic effect on taste function as they have an antiviral effect similar to their antibacterial effect.

The action potential of low-salt foods and the message of very salty foods are not the same. High sodium concentration creates a strong signal. Therefore, salt was tasted straight from the mouth without adding anything in our study. This was to help increase sodium channel signals to the brain taste sensation center. It was concluded that olfactory nerve dysfunction could be relieved by strong stimulation.

It is emphasized that people with impaired salt taste perception may have high salt taste perception thresholds and may recognize salt taste only at higher salt intake[27, 28]. This condition is common in individuals with hypertension, diabetes, and smoking[29]. These factors were among the exclusion criteria in our study; the salt perception of COVID-19 patients who were treated with salt was normal before COVID-19 disease. In conclusion, patients with loss of taste following COVID-19 should try starting a meal with salt to intensify their sense of taste ($p<0.05$).

Conclusion

There are many studies in the literature on smell and taste impairment, which is one of the common findings of COVID-19. However, the number of interventional studies is limited. In our study, two nutritional products that can stimulate the dysfunctional sense of taste were used and pleasing results were obtained. Accordingly, consumption of date palm and salt for therapeutic purposes can relieve taste impairment in COVID-19 patients. We believe that salt tasting increases nerve stimulation. However, we are of the opinion that there is a different mechanism in date palm. This mechanism may be due to the antioxidant/antiviral effect of date palm, which has been reported in the literature from previous research. Future studies should be aimed to determine the effects of date palm and salt on taste impairment on larger populations to validate these findings.

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