Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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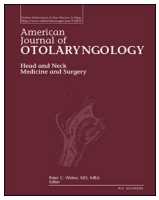

The outcome of fluticasone nasal spray on anosmia and triamcinolone oral paste in dysgeusia in COVID-19 patients☆

Chandra Veer Singh *, Shraddha Jain, Sana Parveen

Department of Otorhinolaryngology, Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences (Deemed to be University), Sawangi Meghe, Wardha, Maharashtra, India - 442004

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ABSTRACT

Background: To study the outcome of fluticasone nasal sprays in smell disorders and triamcinolone paste in taste dysfunction in a population of laboratory-confirmed SARS-CoV-2 patients as the test group. The control group will not be given any intervention and only monitoring of these symptoms will be done to compare the recovery time.

Methods: This prospective interventional study was conducted from June to Nov 2020 at, Datta Meghe University during the COVID-19 outbreak. The 120 enrolled patients were tested at days 1 and 5 after proven infection by RT-PCR test.

Result: The mean age for all cases is 50.88 ± 15.93 years, whereas for the controls mean age is 51.2 ± 14.89. 2. Among cases 45 (75%) were males and 15 (25%) were females, among controls 43 (71.66%) were males and 17 (28.33%) were females. Among the case group, after the use of fluticasone spray in the nose and triamcinolone paste in the mouth there was a statistically significant improvement in recognizing all the odours and taste on day 5 compared to day 1. On comparing the smell and taste of cases and control group, either there is no improvement or worsening in smell or taste on day 5 in the control group.

Conclusion: The use of fluticasone nasal spray and triamcinolone paste had immensely influenced the basic senses such as smell and taste. Our study showed that olfactory and taste function significantly improved in patients with COVID-19. For all anosmia and dysgeusia cases who received fluticasone nasal spray and triamcinolone medications the recovery of smell senses and the taste was within a week.

1. Introduction

Modern man tends to relegate the olfactory sense to a position of secondary importance with respect to the auditory and visual senses. However, the purely aesthetic value of olfaction is in the enhancement of flavour and the enjoyment of food, as well as the more important adaptive aspect which enables man to interpret his environment in the absence of visual sense, is not to be discounted in the evaluation of this little-understood sensory system. A contributory factor to this secondary relegation of olfaction maybe its relative inaccessibility to experimentation. Hence further research is much needed in this regard [1].

Altered or reduced ability to perceive smells are respectively called as anosmia and hyposmia are associated with many respiratory viral infections, including the COVID-19 infection. This infection is characterised by fever, malaise, cough and breathing difficulty.

Since this virus has been identified in Dec 2019, it has spread all over the world at an exponential rate. Several studies have suggested that many patients with the infection also develop hyposmia/anosmia and/or dysgeusia - another name for taste alteration, which is also one of the first symptoms in a few patients. Most of these studies are based on a presumptive diagnosis of COVID-19. Only a single study till now has assessed a sample of lab-confirmed patients, by performing smell testing quantitatively, but they did not assess taste [2].

Extremely limited information is available on severity, recovery time and prevalence of these symptoms in COVID patients. The aim of our study is to investigate the effect of fluticasone sprays in smell disorders and triamcinolone paste in taste dysfunction in a population of laboratory-confirmed SARS-CoV-2 patients as the test group. The control group will not be given any intervention and only monitoring of these symptoms will be done to compare the recovery time [2].

☆ Dr C. Singh takes responsibility for the integrity of the content of the paper.

* Corresponding author at: Department of Otorhinolaryngology, Datta Meghe Institute of Medical Science, Sawangi, Wardha 442004, India.
E-mail address: cheer7us@hotmail.com (C.V. Singh).

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Various studies have been done till now proving the efficacy of the use of steroids in the treatment of diagnosed COVID-19 patients. Till now, no specific treatment has been designed to treat the anosmia and dysgeusia which comes with getting infected with this virus.

Hence, we are conducting this study to evaluate the efficacy of steroids in long-standing, mild-moderate cases of COVID-19, by their local application in the form of sprays for smell disorder and paste for taste disorder. Corticosteroids should always be given under antibiotic cover and it has already been established that they are useful in reducing the viral load. The reason for choosing fluticasone and triamcinolone is that they both are easily available and not many side effects have been reported for these two drugs in SARS-COV2 infected patients.

2. Material and Methods

This prospective interventional study was conducted from June to Nov 2020 at, our hospital during the COVID- 19 outbreak. The 120 enrolled patients were tested at days 1 and 5 after proven infection by RT-PCR test. Administrative information was collected from the hospital database and patients were offered a yes or no questionnaire if they can identify various tastes and smells. Signed informed consent was taken from the patients. History and examination were carried out in person using the questionnaire.

Smells to be tested
- Musky - perfume
- Pungent- vinegar
- Camphoraceous - naphthalene balls
- Floral - jasmine/roses
- Peppermint - mint

Method of testing – the five smells were obtained using the base substance and mixing with 5 ml water and kept in glass bottles.

Patients were given paper strips with 2–3 drops of the smell solution for testing, on day 1, and 5 of admission and asked to identify the smell. Answers were recorded as a yes or no response. 60 patients who were administered the fluticasone spray, 2 puffs od for 5 days; were the test group, and another control group did not receive the drug.

Tastes tested
- Bitter - quinine (hydroxychloroquine)
- Sweet - sugar solution
- Salty-salt solution
- Sour - vinegar

Method of testing – Four tastes were obtained using the base substance and were mixed with 5 ml water and kept in glass bottles.

Testing was done by dipping earbuds in the solution and placing it on the anterior 2/3rd of the tongue and patients were asked if he/she could identify the taste or not; on day 1, and 5 of admission. Answers were recorded as a yes or no response. 60 patients were given triamcinolone paste in the test group, and another control group of 60 patients did not receive any drug.

Inclusion criteria: more than 18-years age, signed informed consent and lab-proven SARS-CoV-2 infection with mild to the moderate presentation of the disease according to the severity classification.
Exclusion criteria: severe symptoms of COVID-19, declined informed consent.

2.1. Mechanism of COVID 19 activity

One of the important means to tackle a pandemic of COVID-19 (coronavirus disease 2019) of this high grade is to muster maximum knowledge about the transmission of this infection and the clinical features while the search for an effective vaccine is ongoing [2]. Even though this virus has been mainly observed to affect the upper and lower respiratory tract, the neurological effects have already been reported in a few published works.

Luca Turin has suggested a similar hypothesis like the vibrational theory of olfaction, by which inelastic tunnelling of electrons causes vibrations detected by olfactory receptors in the nasal mucosa [3]. A recent study has also theorised that epithelial cells in the nose show quite a high angiotensin-converting enzyme 2 (ACE2) expression in this viral infection, and hence it may allow wide viral entry. This was a possible explanation of why anosmia is an atypical manifestation of SARS-Cov2 patients [4].

An underlying neurological basis has also been proposed for dysgeusia. In fact, olfactory and gustatory senses are closely interconnected. Direct damage to the nerves in the olfactory epithelium, where ACE2 is expressed in an enormous quantity, can also disrupt the taste mechanism; mainly in 2 ways- direct damage of cells expressing ACE2, on the taste buds and peripheral neurosensory taste chemoreceptors, or direct damage of any of cranial nerves of gustation namely - CN VII, IX, or X. Out of these, damage to the chorda tympani (CN VII) supplying anterior 2/3rd of the tongue is the most plausible and important explanation: after colonising the nasopharynx, the COVID-19 virus could utilise the eustachian tube as a portal of entry to invade the middle ear mucosa, causing further damage to the branch of the facial nerve and the resulting in dysgeusia [5].

An inflammatory response pathway has also been proposed for dysgeusia. The oral mucosa is also lined with ACE2 receptors, which the SARS-CoV-2 virus uses to enter epithelium. It binds to ACE2 receptors in the mucosa, activates an inflammatory response, leading to genetic and cellular changes that alter taste. This response might be mediated by the interaction between Toll-like receptors and the virus causing tissue damage, in a pathway like acute respiratory distress (ARDS).

Wang et al. provided evidence in mammalian tissue that “taste bud cells express cytokine signalling pathways and that inflammation may affect taste functions via these pathways. Inflammatory cytokines, such as IFN (interferon) can trigger apoptosis and therefore may cause abnormal turnover in taste buds, which may result in net losses of taste bud cells and/or skewing the representation of different types of taste cells and ultimately lead to the development of taste dysfunction.” This could be another mechanism for taste disorders resulting in this viral infection [6].

Chelation of zinc via immune molecules and mechanisms increase in concentration along with inflammatory processes and may result in acute zinc deficiency in SARS-CoV-2 infection. This causes taste alterations like the ones observed in association with other viral mechanisms causing hypozincaemia. Another benefit is that zinc has been proven to inhibit the in vitro activity of coronavirus RNA polymerase and plays a significant role in antiviral immune responses. Systematic reviews of randomized controlled trials and their systematic reviews have concluded that zinc lozenges at a dose of 75 mg/day or higher may reduce the duration of flu-like symptoms in healthy adults and children [6].

2.2. Statistical analysis

Taste and smell assessments were reported using data from scales which have been treated as quantitative real values. A language and environment for statistical computing were taken into consideration. P-value <0.05 was considered significant.

3. Treatment of COVID-19 patients

For COVID-19 patients with mild to moderate disease with SpO2 $>$ 90%, supportive care was provided and tab paracetamol, Tab Zinc 50 mg bd, Cap multivitamin 1od, fluticasone nasal spray 2 puff od, nasal saline irrigation, hydroxychloroquine administration was started (200

mg BID × 2 doses, then 100 mg BID for 5 days). For the patients with moderate COVID-19 presentations, Tab Favipiravir 800 mg BID for up to 1 day then 400 mg for 10 days was prescribed. In patients with progressive COVID-19 disease admitted to the ICU, intravenous immunoglobulin (IVIG) at the standard dose of 0.5 g/kg/day daily for 5 days was administered and intravenous Remdesivir 100 mg for 5 days. The treatment for olfactory dysfunction was nasal fluticasone spray, normal saline irrigation and gustatory dysfunction was treated triamcinolone paste TDS, normal saline gargle.

3. Results

Most common symptoms were fever, cough, and breathlessness whereas sore throat, loss of appetite and vomiting were the least common symptoms in both cases and controls. Our study comprised 120 subjects, among which 60 were in the case group and 60 were in the control group, and the most predominant symptom was cough and breathlessness. All subjects in the case group and the control group had anosmia and dysgeusia. Mean age for cases was 50.88 with an SD 15.93, whereas for the controls mean age was 51.2 and SD was 14.89. Among cases 45 (75%) were males and 15 (25%) were females, among controls 43 (71.66%) were males and 17 (28.33%) were females. For anosmia after administering fluticasone nasal spray in case group had improved for 93.33% for musky smell, 91.67% for pungent smell, 91.67% for camphoraceous smell, 88.33% for floral smell, 90% for minty smell on day five. For dysgeusia after giving local application triamcinolone oral paste had improved 83.33% for bitter 91.67% for sweet 83.33% for salty taste 83.34% for sour taste on the fifth day (Figs. 1–3).

4. Discussion

Jerome et al. concluded olfactory and gustatory dysfunction are both prevalent in a patient with mild to moderate COVID-19 infection. Patent with general symptoms like fever, myalgia, loss of appetite, cough may associate olfactory dysfunction and gustatory dysfunction. There was a positive association between olfactory dysfunction and gustatory dysfunction. In the study of Mao et al., most common symptoms were hypogeusia 5.6% and hyposmia 5.15% in COVID-19 patent.

Valleria et al. included 355 patients with lab-confirmed infection of SARS-CoV-2 (COVID). The combined prevalence of both taste and smell or either of the two alterations was 70% (249 of 355). Between the two symptoms studied, 14 (3.9%) presented with anosmia with no taste

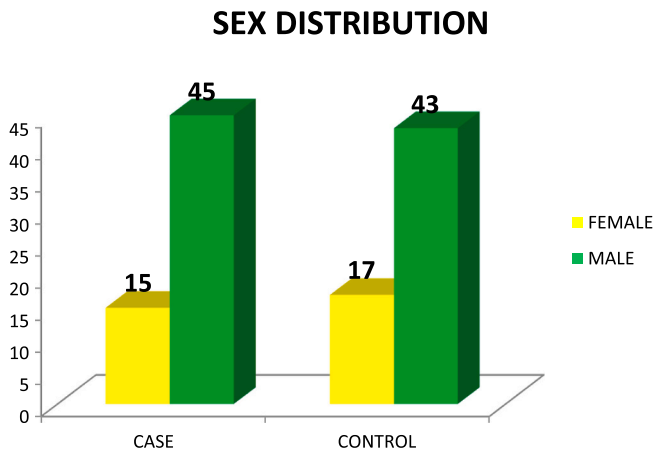

Fig. 2. Gender distribution of patients.
Among cases 75% were males and 25% were females, among controls 71.66% were males and 28.33% were females.

disorder, whereas 12 (3.4%) patients had dysgeusia with no smell alteration [7].

Giacomelli A et al. conducted a cross-sectional study in 59 COVID-19 diagnosed patients which also reported 33.9% taste or smell loss and loss of both senses in 18.6% patients [8].

Beltrán-Corbellini A et al. in 79 COVID-19 cases showed that 35.5% had anosmia and dysgeusia as the initial symptom [9].

In the study of Chin et al. 38% and 34.1% of diagnostically confirmed COVID-19 patients presented with gustatory or olfactory dysfunction, respectively. Elderly patients had a lesser incidence of these manifestations. There was no significant gender preponderance [10].

In a meta-analysis of Tong et al. that there was a prevalence of 52.73% for the absence of smell in SARS Cov2 positive cases. Nine of those studies were further tested for loss of taste, which showed that 43.93% of patients had the symptom [11].

A study by Sayin et al. divided the cases into two groups, one's testing positive for the virus and others testing negative. They observed it that there was a vast difference in the rates of taste and smell and taste dysfunction among the two groups (26.6% for the negative group and 71.9% for the positive group) (P = 0.001). The rate of parosmia/hyposmia and dysgeusia/hypogeusia/was found to be significantly raised in

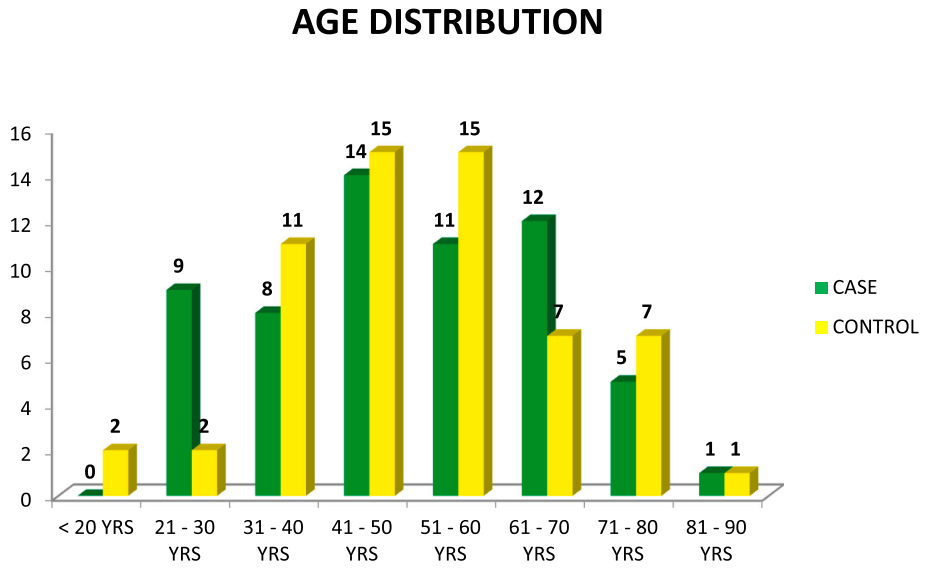

Fig. 1. Age distribution of patients in both cases and controls.
Mean age for cases is 50.88 with a SD 15.93, whereas for the controls mean age is 51.2 and SD is 14.89.

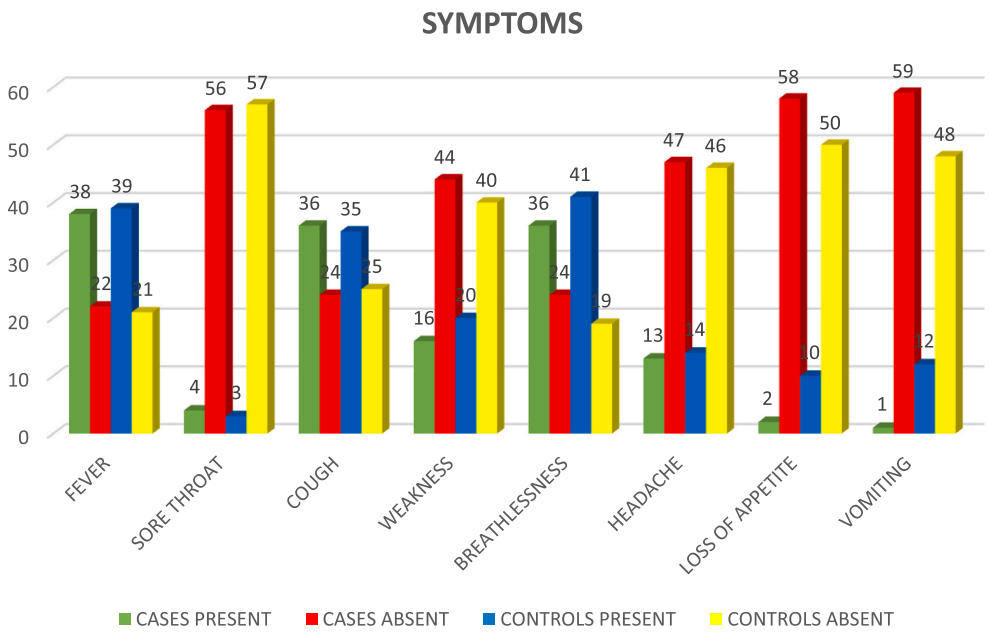

Fig. 3. Distribution of the patients based on presenting symptoms.
Most common symptoms were fever, cough and breathlessness whereas sore throat, loss of appetite and vomiting were the least common symptoms in both cases and controls.
All cases and controls had anosmia and dysgeusia.

the viral- positive group [12].

Yan et al. evaluated fifty-nine COVID-19 positive cases with 203 COVID-19 negative subjects. Dysgeusia and anosmia were reported in 71% and 68% of the positive patients, respectively, in comparison to 17% and 16% of negative subjects ($P < 0.001$) [13].

In a combined analysis of 28 studies relating to COVID-19, SARS-CoV-1, and other coronaviruses, it was demonstrated by Lehrich et al. that a prevalence of 17.9%, 49.6% and 47.9% for loss of both senses, anosmia/hyposmia and, dysgeusia, respectively, in patients affected by COVID-19. Also, there were exponentially higher rates of running nose/rhinitis and nasal obstruction/congestion in other viruses of this family as compared to the SARS-CoV-2 ($P < 0.001$) [14].

Lechien et al. have also found that among 417 mild moderate COVID patients,88.0% and 85.6% of patients reported gustatory and olfactory dysfunction, respectively [15].

Despite so much research done on the prevalence of these symptoms in COVID-19 patients, very few studies are available in the databases on the outcome of the time of recovery for gustatory and olfactory dysfunction during SARS-CoV-2 infection, if a steroid nasal spray or steroid paste are given. The Hopkins and Klopfenstein studies have demonstrated that the average duration of hyposmia/anosmia was 1–21 days, and in that, 98% of patients recovered after around 28 days [16].

In our study, in the case group had anosmia 70% for the musky smell, 66.67% for the pungent smell, 60% for the camphoraceous smell, 91.67% for floral fragrance, 100% for minty smell on day one. After administering fluticasone nasal spray in the case group had anosmia, 6.67% for the musky smell, 8.33% for the pungent smell, 10% for the camphoraceous smell, 11.67% for the floral smell, 10% for minty smell on day five.

In control group had anosmia 85% for the musky smell, 85.67% for the pungent smell, 60% for the camphoraceous smell, 53.33% for floral fragrance, 100% for minty smell on day one. We see a worsening pattern in controls groups had anosmia, 96.3% for the musky smell, 93.33% for the pungent smell, 90% for the camphoraceous smell, 96.67% for the floral smell, 93.33% for minty smell on day five without using steroid spray.

Steroids are implicated to play a very poignant role in the management of SARS-CoV-2 patients, especially by their anti-inflammatory mechanism [17]. Oral corticosteroids have been beneficial in relieving the symptoms of anosmia and dysgeusia [18], hence it is important to observe the effects of a steroid nasal spray on anosmia. This action might be seen on the nerve endings and it reduces neurapraxia caused by the virus, also helps in reducing the smell and taste alteration, which has also been proven by our study [19].

Among case group, patients could correctly identify 73.33% for the bitter taste, 38.33% for sweet,5% for salty, 33.33% for sour taste on the first day which further improved to 83.33% for bitter 91.67% for sweet 83.33% for salty taste 83.34% for sour taste on the fifth day after giving local application triamcinolone oral paste. Among the control group where patients could identify 68.63% for the bitter taste, 26.6% for the sweet, 21.67% for the salty, 33.67% for the sour taste on the first day which further worsening seen for 36.67% for bitter 23.33% for sweet 21.67% for salty taste, and 21.67% for sour taste on day 5.

Strength of the study: Adequate sample size with good short term follow up. Use of less expensive and commonly available medications i. e fluticasone and triamcinolone paste.
Limitations of the study: Lack of long term follow up. Also, the study is done in a single institutione without randomized controlled double-blinding. We regret not using the University of Pennsylvania smell identification test (Tables 1 and 2).

5. Conclusion

Use of commonly available medications such as fluticasone nasal spray and triamcinolone paste had immensely influenced the basic senses such as smell and taste. Our study showed that olfactory and taste function significantly improved in patients with COVID-19. All anosmia and dysgeusia cases who received fluticasone nasal spray and triamcinolone medications the recovery of smell senses and the taste was within a week.

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Ethical approval

The study was approved by the Institutional Ethics Committee.

Table 1
Outcome of fluticasone nasal spray in smell disorder of COVID-19 patients.

Odour	Day	Cases (n = 60)		Controls (n = 60)		P value Case vs Control day 5
		Yes (%)	No (%)	Yes (%)	No (%)	
Musky	Day 1	18 (30%)	42 (70%)	9 (15%)	51 (85%)	
	Day 5	56 (93.33%)	4 (6.67%)	2 (3.33%)	58 (96.67%)	<0.001
	P value	<0.0001		<0.05 (worsened)		
Pungent	Day 1	20 (33.33%)	40 (66.67%)	9 (15%)	51 (85%)	
	Day 5	55 (91.67%)	5 (8.33%)	4 (6.67%)	56 (93.33%)	<0.001
	P value	<0.05		>0.05		
Camphor	Day 1	24 (40%)	36 (60%)	28 (46.67%)	32 (53.33%)	
	Day 5	55 (91.67%)	5 (8.33%)	6 (10%)	54 (90%)	<0.001
	P value	<0.05		<0.05 (worsened)		
Floral	Day 1	5 (8.33%)	55 (91.67%)	6 (10%)	54 (90%)	
	Day 5	53 (88.33%)	7 (11.67%)	2 (3.33%)	58 (96.67%)	<0.001
	P value	<0.05		>0.05		
Mint	Day 1	0 (0%)	60 (100%)	4 (6.67%)	56 (93.33%)	
	Day 5	54 (90%)	6 (10%)	2 (3.33%)	58 (96.67%)	<0.001
	P value	<0.001		>0.05		

Table 2
Outcome of triamcinolone paste in taste disorder of COVID-19 patients.

Taste	Day	Cases (n = 60)		Controls (n = 60)		P value Case vs Control day 5
		Yes	No	Yes	No	
Bitter	Day 1	44 (73.33%)	16 (26.67%)	41 (68.33%)	19 (31.67%)	
	Day 5	53 (88.33%)	7 (11.67%)	22 (36.67%)	38 (63.33%)	<0.05
	P value	<0.05		<0.05 (worsened)		
Sweet	Day 1	23 (38.33%)	37 (61.67%)	16 (26.67%)	44 (73.33%)	
	Day 5	55 (91.67%)	5 (8.33%)	14 (23.33%)	46 (76.67%)	<0.05
	P value	<0.05		>0.05		
Salt	Day 1	3 (5%)	57 (95%)	13 (21.67%)	47 (78.33%)	
	Day 5	50 (83.33%)	10 (16.67%)	13 (21.67%)	47 (78.33%)	<0.05
	P value	<0.001		>0.05		
Sour	Day 1	2 (3.33%)	58 (96.67%)	20 (33.33%)	40 (66.67%)	
	Day 5	50 (83.33%)	10 (16.67%)	13 (21.67%)	47 (78.33%)	<0.05
	P value	<0.001		>0.05		

Declaration of competing interest

None declared.

References

[1] Bourgeois A.E, Bourgeois J.E; Theories of olfaction: a review; Texas A&M University. Revista Interamericana de Psicologia. 193. 196. [Google Search].

[2] Lozada-Nur F, Chainani-Wu N, Fortuna G, Sroussi H. Dysgeusia in COVID-19: possible mechanisms and implications. Oral Surg Oral Med Oral Pathol Oral Radiol 2020;130(3):344–6. https://doi.org/10.1016/j.oooo.2020.06.016 [Google Search].

[3] Hoehn Ross D, Nichols David E, Neven H, Kais S. Status of the vibrational theory of olfaction. Front Phys 2018;6:1–25. https://doi.org/10.3389/fphy.2018.00025 [Google Search].

[4] Lahiri D, Ardila A. COVID-19 pandemic: a neurological perspective. Cureus 2020; 12(4):e7889. Published 2020 Apr 29, https://doi.org/10.7759/cureus.7889 [Google Search].

[5] Paolo G. Does COVID-19 cause permanent damage to olfactory and gustatory function? [published online ahead of print, 2020 Jul 9]. Med Hypotheses 2020; 143:110086. https://doi.org/10.1016/j.mehy.2020.110086 [- Google Search].

[6] Dell'Era V, Farri F, Garzaro G, Gatto M, Aluffi Valletti P, Garzaro M. Smell and taste disorders during COVID-19 outbreak: cross-sectional study on 355 patients. Head Neck 2020;42(7):1591–6. https://doi.org/10.1002/hed.26288 [Google Search].

[7] Printza A, Constantinidis J. The role of self-reported smell and taste disorders in suspected COVID 19. Eur Arch Otorhinolaryngol 2020;277(9):2625–30. https://doi.org/10.1007/s00405-020-06069-6 [Google Search].

[8] Giacomelli A, Pezzati L, Conti F, Bernacchia D, Siano M, Oreni L, et al. Self-reported olfactory and taste disorders in patients with severe acute respiratory coronavirus 2 infection: a cross-sectional study. Clin Infect Dis 2020 Jul 28;71(15): 889–90. https://doi.org/10.1093/cid/ciaa330 [PMID: 32215618; PMCID: PMC7184514].

[9] Beltrán-Corbellini, Á et al. "Acute-onset smell and taste disorders in the context of COVID-19: a pilot multicentre polymerase chain reaction based case-control study." Eur J Neurol, https://doi.org/10.1111/ene.14273. [22 Apr. 2020, doi: 10.1111/ene.14273 - Google Search].

[10] Agyeman AA, Lee Chin K, Landersdorfer CB, Liew D, Ofori-Asenso R. Smell and taste dysfunction in patients with COVID-19: a systematic review and meta-analysis. Mayo Clin Proc 2020. https://doi.org/10.1016/j.mayocp.2020.05.030 [Google Search].

[11] Tong JY, Wong A, Zhu D, Fastenberg JH, Tham T. The prevalence of olfactory and gustatory dysfunction in COVID-19 patients: a systematic review and metaanalysis. Otolaryngol Head Neck Surg 2020;163(1):3–11. https://doi.org/10.1177/0194599820926473. Epub 2020 May 5. [Google Search].

[12] Taste and smell impairment in COVID-19: an AAO-HNS anosmia reporting tool-based comparative study. Otolaryngol Head Neck Surg - [Google Search].

[13] Yan CH, Faraji F, Prajapati DP, Boone CE, DeCode AS. Association of chemosensory dysfunction and COVID-19 in patients presenting with influenza-like symptoms. Int Forum Allergy Rhinol 2020:1 [Google Search].

[14] Lehrich BM, Goshtasbi K, Raad RA, Ganti A, Papagiannopoulos P, Tajudeen BA, et al. Aggregate prevalence of chemosensory and sinonasal dysfunction in SARS-CoV-2 and related coronaviruses. Otolaryngol Head Neck Surg 2020;163(1): 156–61. https://doi.org/10.1177/0194599820929278. Epub 2020 May 19 Google Search.

[15] Lechien R, Chiesa-Estomba CM, De Siati DR, et al. Olfactory and gustatory dysfunctions as a clinical presentation of mild- to- moderate forms of the coronavirus disease (COVID- 19):a multicenter European study. EurArchOtorhinolaryngol 2020. https://doi.org/10.1007/s00405-020-05965-1 [Google Search].

[16] Walker HK. Cranial nerve I: the olfactory nerve. In: Walker HK, Hall WD, Hurst JW, editors. Clinical methods: the history, physical, and laboratory examinations. 3rd ed. Boston: Butterworths; 1990 Chapter 59. Available from https://www.ncbi.nlm.nih.gov/books/NBK382/ [Google Search].

[17] Carrillo-Larco RM, Altez-Fernandez C. Anosmia and dysgeusia in COVID-19: a systematic review. Wellcome Open Res 2020;5:94. Published 2020 May 13, 10.12688/wellcomeopenres.15917 [Google Search].

[18] Seo BS, Lee HJ, Mo JH, Lee CH, Rhee CS, Kim JW. Treatment of postviral olfactory loss with glucocorticoids, Ginkgo biloba, and mometasone nasal spray. Arch Otolaryngol Head Neck Surg 2009 Oct;135(10):1000–4. https://doi.org/10.1001/archotol.2009.141 [PMID: 19841338. - Google Search].

[19] , ENT UK. Guideline for management of covid-19 anosmia. 2020. https://www.entuk.org/advicepatients-new-onset-anosmia-during-covid-19-pandemic; 2020. https://www.entuk.org/advicepatients-new-onset-anosmia-during-covid-19-pandemic. [Accessed 25 March 2020].