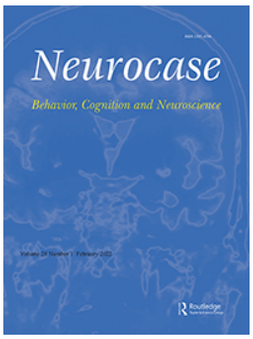

Routledge
Taylor & Francis Group

Neurocase

Behavior, Cognition and Neuroscience

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/nncs20

The impact of COVID-19-related smell and taste disorders on a patient with bulimia nervosa: a case report

N. Leenaerts, J. Ceccarini, S. Sunaert & E. Vrieze

To cite this article: N. Leenaerts, J. Ceccarini, S. Sunaert & E. Vrieze (2022) The impact of COVID-19-related smell and taste disorders on a patient with bulimia nervosa: a case report, Neurocase, 28:1, 72-76, DOI: 10.1080/13554794.2021.2024859

To link to this article: https://doi.org/10.1080/13554794.2021.2024859

NEUROCASE
2022, VOL. 28, NO. 1, 72–76
https://doi.org/10.1080/13554794.2021.2024859

Routledge
Taylor & Francis Group

The impact of COVID-19-related smell and taste disorders on a patient with bulimia nervosa: a case report

N. Leenaerts [a], J. Ceccarini [b], S. Sunaert [c] and E. Vrieze [a]

[a]Mind- Biomedical Sciences Group, KU Leuven, Belgium; [b]Department of Nuclear Medicine and Molecular Imaging, Department of Imaging and Pathology, KU Leuven KU Leuven, Belgium; [c]Department of Radiology, University Hospitals Leuven & Department of Imaging and Pathology, KU Leuven KU Leuven, Belgium

ABSTRACT

A large number of patients with COVID-19 will suffer from long-term smell and taste disorders (STD). These STD symptoms could have a significant impact on patients with an eating disorder (ED). To highlight this issue, a case is presented of a patient with bulimia nervosa who experienced COVID-19-relate STD symptoms. Clinicians should reassess patients with an ED who suffer from COVID-19 with STD symptomatology and potentially redirect treatment. More research is needed on STD symptoms in patients with an ED to improve our knowledge on the role of smell and taste in disordered eating behaviors and improve treatment guidelines.

ARTICLE HISTORY
Received 26 October 2021
Accepted 28 December 2021

KEYWORDS
COVID-19; bulimia nervosa; smell and taste disorders; experience sampling method; stress; craving

1. Introduction

The most common symptoms of coronavirus disease 2019 (COVID-19) are fever, dry cough and shortness of breath (Wiersinga et al., 2020). A large number of patients will also experience smell and taste disorders (STD) (Agyeman et al., 2020). These can include a distorted smell and taste (parosmia and parageusia), phantom odors and tastes (phantosmia and phantogeusia), a decreased smell and taste (hyposmia or hypogeusia), a complete loss of smell and taste (anosmia and ageusia) or a change in the chemical sensitivity of the mucosa (chemesthesis; Agyeman et al., 2020). Such symptoms are reported by approximately 40% of patients with COVID-19 and typically start within four to five days of a symptomatic infection (Agyeman et al., 2020; Santos et al., 2021). Most patients with STD will recover within two weeks, but 12% will still suffer from STD symptoms after two months (Printza et al., 2021).

When it comes to mental health, individuals suffering from COVID-19 and STD report more anxiety and depression and this psychological distress remains after recovery from COVID-19 (Dudine et al., 2021). Previous research also shows that STD can cause weight changes, negatively affect social interactions and lead to greater depressive symptoms (Boesveldt et al., 2017). This impact could be even greater for patients with an eating disorder (ED). This is because smell and taste are hypothesized to play an important role in disordered eating behaviors (Chao et al., 2020; Islam et al., 2015; Leland et al., 2021). In bulimia nervosa (BN), the pleasurableness of tasting and smelling food could be crucial in the use of food to manage negative emotions. When it comes to anorexia nervosa (AN), a lower taste sensitivity could play a role in the restriction of food intake. Several studies have investigated whether smell and taste are processed differently in patients with an ED. In these studies, patients with BN display a greater preference for sweet substances while patients with AN are less able to identify and detect tastes (Chao et al., 2020; Leland et al., 2021). When it comes to smell, patients with AN seem to have a higher sensitivity to odors but a lower capacity to discriminate between odors (Islam et al., 2015; Leland et al., 2021).

As to our knowledge, no studies have looked at patients with an ED that developed STD. However, with the recent COVID-19 pandemic, the number of patients with an ED that experience long-term STD could be significant. With over 270 million confirmed cases of COVID-19 up until December 2021, of which about 5% will lead to long-term STD symptoms and with ED having a point prevalence of 5%, the number could range in the tens to hundreds of thousands (Agyeman et al., 2021; Galmiche et al., 2019; Printza et al., 2021; World Health Organization, 2021). Improved knowledge on the impact of such symptoms could help clinicians to treat patients with an ED that experience STD. It could also help us to better understand the role of smell and taste in disordered eating behaviors. This report wants to highlight the need for further research by describing the case of a patient with BN who experienced COVID-19-related STD symptoms while she was included in a longitudinal study.

2. Case presentation

Our 20-year old female patient with BN was included in a longitudinal experience sampling method (ESM) study on the 2nd of March 2020. The protocol of this study has been described elsewhere (Leenaerts et al., 2021). Briefly, participants

CONTACT N. Leenaerts nicolas.leenaerts@kuleuven.be Mind-body Research, Biomedical Sciences Group, Herestraat 49, KU Leuven 3000, Belgium

were followed over a 1-year period and were required to report on their emotions, context and behavior by answering questions through a smartphone app. The 1-year period was divided into 3-week-long blocks which were separated by 5-week-long intervals. During each block, data were collected every Thursday, Friday and Saturday. On these days, participants received 8 signals which were sent out semi-randomly. Participants were asked to rate negative affect (NA) emotions (afraid, lonely, insecure, sad, distressed, guilty) and positive affect (PA) emotions (satisfied, enthusiastic, relaxed) on a 7-point Likert scale ranging from "Totally Disagree" to "Totally Agree". Participants were also asked to rate their craving for a BE episode on a 5-point Likert scale ranging from "None" to "Overwhelming". The diagnosis of BN was confirmed at inclusion and at the end of the study follow-up with the Structured Clinical Interview for DSM-5 Disorders (SCID-5; American Psychiatric Association, 2017). Disordered eating behaviors were inventoried with the Eating Disorder Examination Questionnaire (EDE-Q; Aardoom et al., 2012). Feelings of depression, anxiety, and stress were scored with the Depression Anxiety Stress Scale (DASS-42; Lovibond & Lovibond, 1995). There was no history of any prior somatic or psychiatric illnesses and no regular pharmacological, nor psychotherapeutic treatment before or during the study. The results of the questionnaires as well as more detailed patient characteristics are reported in Table 1.

Table 1. Patient characteristics and questionnaire results.Patient characteristics and questionnaire results at the beginning and at the end of the study follow-up. Abbreviations: DASS-42, Depression Anxiety Stress Scale; EDE-Q, Eating Disorder Examination Questionnaire; GCCRQ, the Global Consortium of Chemosensory Research Questionnaire

	Timepoint 1 (March 2020)	Timepoint 2 (March 2021)
Age (years)	20	21
Height (m)	1.62	1.62
Weight (kg)	60.8	55.0
Body Mass Index (kg/m^2)	23.2	21.0
Formal Education (years)	14	15
Illness Duration (years)	5	6
Binge eating episodes in the month prior	8	10
Excessive exercise in the month prior	12	6
Fasting in the month prior	19	14
Vomiting in the month prior	0	0
Use of laxatives in the month prior	0	0
Use of diuretics in the month prior	0	0
EDE-Q:		
Total	4.34	4.26
Restraint	3.6	2.4
Eating concern	3	4.6
Weight concern	5.4	4.8
Shape concern	5.4	5.3
DASS-42:		
Anxiety	11	12
Depression	0	20
Stress	7	25
GCCRQ:		100
Smell before the COVID-19 infection		51
Smell during the COVID-19 infection		1
Smell now		100
Taste before the COVID-19 infection		0
Taste during the COVID-19 infection		60
Taste now		100
Chemestesis before the COVID-19 infection		66
Chemestesis during the COVID-19 infection		100
Chemestesis now		

During the study follow-up, our patient experienced a COVID-19 infection and suffered from COVID-19-related STD symptoms. A detailed timeline of the infection can be found in Figure 1. Smell, taste and chemesthesis before, during and after the COVID-19 infection were rated with the Global Consortium of Chemosensory Research Questionnaire (GCCRQ; Parma et al., 2020). These scores can be found in Table 1. Average scores for NA, PA and craving of the ESM block before, during and after the COVID-19 infection are reported in Table 2. A visual representation of the ESM scores can also be seen in Figure 1. The first general COVID-19 symptoms appeared mid-October 2020 and were primarily fatigue, shortness of breath, a dry cough, muscle aches and fever. A nasopharyngeal swab was taken for testing by the patient's primary care physician (PCP) and confirmed the presence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The general COVID-19 symptoms were treated symptomatically with paracetamol and resolved gradually over the course of 2 weeks. No blood tests were performed during the infection, but a test from February 2021 showed no biochemical abnormalities and no change in the white blood cell count or C-reactive protein level.

Our patient first realized that she had difficulties smelling and tasting in the middle of October, when her PCP asked if she had any STD symptoms. At that moment, she remembered that she couldn't taste speculoos anymore (i.e. a spiced biscuit), which she always enjoyed eating. Besides the anosmia symptoms, our patient also experienced a diminished sense of smell during the infection which she first attributed to a clogged nose. In the middle of November, our patient regained the capacity to tell whether food had a sweet, sour, salty or bitter flavor, but pronounced hypogeusia symptoms remained whereby all flavors were blunted. Even more, the sense of smell of our patient deteriorated up to the point of anosmia. Because of this, our patient went to her PCP again and was prescribed a 'Dos Medical Smell Training-SET1' for olfactory training. She followed this training daily until February 2021 when she finally halted her treatment due to a lack of results. Later, in March, parosmia and phantosmia symptoms appeared. For example, some foods smelled burnt, her favorite perfume had a strong and odd smell and on one occasion our patient smelled pizza on a train when there was no food around. This history is reflected in the GCCRQ scores as the patient scored her smell and taste a 100 out of a 100 for the period before the infection, a 51 and 0 for the period during the infection and a 1 and 60 for March 2021.

Looking back at the period before the infection, eating was very pleasurable and a hobby at times for our patient. The pleasantness of eating was an important factor in BE episodes and the food items that she consumed during an episode were mostly sweet or high in fat (e.g., pie, marzipan, waffles or apple turnovers). The patient described that stress and sadness used to be triggers for a BE episode and that the first bite of food during an episode felt like a rush, which immediately calmed her. She told that the episodes were a moment of peace where she lost herself in eating and did not think of anything else. After the COVID-19 infection, food wasn't pleasurable anymore because of

the distorted taste or lost taste. The food items consumed during a BE episode were now savorier and had a crunchier or crispier texture (e.g., nuts or potato chips). The BE episodes themselves no longer were a moment of peace and they did not reduce stress. Even though our patient reported to experience more stress than before the infection, she said that craving (i.e. the urge for a BE episode) was now the most important trigger for a BE episode. She described regular, sudden feelings of craving, which didn't recede until a BE episode had happened. For

Table 2. Experience sampling method results. Mean and standard deviation of negative affect, positive affect and craving of the ESM blocks before, during and after the COVID-19 infection.

	Negative affect (mean ± SD)	Positive affect (mean ± SD)	Craving (mean ± SD)
August/September 2020 (n = 42)	3.8 ± 0.9	3.8 ± 1.0	2.3 ± 1.4
October 2020 (n = 21)	4.1 ± 0.9	3.8 ± 1.2	2.5 ± 1.6
December 2020 (n = 13)	4.5 ± 0.9	3.4 ± 0.7	3.2 ± 1.5

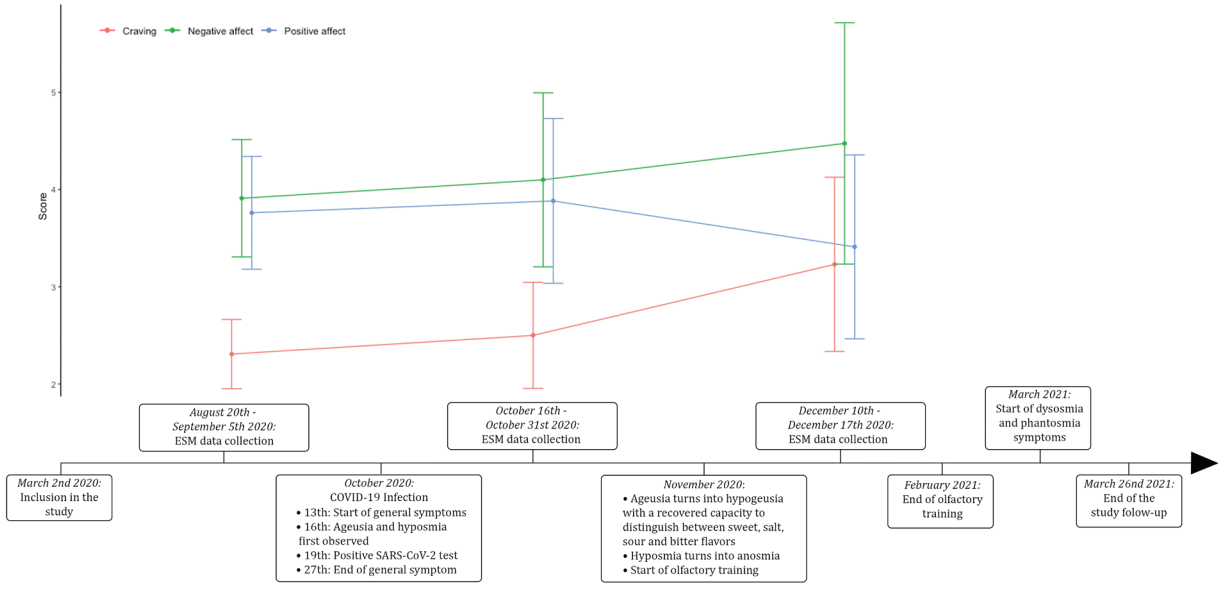

Figure 1. Timeline displaying the course of the patient's study follow-up, COVID-19 infection and STD symptoms. To this timeline, an error bar plot is added showing the ESM data gathered before (August/September 2020), during (October 2020) and after (December 2020) the COVID-19 infection. Abbreviations: ESM, experience sampling method; SARS-CoV-2, severe acute respiratory syndrome coronavirus; STD, smell and taste disorders.

example, during an internship, our patient felt a craving to eat a large amount of food which was unstoppable. After finishing work, she immediately went to a supermarket to buy food and started eating on the bike ride home. At another time, the patient's sister was eating M&M's. The urge to eat a large amount of them remained in our patient's head until she had a BE episode with M&M's the next day. These experiences are reflected in the EDE-Q and ESM scores. First, the EDE-Q scores show no real changes in the severity of the ED symptoms despite the considerable STD symptoms and their impact on the original triggers for a BE episode. Second, the craving scores show that our patient tended to report more craving for a BE episode after the onset of the STD symptoms.

3. Discussion

This case report is the first to describe the impact of COVID-19 related STD symptoms on a patient with BN. Our patient reported that stress was an important trigger for BE episodes before the COVID-19 infection and that eating food immediately calmed her. After the COVID-19 infection, when her sense of smell and taste was severely diminished, eating food wasn't pleasurable anymore. Even though our patient reported to experience more stress, stress wasn't the most important trigger for a BE episode anymore and BE episodes no longer reduced stress. Nevertheless, our patient still had BE episodes, but now with craving as the most important trigger.

These experiences show that STD can severely impact the triggers for disordered eating behaviors as well as the role these behaviors play themselves. First, STD could have a direct impact on ED pathology because of the changes in smell and taste (Chao et al., 2020; Islam et al., 2015; Leland et al., 2021). For instance, a reduced sensitivity to taste could worsen food restriction in patients with AN. Also, a loss of pleasure in eating certain food items could change the types of food that are consumed during a BE episode. Secondly, STD could also have an indirect effect on ED pathology through increased feelings of depression and loneliness (Boesveldt et al., 2017; Dudine et al., 2021). Therefore, clinicians should pay attention to patients developing STD symptoms. In such a case, it might be necessary to reexplore a patient's ED symptoms and intensify or shift the focus of therapy. For example, in our patient's case, a therapy focusing

on coping with stress wouldn't be appropriate anymore as stress no longer was a trigger for BE behavior. However, to make any well-founded recommendations, there need to be actual studies that look at the impact of STD on disordered eating behaviors.

This case report also illustrates the importance of smell and taste in the emotion regulation effect of BE episodes and in the way that stress triggers a BE episode. However, the hypogeusia and hyposmia our patient experienced may not have caused the changes in disordered eating in and of itself. This is because a large portion of patients with BN already show signs of hypogeusia and hyposmia (Leland et al., 2021). Namely, in previous research, between 8.3 to 84.6% of patients with BN displayed hypogeusia in 3 studies and 57.8% of patients with BN displayed hyposmia in 1 study (Leland et al., 2021). This suggests that it was not simply the reduced sense of smell and taste that caused the change in the role of stress in our patient, but rather the reduced hedonic response to eating that she experienced. Importantly, this case report also suggests that the emotion regulation effect of BE episodes is not essential in the maintenance of BE behavior. It illustrates the hypothesis that BE can shift from motivated behavior (e.g., due to stress) to habitual behavior where other factors such as craving are important (Novelle & Diéguez, 2018). Such a shift has been studied extensively in animals where endogenous opioids were found to be important neurotransmitters in compulsive eating and where opioid antagonists reduced compulsive or excessive eating in binge-eating rats (Novelle & Diéguez, 2018). However, the role of habit and craving in BE behavior in humans remains unclear (Novelle & Diéguez, 2018). This case report shows the importance of habit and craving and more research is needed to understand their role in BE behavior.

3.1. Limitations and strengths

The primary limitation of this case report is that it's based on the experiences of one patient. Because of this, it's not possible to make any statements on a population level. More research is needed in order to do so and that is the point that this case report wants to make. Furthermore, the patient's STD symptoms were not evaluated by an otorhinolaryngologist or by an olfactory testing method which could have provided more information. Nevertheless, the COVID-19 infection was confirmed with a polymerase chain reaction test and the STD symptoms were assessed by a PCP. Also, no blood tests were performed during the infection which could have been interesting as previous studies have shown associations between certain inflammatory markers and STD (Cazzolla et al., 2020).A particular strength of this case report is the availability of questionnaire and ESM data from before and after the COVID-19 infection. This provides a unique insight into the patient's eating behaviors, affect and craving before and after the start of the STD symptoms.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

The data that support the findings of this study are available on request from the corresponding author.

Ethics statement

This case report has been approved by the ethical committee UZ/KU Leuven (Herestraat 49, 3000 Leuven, Belgium).

Consent to participate/consent for publication

The patient gave her written consent to participate in this case report and for results to be published.

Author agreement

All authors have agreed with the submission of the current manuscript.

Funding

A C1 grant of the Special Research Fund KU Leuven to EV and JC served as a PhD Scholarship for NL. JC was supported by a postdoc grant from the Research Foundation Flanders. No other grant of any kind was received.;

ORCID

N. Leenaerts http://orcid.org/0000-0003-2421-6845
J. Ceccarini http://orcid.org/0000-0003-2774-9516
S. Sunaert http://orcid.org/0000-0002-1177-4680
E. Vrieze http://orcid.org/0000-0001-7766-9245

References

Aardoom, J. J., Dingemans, A. E., Slof Op't Landt, M. C., & Van Furth, E. F. (2012). Norms and discriminative validity of the Eating Disorder Examination Questionnaire (EDE-Q). *Eating Behaviors*, *13* 4, 305–309. https://doi.org/10.1016/j.eatbeh.2012.09.002

Agyeman, A. A., Chin, K. L., Landersdorfer, C. B., Liew, D., & Ofori-Asenso, R. (2020). Smell and taste dysfunction in patients with COVID-19: A systematic review and meta-analysis. *Mayo Clinic Proceedings*, *95* 8, 1621–1631. https://doi.org/10.1016/j.mayocp.2020.05.030

American Psychiatric Association. (2017). *SCID-5-S gestructureerd klinisch interview voor DSM-5 Syndroomstoornissen. Nederlandse vertaling van structured clinical interview for DSM-5 Disorders– Clinician Version (SCID-5-CV)* (first (Boom Psychologie) ed.).

Boesveldt, S., Postma, E. M., Boak, D., Welge-Luessen, A., Schöpf, V., Mainland, J. D., Martens, J., Ngai, J., & Duffy, V. B. (2017). Anosmia-A clinical review. *Chemical Senses*, *42* 7, 513–523. https://doi.org/10.1093/chemse/bjx025

Cazzolla, A. P., Lovero, R., Lo Muzio, L., Testa, N. F., Schirinzi, A., Palmieri, G., Pozzessere, P., Procacci, V., Di Comite, M., Ciavarella, D., Pepe, M., De Ruvo, C., Crincoli, V., Di Serio, F., & Santacroce, L. (2020). Taste and smell disorders in COVID-19 patients: Role of interleukin-6. *ACS Chemical Neuroscience*, *11* 17, 2774–2781. https://doi.org/10.1021/acschemneuro.0c00447

Chao, A. M., Roy, A., Franks, A. T., & Joseph, P. V. (2020). A systematic review of taste differences among people with eating disorders. *Biological Research for Nursing*, *22* 1, 82–91. https://doi.org/10.1177/1099800419872824

Dudine, L., Canaletti, C., Giudici, F., Lunardelli, A., Abram, G., Santini, I., Baroni, V., Paris, M., Pesavento, V., Manganotti, P., Ronchese, F., Gregoretti, B., & Negro, C. (2021). Investigation on the loss of taste and

smell and consequent psychological effects: A cross-sectional study on healthcare workers who contracted the COVID-19 infection. *Frontiers in Public Health*, *9*, 666442. https://doi.org/10.3389/fpubh.2021.666442

Galmiche, M., Déchelotte, P., Lambert, G., & Tavolacci, M. P. (2019). Prevalence of eating disorders over the 2000-2018 period: A systematic literature review. *The American Journal of Clinical Nutrition*, *109* 5, 1402–1413. https://doi.org/10.1093/ajcn/nqy342

Islam, M. A., Fagundo, A. B., Arcelus, J., Agüera, Z., Jiménez-Murcia, S., Fernández-Real, J. M., Tinahones, F. J., de La Torre, R., Botella, C., Frühbeck, G., Casanueva, F. F., Menchón, J. M., & Fernandez-Aranda, F. (2015). Olfaction in eating disorders and abnormal eating behavior: A systematic review. *Frontiers in Psychology*, *6*, 1431. https://doi.org/10.3389/fpsyg.2015.01431

Leenaerts, N., Vaessen, T., Ceccarini, J., & Vrieze, E. (2021). How COVID-19 lockdown measures could impact patients with bulimia nervosa: Exploratory results from an ongoing experience sampling method study. *Eating Behaviors* 101505. Advance online publication. https://doi.org/10.1016/j.eatbeh.2021.101505

Leland, E. M., Xie, D. X., Kamath, V., Seal, S. M., Lin, S. Y., & Rowan, N. R. (2021). Psychophysical chemosensory dysfunction in eating disorders: A qualitative systematic review. *Eating and Weight Disorders: EWD*. Advance online publication. https://doi.org/10.1007/s40519-021-01189-2

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the beck depression and anxiety inventories. *Behaviour Research and Therapy*, *33* 3, 335–343. https://doi.org/10.1016/0005-7967(94)00075-u

Novelle, M. G., & Diéguez, C. (2018). Food addiction and binge eating: Lessons learned from animal models. *Nutrients*, *10* 1, 71. https://doi.org/10.3390/nu10010071

Parma, V., Ohla, K., Veldhuizen, M. G., Niv, M. Y., Kelly, C. E., Bakke, A. J., Cooper, K. W., Bouysset, C., Pirastu, N., Dibattista, M., Kaur, R., Liuzza, M. T., Pepino, M. Y., Schöpf, V., Pereda-Loth, V., Olsson, S. B., Gerkin, R. C., Rohlfs Domínguez, P., Albayay, J., … Hayes, J. E. (2020). More than smell-COVID-19 is associated with severe impairment of smell, taste, and chemesthesis. *Chemical Senses*, *45* 7, 609–622. https://doi.org/10.1093/chemse/bjaa041

Printza, A., Katotomichelakis, M., Valsamidis, K., Metallidis, S., Panagopoulos, P., Panopoulou, M., Petrakis, V., & Constantinidis, J. (2021). Smell and taste loss recovery time in COVID-19 patients and disease severity. *Journal of Clinical Medicine*, *10* 5, 966. https://doi.org/10.3390/jcm10050966

Santos, R., Da Silva, M. G., Do Monte Silva, M., Barbosa, D., Gomes, A., Galindo, L., Da Silva Aragão, R., & Ferraz-Pereira, K. N. (2021). Onset and duration of symptoms of loss of smell/taste in patients with COVID-19: A systematic review. *American Journal of Otolaryngology*, *42* 2, 102889. https://doi.org/10.1016/j.amjoto.2020.102889

Wiersinga, W. J., Rhodes, A., Cheng, A. C., Peacock, S. J., & Prescott, H. C. (2020). Pathophysiology, transmission, diagnosis, and treatment of coronavirus disease 2019 (COVID-19): A review. *JAMA*, *324* 8, 782–793. https://doi.org/10.1001/jama.2020.12839

World Health Organization, (2021). *WHO Coronavirus (COVID-19) dashboard*. Retrieved September 1, 2021, from https://covid19.who.int/