



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.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Taste Changes (Dysgeusia) in COVID-19: A Systematic Review and Meta-analysis



Muhammad Aziz,¹ Abhilash Periseti,² Wade M. Lee-Smith,³ Mahesh Gajendran,⁴ Pardeep Bansal,⁵ and Hemant Goyal⁶

¹Department of Internal Medicine, University of Toledo, Toledo, OH; ²Department of Gastroenterology and Hepatology, University of Arkansas for Medical Sciences, Little Rock, AR; ³University of Toledo Libraries, Toledo, OH; ⁴Paul L. Foster School of Medicine, Texas Tech University Health Sciences Center El Paso, El Paso, TX; ⁵Division of Gastroenterology, Moses Taylor Hospital and Regional Hospital of Scranton, Scranton, PA; and ⁶The Wright Center for Graduate Medical Education, Scranton, PA

The coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus -2 (SARS-CoV-2), originated in China and rapidly spread across the world, causing a pandemic.¹ The well-recognized symptoms of COVID-19 include fever, cough, dyspnea, sputum production, myalgia, arthralgia, headache, diarrhea, nausea/vomiting, and sore throat. It appears that a subset of patients with COVID-19 also develop other symptoms, such as ageusia/dysgeusia.² We performed a systematic review of the available literature to assess the presence of ageusia/dysgeusia among patients with COVID-19.

Methods

We performed a systematic review of the databases PubMed/Medline, Embase, Cochrane, and Web of Science from January 1 to April 21, 2020, to identify relevant articles reporting ageusia/dysgeusia as a symptom in patients with laboratory-confirmed COVID-19. Relevant articles reporting data on ageusia/dysgeusia in the form of case series, case-control, and cohort studies were included. Studies were excluded if they did not report the symptoms of interest, that is, ageusia/dysgeusia. Pooled analysis (where applicable) was performed using a random-effects model and DerSimonian-Laird approach. Study heterogeneity was assessed using the I^2 statistic.

Results

The initial search yielded a total of 33 articles, and after screening for duplicates and excluding irrelevant articles, a total of 5 studies with 817 patients were finally included.^{2–6} Four of these studies were single-nation studies, and 1 study was a multinational study from Europe. The study period ranged from January 16, 2020, to March 29, 2020. The proportion of female patients was reported in 3 studies (60.7%, 95% confidence interval 51.3%–70.1%). We found the prevalence of ageusia/dysgeusia was 49.8% (95% confidence interval 8.2%–91.5%, $I^2 = 99.6%$) across these 5 studies (Figure 1).

Discussion

In our pooled analysis, almost half of the patients (49.8%) with COVID-19 have altered taste sensation. Taste disorders are well known to be related to a wide variety of

viral illnesses.⁷ The suggested mechanism of SARS-CoV-2 causing altered taste is its ability to bind to angiotensin-converting enzyme-2 receptor, which is readily expressed on multiple organ systems, including the surface of the tongue and oral cavity. The oral cavity can act as a gateway to infection and lead to the development of ageusia/dysgeusia.⁸ Given the lack of access to diagnostic tests for COVID-19, particularly in the developing world, the utility of distinctive clinical features (such as ageusia/dysgeusia) in identifying patients with suspected COVID-19 is of paramount significance.

Reporting of gustatory and olfactory disturbances is subjective in nature, and patients with COVID-19 (without a history of ear, nose, and throat disorders) should be actively evaluated for these symptoms at presentation. Our study has multiple limitations. First, there is a lack of data comparing ageusia/dysgeusia in laboratory-confirmed COVID-19–positive and –negative patients. Only one study, by Bénézit et al,² compared the prevalence of altered taste in COVID-19–positive and –negative patients who underwent testing based on suspicion.² A significantly increased proportion of patients reported ageusia/dysgeusia (62% vs 11%, odds ratio 7.4, $P < .01$) in the COVID-19–positive arm.² There was also a lack of studies reporting an association of ageusia/dysgeusia with severe COVID-19. Mao et al⁵ also compared the presence of altered taste sensations in severe and nonsevere COVID-19 cases. A somewhat lower prevalence of ageusia/dysgeusia was seen in severe cases and was not statistically significant ($P = .24$).

Second, the inclusion of observational studies can undoubtedly lead to several biases, including but not limited to selection bias, information bias, recall bias, and confounding bias. Third, no study reported the association of acute respiratory distress syndrome, mortality, intensive care unit admission, need for a ventilator, and length of intensive care unit stay with ageusia/dysgeusia. Significant heterogeneity was noted in our analysis of prevalence. This is likely because

Abbreviations used in this paper: COVID-19, Coronavirus Disease 2019.

Most current article

© 2020 by the AGA Institute
0016-5085/\$36.00

<https://doi.org/10.1053/j.gastro.2020.05.003>

Studies	Estimate (95% C.I.)	Ev/Trt
Benezit 2020	0.618 (0.502, 0.733)	42/68
Giacomelli 2020	0.288 (0.173, 0.404)	17/59
Lechien 2020	0.820 (0.783, 0.857)	342/417
Mao 2020	0.056 (0.025, 0.087)	12/214
Yan 2020	0.712 (0.596, 0.827)	42/59
Overall ($I^2=99.61\%$, $P < .001$)	0.498 (0.082, 0.915)	455/817

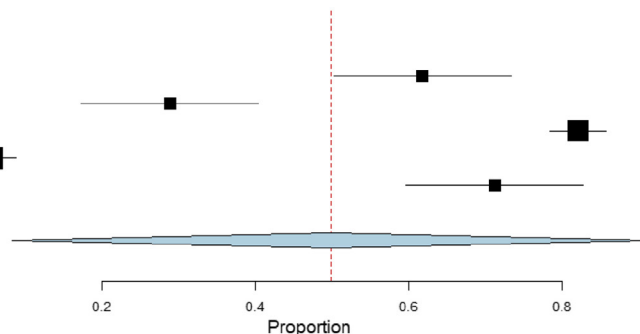


Figure 1. Forrest plot demonstrating the pooled prevalence of ageusia/dysgeusia in patients with COVID-19. C.I., confidence interval; Ev/Trt, patients with symptoms/total patients.

of the reason mentioned previously, that is, the observational nature of the study. The data were retrospectively collected from medical files, and the presence of ageusia/dysgeusia might have been underestimated. Fourth, the presence of these symptoms may not be reported in the presence of other severe symptoms, such as dyspnea, fever, and productive cough. For these reasons, the true prevalence of ageusia/dysgeusia might be significantly higher (than reported in our analysis) and should be included as a screening question for patients evaluated for suspected COVID-19.

Currently, there is weak evidence if the taste or smell changes could prognosticate COVID-19-related severity and mortality. More epidemiological studies are needed to assess the prevalence of ageusia/dysgeusia in patients with COVID-19, as well as comparing mild to moderate and severe cases. Recognizing these distinctive clinical features can raise the suspicion of COVID-19, leading to early testing and diagnosis of the disease.

References

1. World Health Organization. Available at: <https://www.who.int/csr/don/05-january-2020-pneumonia-of-unknown-cause-china/en/>. Accessed April 25, 2020.

2. Bénézit F, et al. Published online ahead of print April 15, 2020. *Lancet Infect Dis*. 10.1016/S1473-3099(20)30297-8.
3. Giacomelli A, et al. *Clin Infect Dis* 2020;71:889–890.
4. Lechien JR, et al. *Eur Arch Otorhinolaryngol* 2020; 277:2251–2261.
5. Mao L, et al. *JAMA Neurol* 2020;77:1–9.
6. Yan CH, et al. *Int Forum Allergy Rhinol* 2020;10:806–813.
7. Wang H, et al. *Ann N Y Acad Sci* 2009;1170:596.
8. Xu H, et al. *Int J Oral Sci* 2020;12:1–5.

Author names in bold designate shared co-first authorship.

Received April 25, 2020. Accepted May 1, 2020.

Correspondence

Address correspondence to: Hemant Goyal, MD, FACP, PGDCA (MBA), The Wright Center for Graduate Medical Education, 501 S. Washington Avenue, Scranton, PA 18505. e-mail: doc.hemant@yahoo.com.

CRedit Authorship Contributions

Muhammad Aziz, MD (Formal analysis: Lead; Writing – original draft: Equal). Abhilash Perisetti, MD FACP (Writing – review & editing: Equal). Wade M. Lee-Smith, MLS, BS (Data curation: Lead). Mahesh Gajendran, MD, MPH, FACP (Writing – review & editing: Equal). Pardeep Bansal, MD FACP (Writing – review & editing: Supporting). Hemant Goyal, MBBS, MD, FACP (Conceptualization: Lead; Writing – review & editing: Lead).

Conflict of interest

The authors disclose no conflicts.