

LETTER TO THE EDITOR

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# A cross-sectional study of olfactory and taste disorders among COVID-19 patients in China

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## Abstract

To determine the prevalence and clinical features of olfactory and taste disorders among coronavirus disease 2019 (COVID-19) patients in China. A cross-sectional study was performed in Wuhan from April 3, 2020 to April 15, 2020. A total of 187 patients with confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) completed face-to-face interviews or telephone follow-ups. We found that the prevalence of olfactory and taste disorders was significantly lower in the Chinese cohort than in foreign COVID-19 cohorts. Females were more prone to olfactory and taste disorders. In some patients, olfactory and taste disorders precede other symptoms and can be used as early screening and warning signs.

**Key words** Coronavirus disease 2019, Severe acute respiratory syndrome coronavirus 2, Olfactory, Taste

Dear Editor,

The spread of coronavirus disease 2019 (COVID-19) infection abroad has highlighted a novel and atypical set of symptoms: olfactory and taste disorders. It was not reported by most of the early studies from China and is still neglected in Chinese COVID-19 patients. Herein, we present the prevalence and clinical features of olfactory and taste disorders among COVID-19 patients in China.

A cross-sectional study was performed in Wuhan from April 3, 2020 to April 15, 2020. A total of 187 patients with confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection were admitted to the General Hospital of Central Theater Command of PLA in Wuhan, and face-to-face interviews or telephone follow-ups were completed. The demographic characteristics of olfactory and taste disorders are shown in Additional file 1: Table S1. The exclusion criteria were patients who were unable to independently complete the questionnaire, patients who had previous olfactory or taste disorders, and patients who were currently in the intensive care unit (ICU). A visual analog scale was used to score the patients'

olfactory status and taste. These data were also collected through online forms of discharged patients. SPSS version 22.0 was used to perform the statistical analysis.

The data analyses have led us to draw the following conclusions. Compared with the foreign cohort, the prevalence of smell and taste disorders in the Chinese cohort was significantly lower (Additional file 1: Table S1). The prevalence of olfactory and taste disorders in COVID-19 patients was higher in females than in males (Additional file 1: Table S1). In some patients, olfactory and taste disorders precede other symptoms and can be used as early screening and warning signs (Additional file 1: Table S2). The recovery of olfactory and taste function was independent of age; females have an easier recovery than males; olfactory or taste disorders were not easy to recover for those who are clinically classified as severe; when the olfactory or taste disorder itself was severe, it was not easy to recover; and olfactory or taste disorders that occurred in the early stage of the disease were more likely to recover than late-stage symptoms (Additional file 1: Table S3).

According to our research results, the incidence of olfactory and taste disorders in Chinese patients is markedly lower than that reported abroad, which is 64.4%[1]. The possible reason may be that the expression of the angiotensin-converting enzyme 2 (ACE2) receptor is different in the nasopharynx between East Asians and Europeans[2]. Increased expression of ACE2 in the nasopharynx may lead to an increased risk of

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olfactory and taste symptoms. The other possible reason is that the virus has mutated during the transmission process, or there are different strains. Different subtypes of viruses have different affinities and neurotoxicity to mucosal receptors in the olfactory and gustatory regions, resulting in differences in their biological behavior[3].

Olfactory disorders were significantly more prevalent among females than among males. The *ACE2* gene is located on the X chromosome, so female individuals should have a higher *ACE2* level[4], which might be the reason why they are more likely to be infected with SARS-CoV-2 than males. In addition, due to the effect of estrogen, women's sense is more sensitive than men's, and women's sense of smell fluctuations more obviously than men's.

The pathophysiology of SARS-CoV-2's influence on the olfactory and taste systems is unclear. Nevertheless, neuroinvasion through the olfactory sensory neurons (OSN) appears to be dominant because these cells are clearly the most susceptible to infection in the nasal cavity, and the olfactory bulb is the first central nervous system (CNS) tissue colonized upon intranasal inoculation[5]. Olfactory or taste disorders in the early stage of disease may trigger a series of early warning mechanisms to quickly mobilize the body's immune system to fight the virus's attack, thereby preventing the virus from further attacking other important tissues and organs. Olfactory or taste disorders in the early stage of the disease may also mean that the host's immune response is strong and effective, which is more conducive to the recovery of function.

Generally, there is no fever, cough or other symptoms in the early stage. These may lead to delays in diagnosis, treatment and further spread of the infections. We would consider olfactory or taste dysfunction as a possible early-warning symptom, especially in the absence of rhinitis. Compared with nucleic acid detection and chest CT, olfactory or taste disorder is a unique screening index because of its simplicity and low cost. Early identification of suspected patients, isolation monitoring, early diagnosis and treatment of COVID-19 patients are of great significance for China and other affected countries to conduct more accurate prevention and more efficient monitoring of COVID-19.

#### Abbreviations

ACE2: Angiotensin-converting enzyme 2; CNS: Central nervous system; COVID-19: Coronavirus disease 2019; ICU: Intensive care unit; OSN: Olfactory sensory neurons; SARS-CoV-2: Severe acute respiratory syndrome coronavirus 2.

#### Supplementary information

The online version contains supplementary material available at

<https://doi.org/10.1186/s40779-021-00339-y>.

**Additional file 1. Table S1.** Demographic characteristics of olfactory and taste dysfunction in 187 COVID-19 patients. **Table S2.** Occurrence time and the corresponding proportion of personnel about olfactory and taste disorders. **Table S3.** Functional recovery vs. non-recovery in COVID-19 patients with olfactory or taste impairments.

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#### Authors' contributions

All authors contributed to the study conception and design. SMY, XBF and CLY supervised the overall study. YS, CCH, FJZ, RYC, and LBZ collected clinical data. JHL and MRL made the table. HY, QL, JJH and XJZ searched the literature. JHL and MRL wrote the manuscript. HY and NY revised the manuscript. All authors read and approved the final manuscript.

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#### Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available due to individual privacy, but are available from the corresponding author on reasonable request.

#### Declarations

##### Ethics approval and consent to participate

This research study was conducted retrospectively from data obtained for clinical purposes. The Medical Ethics Committee of PLA General Hospital has confirmed that no ethical approval is required.

##### Consent for publication

Not applicable.

##### Competing interests

The authors declare that they have no competing interests.

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