Research Article

Awareness of smell exercise after smell dysfunction related to COVID-19 in Alahsaa, Saudi Arabia

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Abstract

Introduction: Coronavirus disease 2019 (COVID-19) is a severe acute respiratory syndrome. Globally, COVID-19 has infected more than 573 million people, with over 6.3 million deaths as of July 27, 2022 [1]. This epidemic was first discovered in Wuhan, China in December 2019. It spreads throughout the world and is transmitted via upper respiratory tract droplet inhalation. The World Health Organization labeled it a global pandemic on March 11, 2020. (WHO) [2]. The Kingdom of Saudi Arabia declared its first case of the virus on the 2nd of March 2020 [3]. According to the WHO, the number of confirmed cases in Saudi Arabia has exceeded 808,053, with 9,240 deaths reported [4]. Some studies reveal that patients typically experience issues with smell and taste disorders (STD), in addition to cold-like symptoms like cough, fever, shortness of breath, sore throat, decrease or loss of smell (hyposmia or anosmia), and decrease or loss in taste (hypogeusia or ageusia) [5]. Olfactory disorders have a strong impact on the quality of life; these impairments affect the ability to perceive odors in foods and the environment, leading to consequences such as malnutrition, weight loss, food poisoning, and depression [6]. Olfactory training (OT) is an innovative, non-invasive intervention for the rehabilitation of olfactory disorders. Evidence has shown the effectiveness of this treatment among patients with olfactory disorders for a variety of reasons [7]. To

Introduction

Coronavirus-2 (SARS-COV-2) or coronavirus disease 2019 (COVID-19), is a severe acute respiratory syndrome. Globally, COVID-19 has infected more than 573 million people, with over 6.3 million deaths as of July 27, 2022 [1]. This epidemic was first discovered in Wuhan, China in December 2019. It spreads throughout the world and is transmitted via upper respiratory tract droplet inhalation. The World Health Organization labeled it a global pandemic on March 11, 2020. (WHO) [2]. The Kingdom of Saudi Arabia declared its first case of the virus on the 2nd of March 2020 [3]. According to the WHO, the number of confirmed cases in Saudi Arabia has exceeded 808,053, with

Keywords: Hyposmia; Anosmia; Hypogeusia; Ageusia; STD; COVID-19

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the best of our knowledge, no previous study has investigated the prevalence of COVID-19–related anosmia, hyposmia, and parosmia and awareness of smell exercises in the Alahsaa region; we aim to do that here.

Methodology

A cross-sectional study design using a “Google Form” was adopted to estimate the prevalence of COVID-19–related anosmia, hyposmia, and parosmia among the patients in Alahsaa City, Saudi Arabia during the outbreak of COVID-19 and establish the level of awareness of smell exercises. Data were collected from Jan 10, 2022, to Feb 16, 2022, a self-reported retrospective study was conducted using a standardized questionnaire that included demographic information, vaccination status, level of loss of smell and taste, and the level of awareness about smell training. The sample size was determined to be 535 COVID-19–infected patients. The representative sample size was calculated using the following statistical formula: 95% confidence interval; margin of error was 5%. Patients who were infected with COVID-19 in Alahsaa City participated in the selection criteria. All participants younger than 18 years or older than 60 years who were not infected with COVID-19 or who did not fully answer the questionnaires were excluded.

Statistical analysis

Descriptive statistics were presented as numbers and percentages. The prevalence of smell dysfunction was grouped depending on the vaccination status. The association between the vaccination status and the prevalence of smell dysfunction has been established using a Chi-square test. Based on the significant results, a multivariate regression model was constructed to determine the significant independent factor associated with the level of awareness of a smell exercise with a corresponding odds ratio and a 95% confidence interval. Two-tailed analyses were used, with p < 0.05 as a statistical significance cutoff. All data analyses were performed using the statistical package for social sciences, version 26 (SPSS, Armonk, NY: IBM Corp, USA).

Results

We approached 535 COVID-19–infected patients, and out of this, 524 patients gave consent to participate in the study. The baseline characteristics of the participants showed that 40.3% belonged to the age group of 18–60 years, 66% were females, and 46.2% were infected with COVID-19 before taking the vaccine. It was reported that 19.3%, 29.2%, and 16% were reported to be infected with COVID-19 after the first, second, and third doses, respectively. The most commonly reported complaint in infected patients was malaise (63.9%), followed by headache (55.7%), fever (54.2%), chills (35.1%), and cough (25.8%). Nasal congestion and Rhinorrhea were reported in 14.9% and 19.1%, respectively. The source of COVID-19 infection was identifiable in 273 patients, and it was found that 84.5% of the patients had recovered from the infection during the time of this study (Table 1).

About 287 (54.8%) patients reported chemosensory impairment, where olfactory dysfunction was seen in 286 (54.6%) and gustatory dysfunction in 275 (52.5%) patients. Anosmia and parosmia were reported in 156 and 42 patients, respectively, among olfactory changes. In patients who had olfactory disturbances, about 11.9% had it lasted more than 61 days, whereas 45.1% and 23.4% had it for 1–7 days and 8–14 days, respectively. The mean degree of olfactory dysfunction was found to be 4.76 ± 3.16 (95% CI = 4.4–5.1). Gustatory dysfunction was reported in 275 patients (52.4%), where ageusia, dysgeusia, and hypogeusia were seen in 21.2%, 12.6%, and 18.7% of the patients. In patients who had gustatory disturbances, about 5.1% had it lasted more than 61 days, whereas 51.3% and 24% had it for 1–7 days and 8–14 days, respectively. The mean degree of gustatory dysfunction was found to be 5.4 ± 2.8 (95% CI = 5.1–5.7). Only 12 patients (4.2%) were in a hospitalized condition when olfactory and gustatory dysfunctions were observed. About 59.9% of these dysfunctions were observed after diagnosis of COVID-19 infection, and 64.8% reported other symptoms along with these dysfunctions. Among patients who had olfactory and gustatory dysfunctions, 33.1% reported that their health condition worsened, whereas 60.6% said that it was improved. These olfactory and gustatory dysfunctions were reported to be resolved in 88.2% of the patients (Table 2).

| Table 1: Baseline characteristics of the patients (n = 524). |
|---|---|---|
| Age (Years) | Frequency | Percent |
| 18-25 | 211 | 40.3 |
| 26-35 | 105 | 20.0 |
| 36-45 | 122 | 23.3 |
| 46 and more | 86 | 16.4 |
| Gender | | |
| Female | 346 | 66.0 |
| Male | 178 | 34.0 |
| Infected with COVID-19 before taking vaccine | 242 | 46.2 |
| Infected with COVID-19 after taking first dose | 101 | 19.3 |
| Infected with COVID-19 after taking second dose | 153 | 29.2 |
| Infected with COVID-19 after taking third dose | 84 | 16.0 |
| Complaints reported by the patients | | |
| Fever | 284 | 54.2 |
| Chills | 184 | 35.1 |
| Malaise | 335 | 63.9 |
| Cough | 135 | 25.8 |
| Headache | 292 | 55.7 |
| Nasal congestion | 78 | 14.9 |
| Rhinorrhea | 100 | 19.1 |
| Gastrointestinal distress | 56 | 10.7 |
| Pneumonia | 55 | 10.5 |
| Other | 12 | 19.8 |
| None | 59 | 11.3 |
| COVID-19 infection source identifiable | 273 | 52.1 |
| Current COVID-19 infection status | | |
| Active | 81 | 15.5 |
| Recovered | 443 | 84.5 |
| Patients received treatment | 199 | 38 |

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Table 2: Olfactory and gustatory dysfunctions characteristics.

| Chemosensory dysfunction (CD) reported | N   | %    |
|----------------------------------------|-----|------|
| Anosmia                                | 156 | 29.8 |
| Hyposmia                               | 88  | 16.8 |
| Parosmia                                | 42  | 8    |
| No change                              | 238 | 45.4 |

Duration of olfactory dysfunction (n = 286)

| Duration of olfactory dysfunction | N   | %    |
|-----------------------------------|-----|------|
| 1 – 7 days                         | 129 | 45.1 |
| 8 – 14 days                        | 67  | 23.4 |
| 15 -21 days                       | 17  | 5.9  |
| 22 -29 days                       | 16  | 5.6  |
| 30-37 days                        | 10  | 3.5  |
| 38-45 days                        | 7   | 2.4  |
| 46-52 days                        | 2   | 0.7  |
| 53-60 days                        | 4   | 1.4  |
| 61 days and more                  | 34  | 11.9 |

The degree of olfactory dysfunction

| Gustatory changes |
|-------------------|
| Ageusia           | 111  |
| Dysgeusia         | 66   |
| Hypogeusia        | 98   |
| No change         | 249  |

Duration of olfactory dysfunction (n = 286)

| Duration of olfactory dysfunction | N   | %    |
|-----------------------------------|-----|------|
| 1 – 7 days                         | 141 | 51.3 |
| 8 – 14 days                        | 66  | 24   |
| 15 -21 days                       | 16  | 5.8  |
| 22 -29 days                       | 16  | 5.8  |
| 30-37 days                        | 7   | 2.5  |
| 38-45 days                        | 6   | 2.2  |
| 46-52 days                        | 4   | 1.5  |
| 53-60 days                        | 5   | 1.8  |
| 61 days and more                  | 14  | 5.1  |

The degree of olfactory dysfunction

| Condition of the patient at the time of Olfactory and gustatory changes |
|------------------------------------------------------------------------|
| Inpatient / hospitalized                                              | 12  |
| Outpatient                                                            | 275 |

Time of Olfactory and gustatory changes observed

| Time of Olfactory and gustatory changes observed             |
|--------------------------------------------------------------|
| After diagnosis                                              | 172 |
| Before diagnosis                                             | 115 |

Other symptoms reported during Olfactory and gustatory dysfunction

| Reported symptoms (n = 186) |
|-----------------------------|
| Fever                       | 119 |
| Chills                      | 62  |
| Malaise                     | 83  |
| Cough                       | 101 |
| Headache                    | 131 |
| Nasal congestion            | 82  |
| Rhinorrhea                  | 75  |
| Gastrointestinal distress   | 49  |
| Pneumonia                   | 20  |
| Other                       | 7   |

Condition of the patients after the Olfactory and gustatory changes was observed

| Condition of the patients after the Olfactory and gustatory changes |
|---------------------------------------------------------------------|
| No change                                                           | 18  |
| Worsened                                                            | 95  |
| Improved                                                            | 174 |
|                       |

Status of olfactory and gustatory dysfunction

| Status of olfactory and gustatory dysfunction |
|---------------------------------------------|
| Not resolved                                | 34  |
| Resolve                                    | 253 |

the prevalence of OD and GD was markedly higher in patients who got infected with COVID-19 after taking the first dose (p < 0.001). It was found the prevalence of OD and GD was comparatively less when got infected with COVID-19 after taking the third dose (p < 0.05) (Table 3).

When we assessed the awareness of the smelling exercise, it was found that only 115 patients (21.9%) were aware of this exercise, and among these, 59% correctly identified the definition of smell exercise. It was agreed by 47.9% of the participants that smell exercise aims to help recovery based on neuroplasticity. About 49 patients (61.3%) practiced smell exercise, and 55% reported improvement after this exercise. It was reported by 69.4% that they practiced this exercise for 1–7 days, whereas 4.1% did it for 53–60 days. About 46.9% reported that it took 1–7 days to get recovery after smell exercise, whereas 8.2% recovered after 53–60 days only (Table 4).

Discussion

Chemosensory dysfunction (CD) such as olfactory dysfunction (OD) and gustatory dysfunction (GD) are commonly reported symptoms in COVID-19 patients [8]. Unpublished statistical data and anecdotal findings claim that these CD symptoms resolve within 2–3 weeks. However, due to a lack of long-term follow-up, the percentage of patients who suffer chronic post-infectious CD is uncertain. In patients with recent-onset acute olfactory and/or gustatory dysfunction, with or without accompanying symptoms of COVID-19, self-isolation and SARS-CoV-2 testing should be done as soon as possible. Chemosensory assessment of smell and taste should be considered in patients who require urgent hospitalization (e.g., breathing difficulties) only when clinical conditions permit and adequate PPE is available [9]. Olfactory training (OT), commonly known as smell exercise, entails the deliberate and repeated sniffing of various natural odorants such as eucalyptus, lemon, cloves, or rose for 20–30 seconds minimum twice daily for at least 90 days. Evidence shows OT effectively improved post-infectious OD in COVID-19 patients [10]. Patients with chronic COVID-19-related OD may benefit from olfactory training, which is simple, economical, and has few side effects. The current study findings showed that more than half of the patients (54.8%) had experienced olfactory and/or gustatory dysfunction. A meta-analysis estimated alteration of the sense of smell or taste prevalence to be 47% [11]. In Saudi Arabia, smell loss was reported in 62% of the patients with a mean persistence of 15.9 days, whereas 55% of the patients showed loss of taste [12]. Another study done in India by Gupta et al. reported OD and GD prevalence to be 43.15% and 39.53%, respectively [13]. In our study, anosmia was the commonly reported OD, and ageusia was the commonly reported GD. An accumulating amount of anecdotal evidence suggests that anosmia, hyposmia, ageusia, and dysgeusia may all be potential signs of SARS-CoV-2 infection, either independently or in conjunction with conventional symptoms. According to research by Moein et al., the incidence of anosmia in patients who were positive for COVID-19 was as high as 98%, and 63 percent of patients were unaware of their anosmia [14]. In our study, 11.8% of the
patients had reported they had not resolved from CD. Even before COVID–19, viral infections were the most common cause of persistent anosmia [15], but the pandemic amplified these issues dramatically as evidence shows that up to 67% of the symptomatic COVID–19 patients experience CD [16–18]. In addition, the CD has been found to be a common symptom in reinfections [19] and in cases of COVID–19 infection in people who have been vaccinated [20]. A longitudinal study done by Herman et al. reported that the prevalence of OD after two weeks and four weeks of immunization was 9.95% and 5.43%, respectively, and the prevalence increased to 69% when people got infected after 14 days of taking the vaccine [21]. Evidence shows that post–infectious OD might be related to immune–mediated processes, whereas anti–nuclear antibodies were considerably higher in individuals with olfactory impairment than in controls following viral infection [22] The awareness regarding olfactory training (OT) was observed in only 21.9% of the patients, and among this, 59% knew how to do it. Only 28% of the patients who had OD were aware of this training, and among this, 61.3% reported that they performed this exercise. OT has been used to effectively treat smell impairments caused by upper respiratory tract illness, dramatically improving odor discrimination and recognition abilities [23]. It has also been reported that OT helps in reducing depression symptoms in people with OD [24]. OT is an effective and low–cost non–pharmacological therapy for post–viral OD when there is a lack of specific pharmacologic therapies [18]. Our study findings showed that 55% benefited from OT in improving olfactory functions, and 67.3% recovered from OD within two weeks (<14 days).

Research suggests that the majority of patients will be able to return to their normal sense of smell within 14 days of completing their OT. Our study findings are consistent with the one reported by Lechien et al., which showed that 67.8% of the anosmia patients recovered olfactory function and 25.5% recovered from both OD and GD within less than two weeks after the resolution of conventional symptoms. Nevertheless, there are several notable limitations to our study. Firstly, a self–administered questionnaire to collect the data, and this retrospective method of data collection could have resulted in recall bias and, to some extent, social desirability bias. Also, self–reported health measures could give false negative and false positive reports leading to underestimation and overestimation, respectively. Thus, this type of reporting should be interpreted with caution.

## Conclusion

The prevalence of olfactory dysfunction and gustatory dysfunction was found to be 54.6% and 52.5%, respectively. The incidence of olfactory and gustatory dysfunctions was significantly higher when the patients got infected before taking the vaccine and after taking the first dose when compared to the incidence after taking the second and third doses, respectively. The awareness of olfactory training was moderately low among the COVID–19 infected, where 28% of the patients who had experienced olfactory disturbances were of this training. Active, collaborative research is

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**Table 3: Relationship of Chemosensory dysfunction with baseline characteristics.**

| Age     | Olfactory dysfunction (Present) | Olfactory dysfunction (Absent) | Gustatory dysfunction (Present) | Gustatory dysfunction (Absent) | p value* |
|---------|-------------------------------|-------------------------------|---------------------------------|---------------------------------|---------|
| 18-25   | 104                           | 107                           | 98                              | 113                             | 0.093   |
|         | 49.3%                         | 50.7%                         | 46.4%                           | 53.6%                           |         |
| 26-35   | 65                            | 40                            | 61                              | 44                              | 0.087   |
|         | 61.9%                         | 38.1%                         | 58.1%                           | 41.9%                           |         |
| 36-45   | 73                            | 49                            | 72                              | 50                              | <0.001  |
|         | 59.8%                         | 40.2%                         | 59.0%                           | 41.0%                           |         |
| 46 and more | 51.2%                       | 48.8%                         | 51.2%                           | 48.8%                           | <0.001  |

* p value <0.05 is considered statistically significant.

**Table 4: Knowledge and practices related to smell exercise.**

| Awareness of smell exercise (n = 524) | N | % |
|--------------------------------------|---|---|
| No                                   | 409 | 78.1 |
| Yes                                  | 115 | 21.9 |

| Definition of smell exercise (n = 115) | No | 47 | 41 |
| Definition of smell exercise (n = 115) | Yes | 68 | 59 |

| Smell exercise aims to help recovery based on neuropathology (n = 115) | No | 60 | 52.1 |
| Smell exercise aims to help recovery based on neuropathology (n = 115) | Yes | 55 | 47.9 |

| Awareness of smell exercise in patients who experiences smell changes (n = 286) | No | 206 | 72 |
| Awareness of smell exercise in patients who experiences smell changes (n = 286) | Yes | 80 | 28 |

| Practiced smell exercise (n = 80) | No | 31 | 38.8 |
| Practiced smell exercise (n = 80) | Yes | 49 | 61.3 |

| Olfactory dysfunction improved after smell exercise (n = 80) | No | 36 | 45.0 |
| Olfactory dysfunction improved after smell exercise (n = 80) | Yes | 44 | 55.0 |

| Duration of practicing smell exercise (n = 80) | 1-7 days | 34 | 69.4 |
| Duration of practicing smell exercise (n = 80) | 8-14 days | 8 | 16.3 |
| Duration of practicing smell exercise (n = 80) | 15-21 days | 2 | 4.1 |
| Duration of practicing smell exercise (n = 80) | 22-29 days | 1 | 2.00 |
| Duration of practicing smell exercise (n = 80) | 30-37 days | 2 | 4.1 |
| Duration of practicing smell exercise (n = 80) | 46-52 days | 2 | 4.1 |

| Time taken to reach recovery after performing smell exercise (n = 80) | 1-7 days | 23 | 46.9 |
| Time taken to reach recovery after performing smell exercise (n = 80) | 8-14 days | 10 | 20.4 |
| Time taken to reach recovery after performing smell exercise (n = 80) | 15-21 days | 3 | 6.1 |
| Time taken to reach recovery after performing smell exercise (n = 80) | 22-29 days | 2 | 4.1 |
| Time taken to reach recovery after performing smell exercise (n = 80) | 30-37 days | 4 | 8.2 |
| Time taken to reach recovery after performing smell exercise (n = 80) | 46-52 days | 3 | 6.1 |
| Time taken to reach recovery after performing smell exercise (n = 80) | 53-60 days | 4 | 8.2 |
essential to describe the natural history and effective therapy of chemosensory impairment in COVID-19. Anosmia and ageusia are complaints that warrant additional investigation during a patient encounter, given the rising evidence of their relationship with COVID-19. Comprehensive screening and prophylaxis must be performed to prevent nosocomial and community infection.

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**Statement of ethics**

This study protocol was reviewed and approved by King Faisal University, approval number [KFU-REC-2021-DEC-EA000286]. Informed consent was obtained from all participants.

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**Author contributions**

KAA, AAA, AKD, AFA, SMA, and FKA conceptualized the study, contributed to data interpretation, and revised and finalized the manuscript. AFA and SMA contributed to statistical analysis and drafted the manuscript; AKD, AA, KA, and FKA contributed to drafting and revising the article. All authors have read and approved the published version of the manuscript.

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