



Impact of the smell loss on the quality of life and adopted coping strategies in COVID-19 patients

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Abstract

Purpose To study the impact of smell loss on quality of life in patients with Coronavirus Disease 2019 (COVID-19), and assess the importance of olfaction before and after the loss of smell. In addition, to assess the impact of smell loss on psychological well-being and distress, and to assess coping strategies used by COVID-19 patients with smell loss.

Methods This study was a cross-sectional study. A total of 487 COVID-19 positive patients with anosmia were recruited. All participants filled in the validated Multi-Clinic Smell and Taste Questionnaire, and the validated General Well-being Schedule.

Results Negative impacts of smell loss, associated risks, interference with daily activities, and deterioration in well-being were common. The importance of the sense of smell was evaluated (In relation to other senses) as higher in the period after the loss than before the loss ($p < 0.001$). All aspects of health-related QOL are statistically significant ($p < 0.001$), with the exception of financial security and friendship, which are not statistically significant ($p = 0.129$, $p = 0.334$), respectively. Psychological well-being was negatively affected, and the use of both problem- and emotion-focused strategies was common.

Conclusion COVID-19 Patients with loss of smell have significant reductions in health-related QOL. Their loss of smell directly affects daily activities related to the olfactory function. Therefore, priority should be given to diagnose and treat the loss of smell. Patients who have recently developed smell loss may be offered a combination of the problem- and emotion-focused strategies to cope with their condition.

Keywords COVID-19 · Smell · Quality of life · Olfaction · Coping

Introduction

Coronaviruses (Co-Vs), which include Severe Acute Respiratory Syndrome (SARS-CoV-2), are the principal cause of the existing pandemic of coronavirus disease 2019 (COVID-19) and have a predilection for neuro-invasion. Olfactory neurons are presently being researched as a portal of entry and spread of Co-Vs through a trans neural route [1]. The

human strains of Co-Vs have been demonstrated to attack the central nervous system through the neuroepithelium and spread from inside the olfactory bulb [2].

SARS-CoV-2 affects people of all ages and genders. The symptoms range from asymptomatic to lethal infection [3]. Recently, olfactory and gustatory dysfunctions have been established to be related to COVID-19 infection. Now, in ambulatory populations, patients who complain of anosmia and influenza-like symptoms are six to ten times more likely to test positive for a COVID-19 infection [4]. This olfactory dysfunction is due to the direct destruction of the olfactory epithelium, which prohibits odours from binding to olfactory receptors in the olfactory epithelium [5]. Certainly, Xie et al. and Sutton et al. investigated the prevalence of smell and taste loss in COVID-19 positive patients and found that the prevalence is highly variable, ranging between 5, and 48% [6, 7]. Because of the benignity of the symptoms, under-reporting was likely to occur. In addition, other studies

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have declared that the prevalence of smell and taste loss in COVID-19 positive patients is 59–86% [8, 9].

Sense of smell is an essential chemical alarming system that regulates the intake of food and is participated in interpersonal relations. Unfavourable effects in patients with olfactory loss have been reported, including decreased pleasure in food, poor appetite, trouble with cooking and detecting spoiled food, alteration in body weight, reduced safety, doubts about personal hygiene, feelings of vulnerability, mood changes, depression and deterioration in social interactions, work life and sexual life [10]. Patients with olfactory loss disclose difficulties in everyday activities and a decrease in the quality of life (QOL) as a result of the loss of smell [11]. QOL is the level of well-being felt by a group of people or an individual or, ‘the functional impacts of sickness and its treatment upon a patient, as recognized by the patient himself’ [12].

Olfactory deprivation for a month may be not serious. But if the deprivation lasts more than two months, it starts to become a problem. If the loss of smell persists for a long time, the QOL is affected. Olfactory loss in COVID-19 patients is usually severe and sudden, but it is temporary in most patients, although 10.6% of patients do not recover within one month [13]. Hufnagl et al. established negative effects in the enjoyment of food, personal hygiene, matters of safety, mood, sexual life and social interaction in patients with smell loss [14]. Therefore, coping strategies have played a key role in dealing with ordinary disorders and problems, mainly in patients with loss of smell, since treatment is limited or non-existent [15].

Therefore, the study aims to investigate the impacts of smell loss in COVID-19 patients in relation to QOL, and to assess the importance of olfaction before and after the loss of smell. In addition, to assess the impact of smell loss on psychological well-being and distress, and coping strategies used by COVID-19 patients with smell loss.

Methodology

Study design and subjects

The current study was a cross-sectional study utilizing an online self-reported questionnaire survey that was conveyed through: emails, shared in faculties official pages, and social media platforms (e.g., Facebook™, WhatsApp and Twitter™). Data were collected from July 13th until September 8th, 2020. The participants of this study were 487 COVID-19 positive patients with loss of smell. Investment in the online questionnaire was intentional and participants had no compensation.

The inclusion criteria established for this research are:

1. Patients with a positive diagnosis of COVID-19, confirmed by PCR results, manifested by anosmia lasting more than two months.
2. Patients with a subjective scale of the olfactory function 0 points.
3. Age more than 18 years old.
4. Ability to read and understand questions as the survey was distributed electronically.

The exclusion criteria are:

1. COVID-19 patients without loss of smell.
2. Any other manifestation of COVID-19 besides the loss of smell.
3. People with a loss of smell for reasons other than COVID-19.
4. Patients with parosmia and/or phantosmia.
5. Patients below 18 years old.
6. Patients with known chronic conditions or disabilities (physical or mental) that affect QOL.

The questionnaire ended automatically if the participant did not meet the inclusion criteria or had the exclusion criteria using branching logic. Initially, the questionnaire was pilot tested on a group of 20 patients to assess the comprehension, content and clarity of the questionnaire.

Procedure

Researches prepared online questionnaire survey forms that consist of many sections. The first section includes sociodemographic information to determine the age and gender, if their smell loss due to COVID-19, and the threshold values for impairment of subjective olfactory functioning, that were assessed on an 11-point scale from 0 (no smell) to 10 (the best possible) [11]. The second section consists of questions from the Multi-Clinic Smell and Taste Questionnaire [16] that incorporates (1) questions to evaluate self-revealed anosmia, besides questions related to the outcomes of smell loss (Table 1). (2) questions concerning the importance of the sense of smell (Table 2), these were appraised on a 6-point scale extending from 0 (No importance) to 5 (Very large importance). (3) questions regarding QOL (Table 3), these questions include, ‘How significant are the following aspects for your QOL: physical health, work-life, financial security, partnership, friendship, leisure, and emotional stability?’ Each point had to be valued on a 6-point scale from 0 (not at all important) to 5 (very important), and also involve, ‘How much has the loss of smell affected the related parts of your QOL: physical health, work-life, financial security, partnership, friendship, leisure, and emotional stability?’ Each answer was to be valued on an 11-point scale from

Table 1 Questions and responses (%) about self-reported anosmia, as well as questions pertaining to the consequences of smell loss

Question	Response (%)
Has the quality of your life declined in general since you lost your sense of smell?	
Yes	76
No	24
Has your smell loss had any negative effects? If so, what is the most negative effect? ^a	
Less aware of personal hygiene	38
Less interested in food and drink	23
Less appreciation of nature	2.9
Poorer quality of life in general	3.7
Unable to perceive fire/smoke	3.5
Less emotional satisfaction	0.6
General feeling of uncertainty	1.2
Less satisfied with the profession	0.4
Has your smell loss had any positive effects? If so, what is the most positive effect? ^a	
No longer bothered by unpleasant odors	20.7
Have no need to buy perfume	2.9
Do you perceive any risks associated with your smell loss?	
If so, what is the main risk? ^a	
Failure to perceive fire/smoke	53.5
Failure to perceive rancid/ill-smelling food	14.2
Failure to perceive dangerous chemicals/gases	5.2
Does your smell loss interfere with your daily activities?	
If so, what is the main type of interference? ^{a,b}	
Difficulties in cooking	24.5
Problems with eating	14.6
Feel obliged to wash myself/my home more often	2.7
Difficulties in using perfume/after shave	2.5
Need to change leisure/spare-time activities	0.8
Reduced ability to do professional work	0.9
Seek clean air more often	2.1
Difficulties in mixing with friends	0.8
Has your smell loss affected your well-being? If so, what is the main effect? ^{a,b}	
Depression	15.8
Poorer general well-being	5.6
Irritability	3.6
Asthmatic reactions more often	1.1
How has your smell loss affected your ability to taste/enjoy food? ^b	
Improved	2.7
No change	10.9
Diminished	84.6
How has your smell loss affected your appetite? ^b	
Improved	3.1
No change	30.4
Worsened	66.5

^aOpen-ended question^bEvaluated regarding comprehension and reliability [16]

– 5 (very extensive deterioration), to 0 (no change at all) to 5 (very extensive improvement). The Multi-Clinic Smell and Taste Questionnaire has been shown to have good test–retest reliability, internal consistency, validity [16].

The last section of the questionnaire consists of the General Well-Being Schedule (GWBS) [17]. That includes questions for evaluating psychological well-being and distress & questions about coping strategies with the smell loss.

Table 2 Questions and responses (%) about the importance of the sense of smell

(a) Has your view concerning the importance of your sense of smell changed since you lost your sense of smell? ^a If so, how? ^b	
It has become less important	3.1
It has become more important	87.7
My opinion has not changed	9.2
(b) How important did you think your sense of smell was in relation to your other senses (hearing, vision, touch and taste) before you lost your sense of smell? (median) ^c	4
How important did you find your sense of smell to be in relation to your other senses (hearing, vision, touch and taste) after you lost your sense of smell? (median) ^c	5

^aOpen-ended question^bEvaluated regarding comprehension and reliability[16]^c(b) The importance of the sense of smell was rated on a 6-point scale ranging from 0, No importance, to 5, very large importance**Table 3** Questions and responses as medians (interquartile range) and *p* value about aspects of health-related quality of life

Question	Responses as median (interquartile range)	<i>p</i> value
How important are the following aspects for your quality of life? ^a		
Physical health	5.0 (1.0)	0.000*
Financial security	4.0 (1.0)	0.000*
Work life	3.0 (2.0)	0.025*
Partnership	3.0 (1.0)	0.000*
Friendship	3.0 (1.0)	0.036*
Emotional stability	4.0 (2.0)	0.033*
Leisure	4.0 (1.0)	0.030*
To what extent has your smell loss affected the following aspects of your quality of life? ^b		
Physical health	− 2.0 (2.0)	0.000*
Financial security	0.0 (1.0)	0.129
Work life	− 1.0 (3.0)	0.000*
Partnership	− 1.0 (3.0)	0.000*
Friendship	0.0 (3.0)	0.334
Emotional stability	− 1.0 (3.0)	0.000*
Leisure	− 2.0 (3.0)	0.000*

**p* < 0.05: significant. *p* ≥ 0.05: nonsignificant^aRated on a six-point scale ranging from ‘not at all important, 0’ to ‘very important, 5’^bRated on an 11-point scale ranging from ‘very extensive deterioration, −5’ to ‘no change at all, 0’, to ‘very extensive improvement, 5’

The scores of GWBS ranges between 0 and 110 [It can be mentioned that patients have a ‘positive wellbeing’ (scores 73–110), a ‘moderate distress’ (scores 61–72), and a ‘severe distress’ (scores 0–60)]. It has been shown to have good test–retest reliability, internal consistency, validity [18] and it has normative data [19].

The GWBS includes five problem-oriented and six emotion-oriented questions about the use of coping strategies for the loss of smell, which were used with yes or no answers. Emotional strategies and problem-based information-seeking strategies are commonly used to deal with situations in general, while the other four problem-oriented strategies can be seen as specific to the loss of smell.

Statistical analysis

Data were analyzed by the Statistical Package of Social Science (SPSS), software version 26.0 (SPSS Inc., 2019). The normality of data distribution was checked using the Shapiro–Wilk *W* test. Chi-square test was used to analyze data on psychological well-being and distress. One-sample sign tests were used to analyze the QOL data. Wilcoxon’s matched-pairs signed-ranks test was used to analyze the importance of the sense of smell before and after the smell loss. The level of significance was set at 0.05.

Ethical consideration

All ethical considerations were completed before the study. Ethical approval from the Medical University Research Center has been requested (IRB No. 20-0264, July 13th, 2020). Informed consent was obtained before each participant answered the online questionnaire. Thus, potential participants were made aware of the purpose and the content of the study before entering the study. After being fully instructed and acknowledging the principle of anonymity and unlinking, along with other ethical considerations, they answered questions online out of their own accord. Consent was recorded electronically at the start of the survey, all participants agreed to the purpose of the survey and contributed to this online survey.

Result

Baseline characteristics of the study group

This study included 487 patients who tested positive for COVID-19 with anosmia. The study sample consisted of 370 (76%) females and 117 (24%) males. The average age was 31.4 ± 9.7 years.

Consequences of smell loss

Table 1 shows the distribution of answers about the effects of loss of smell. About 76% of patients noted a decrease in their QOL. The negative effects were reported by 73.3%, who were most concerned about the attentiveness of personal hygiene, interest in food, and drinks. While the positive effects were reported by 23.6% who were not disturbed by unpleasant odors, and do not need to buy perfume. Answers to questions about associated risks were reported by 72.9% of patients, interventions of the loss of smell during daily activities were reported by 48.9%, and the effect on well-being was reported by 26.1%. When asked about food intake, 84.6% said their ability to taste or enjoy food had decreased, and 66.5% said their appetite had worsened.

The importance of smell

Table 2 shows that 87.7% of patients answered, that they became more concerned about the importance of smell after the loss. The importance of the sense of smell was evaluated (In relation to other senses) as higher in the period after the loss than before the loss, as evidenced by the Wilcoxon's matched-pairs signed-ranks test [$Z = -8.62$, $p < 0.001$].

Impact of smell loss on QOL

Table 3 shows the median (interquartile range) assessments of the importance of aspects of QOL, which suggests that all the seven aspects were important for QOL, as confirmed by one-sample sign tests. Table 3 also shows to what extent the loss of smell has affected these aspects of QOL. One-sample sign test shows that all aspects are statistically significant ($p < 0.001$), with the exception of financial security and friendship, which are not statistically significant ($p = 0.129$, $p = 0.334$), respectively.

Coping with loss of smell

The mean \pm standard error of psychological well-being and distress on the GWBS scale were 69.73 ± 20.98 . According to these estimates, 47% of patients were categorized as 'positive well-being' (scores 73–110), 23% as 'moderate distress' (scores 61–72), and 30% as 'severe distress' (scores 0–60). These percentages were compared with the standard data for the population [19], which are 71%, 15%, and 14%, respectively. Chi-square analysis gives a significant difference in the distribution of the three categories between patient and normative data [$\chi^2(2) = 12.73$, $p < 0.05$].

The most common problem-focused strategy was to let a relative to taste food that might have been rotten (69.4%), other strategies were, Do you ask a family member whether you have just enough perfume/aftershave? (49.7%), have you looked for information about your smell loss? (33.3%), Do you avoid meeting other people? (6%), and Have you found solutions to problems caused by your smell loss? (6%). The most common emotion-focused strategy was to try to accept the situation (61.4%), other strategies were, Do you compare your problems with those who are worse off? (47.8%), Do you try not to think about your smell loss? (23%), Do you seek support from family members? (30%), Do you try to concentrate on the advantages of your smell loss? (8%), and Do you try to reprioritize how important different things are to you? (7%).

Discussion

Smell loss significantly impacts patients' lives. It is difficult for the normosmic individual to imagine what life would be without the sense of smell [20]. Certain viruses such as rhinovirus, parainfluenza virus, and coronavirus (SARS-CoV-2) [21] can cause post-viral loss of smell via processes other than the obstruction of the olfactory clefts, indicating a certain affinity of these viruses for olfactory neuroepithelium [22]. To the best of our knowledge, there

is no QOL literature related to the loss of smell in patients with COVID-19.

The results of this study indicate that the overall aspects of QOL deteriorate after the onset of smell loss, as 76% of the patients indicated. This percentage is higher than the 67% quoted by Blomqvist et al. [23] in their study. Concerning the effects of the loss of smell, this study discovered only the main effects, which are depicted in Table 1. Regarding the negative effects of the loss of smell, 38% of the patients chose ‘less aware of own hygiene’, as also noted by Temmel et al., Blomqvist et al., and Nordin et al. in 41%, 36% and 19% of their patients, respectively [23–25]. The second main negative effect is ‘less interest in food and drink’, which was indicated by 23% of the patients. ‘Less interest in food and drink’ was also reported by Blomqvist et al., Nordin et al., and Ferris et al. in 21%, 15% and 69% of their patients, respectively [23, 25, 26]. ‘No longer bothered by unpleasant odours’ was considered the most frequent benefit, experienced by 20.7% of patients. However, the fact that most patients did not choose this option may be due to the realization that foul odours can be toxic or dangerous, and, therefore, it is important to perceive sensory warning through the sense of smell. Another study demonstrated that 38% of the patients chose ‘no longer bothered by unpleasant odours’ as the most frequent benefit [25].

Working again! The principal threat associated with the loss of smell is the inability to detect gas, fire, or smoke, which were symptoms indicated by 53.5% of the patients in this study. Additionally, Miwa et al., Blomqvist et al., and Nordin et al. stated that 61%, 42%, and 38%, correspondingly, of the patients were also unable to detect the fumes of gas, fire, or smoke [23, 25, 27]. In contrast, Haxel et al. reported that only 20% of patients stated that they were unable to detect smoke from a fire [28]. Nonetheless, these deficiencies in the ability to smell can affect patient safety and may cause a multitude of side effects that must be taken with caution in advance so as not to harm patients.

Regarding the disruption of daily activities, 24.5% of patients reported difficulties with the preparation of food and 14.6% reported troubles with eating. Although these struggles were not disclosed by all participants, these types of issues can affect an individual’s level of independence, leading to occupational deprivation. This is especially true for mothers, housewives, and other individuals whose work may involve cooking. A decrease in the ability to taste and experience the enjoyment of eating, as noted with 84.6% of patients, resulted in a decrease in appetite in 66.5% of patients. A diminished desire for food was also reported by 32%, 27%, and even 56% of the patients in other studies, respectively [23–25]. Complaints of taste loss in COVID-19 patients are likely to reflect disruptions in the olfactory system, rather than disrupt the taste afferents or taste buds. Thus, the majority of people who clinically complain of loss

of taste actually exhibit olfactory loss, including those with viral etiology [29]. Loss of appetite itself is considered a major issue, as it can lead to malnutrition and weakness, as well as affect the general health of patients. Depression was the most frequently disclosed symptom affecting well-being, which was reported by 15.8% of patients.

It can be concluded that COVID-19 patients with a loss of smell experience limitations in daily life and professional activities, the pleasure of food and drink, communication, intimate relationships, and even the perception of warning signals related to the ability to smell. Correspondingly, previous reports have also shown that patients with olfactory loss have problems in daily life circumstances relating to smell [30, 31].

This research focused on the importance of smell. The results clearly show that the sense of smell becomes more important after the loss of it, as reported by 87.7% of patients as shown in Table 2. This opinion is also supported by the assessment of smell in relation to other senses (sight, hearing, touch, and taste). Thus, continually concluding that the sense of smell was judged to be much more important after the loss than before as ($p < 0.001$) although this result should be interpreted carefully due to the reverse nature of both questions. Nevertheless, the results regarding the importance of smell are consistent with other studies [23, 25].

All participants in this study were united in the opinion that all seven aspects of health-related QOL are important ($p < 0.05$), as shown in Table 3. An assessment of health-related QOL using the Multi-Clinical Smell and Taste Questionnaire clearly demonstrated that COVID-19 patients with a loss of smell experienced significant effects on physical health, work-life, partnerships, emotional stability, and leisure ($p < 0.001$). Financial security ($p = 0.129$) and friendship ($p = 0.334$), however, were not significantly affected. In line with this study, Blomqvist et al. stated that all aspects of health-related QOL were statistically significant, except for financial security [23]; Nordin et al. stated that all seven aspects were significantly affected [25]. There was no effect of age or gender on any of the aspects of health-related QOL. The lack of association between health-related QOL on age and gender was unexpected, due to the known effects of age and gender on olfactory function [32]. However, these results support previous research showing no effect of age and gender on aspects of QOL [33].

GWBS scores also show that psychological well-being (depression, anxiety, general health, self-control, wellness, and vitality) was negatively affected. This study found that 47% of patients reported positive wellbeing, 23% reported moderate distress, and 30% reported severe distress. Similarly, another study found 50% of patients with positive wellbeing, 20% with moderate distress, and 30% with severe distress [25]. Most patients developed a various problem and emotion-focused strategies to cope with their

loss of smell, as shown in result section. Problem-based strategies that were often reported included ‘let a family member taste the food’ 69.4%; ‘check for too much perfume/aftershave’ 49.7%; and ‘look for information about loss of smell’ 33.3%. Emotional strategies that were often reported included ‘trying to accept the situation and get the most out of it’ 61.4%, ‘comparing your problems with those who are worse off’ 47.8%, and ‘Are you seeking social support from family members?’ 30%. These coping strategies have also been used by people with loss of smell in other studies [23, 25].

Taken together, the results of this study show that loss of smell in COVID-19 patients had a significant impact on QOL when it was associated with those situations or functions in which chemical senses play a significant role.

This study has some limitations. First, all collected data were self-reported. The inclusion of patients with loss of smell was based on self-attributed loss of smell. In most studies, individuals with a loss of smell were included after a test of olfactory function, often including an odour-identification test, showed a decrease in ability compared to age and gender norms. In addition, loss of smell in self-reported olfactory function may mean that it could be normal. Second, the apparent predominance of female (76%) warrants further investigation, as this may simply reflect gender differences in the completion and dissemination of the survey. Third, only a small percentage in this study were over 60 years old (0.4%), but this may reflect a selection bias regarding the type of people who will complete the online survey using email as a contact point or the high prevalence of pre-existing smell loss in this age group.

Conclusion

COVID-19 patients with a loss of smell have significant reductions in their health-related quality of life. Their smell deprivation directly affects daily activities related to olfactory functions. Therefore, priority should be given to the diagnoses and treatments of the loss of smell, especially when using an olfactory training program. Additionally, patients who have recently developed a loss of smell may be offered a combination of problem-focused as well as emotion-focused strategies to cope with their condition.

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Author contributions MA conceived and designed the study, wrote the paper, participated in data analysis, and participated in reviewing, and revising the manuscript. SE collected the data, and participated in reviewing, and revising the manuscript. MKA analyzed the data.

Availability of data and material The authors confirm that the data supporting the findings of this study are available within the article.

Compliance with ethical standards

Conflict of interest The authors have no conflicts of interest to report.

Ethics approval All ethical considerations were completed before the study. Ethical approval from the Medical University Research Center has been requested (IRB No. 20–0264, July 13th, 2020).

Consent to participate Informed consent was obtained before each participant answered the online questionnaire. Thus, potential participants were made aware of the purpose and content of the study before entering the study.

Consent for publication The publication is approved by all authors, and that, if accepted, it will not be published elsewhere in the same form.

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