Validity and reliability of a French version of the olfactory disorders questionnaire

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Abstract

Objective: To validate a French version of the Olfactory Disorders Questionnaire (Fr-ODQ).

Methods: Patients with olfactory disorder (OD) and controls were enrolled from two medical centers. Individuals completed the Fr-ODQ and the French version of the sinonasal outcome tool-22 (SNOT-22). The extended Sniffin’Sticks procedure was used to test odor Threshold, Discrimination, and Identification (TDI). Cronbach’s alpha was used to measure the internal consistency of Fr-ODQ. The reliability and the external validity were evaluated through a test–retest approach and by correlating Fr-ODQ and SNOT-22 scores.

Results: Eighty-nine patients with OD and 65 healthy individuals completed the evaluations. The Cronbach’s alpha was 0.827, reporting adequate internal consistency. The test–retest reliability was high ($r_s = 0.944, p = 0.001$). The external validity was adequate regarding the significant correlation between Fr-ODQ and SNOT-22 ($r_s = 0.498; p = 0.001$). Patients with OD reported a significant higher score of Fr-ODQ than healthy individuals ($p < 0.001$), indicating a high internal validity. The baseline Fr-ODQ significantly improved after 3-month olfactory training, which corroborated the improvement of TDI scores.

Conclusion: The Fr-ODQ is the first patient-reported outcome questionnaire validated for French speaking patients. Fr-ODQ is reliable and valid for the evaluation of the olfactory dysfunction and the related impact on quality of life of French-speaking patients.

Keywords: Olfactory, Smell, Olfaction, Anosmia, Odor, Rhinology, Head neck surgery, Otolaryngology

Introduction

Olfactory Dysfunction (OD) may affect 1 to 20% of the general population [1]. The primary causes of OD are sinonasal disorders, post-viral olfactory dysfunction, neurological diseases and post-traumatic lesions of the olfactory nerve [1]. The prevalence of OD has substantially increased since the onset of the coronavirus disease 2019 (COVID-19) pandemic, reaching 30 to 86% of patients infected by Alpha, Delta or Omicron variants [2–4]. The OD may include anosmia, hyposmia or parosmia throughout the clinical course of the disease. According to several studies, the OD may persist in a significant number of patients more than 6-month post-infection and may affect their quality of life (QoL) [4, 5]. The evaluation of OD has to involve psychophysical tests and patient-reported outcome questionnaires that provide additional insight into the impact of OD on patients QoL [6].

In 2005, Frasnelli et Hummel developed the Olfactory Disorder Questionnaire (ODQ), which is a patient-reported outcome questionnaire reporting the features of the olfactory disorders and the related impact on QoL [7]. ODQ was validated in English [6], Korean [8] and Chinese [9]. To date, there is no validated version for
French speaking countries, which include more than 400 million inhabitants.

**Methods**

**Ethical statement**
The study protocol was approved by the Institutional Ethics Committee (n° CHUSP20032020). Patient and healthy individual informed consent was obtained.

**Questionnaire development**
A multidisciplinary team composed of two otolaryngologists, a psychologist and a linguist worked on the French adaptation of ODQ (Fr-ODQ) from the English ODQ [6]. Members of the team were native French speakers. Prior to the validation of Fr-ODQ, the draft was sent to 5 patients to detect potential misunderstandings and was improved to have the final version (Additional file 1: Appendix 1).

**Setting**
The study was conducted in two medical centers (University of Mons and Dour Medical Center, Dour, Belgium) between January 2021 to April 2022. Irrespective to the etiology, patients with OD were asked to participate to the study. Patients with severe neurological diseases limiting the understanding of the study protocol or those who were not native French-speaker were excluded.

A control group of healthy individuals was composed, matching age and gender of the study group. To be included, healthy individuals had to have no neurological, otolaryngological (sinonasal) or general disorders that may impact the olfactory function. Individuals with a history of COVID-19 were not included in the control group.

**Olfactory and nasal evaluations**
Participants completed Fr-ODQ, while nasal complaint evaluation was performed using the French version of the sinonasal outcome tool-22 (SNOT-22) [10, 11]. Psychophysical olfactory evaluations were performed with Threshold, Discrimination and Identification test (TDI; Medisense, Groningen, Netherlands), which is a standardized and validated evaluation of olfaction. The sum of the scores of threshold, discrimination and identification subtests was used clinically to assess olfactory performance. Participants were considered normosmic or dysosmic when TDI ≥ 30.75 and < 30.75, respectively [12].

**Validity, reliability and responsiveness to change**
The statistical analyses were performed with Statistical Package for the Social Sciences for Windows (SPSS version 22.0; IBM Corp, Armonk, NY, USA). A level of significance of \( p < 0.05 \) was used. The Fr-ODQ was completed twice over 7-day period to evaluate the test–retest reliability (Spearman correlation coefficient). The internal consistency was evaluated with Cronbach’s alpha. External validity was assessed by a correlation analysis between Fr-ODQ and Fr-SNOT-22 (Spearman correlation coefficient). The internal validity was evaluated with a comparison of the Fr-ODQ scores between patients and healthy subjects (Mann–Whitney \( U \) test.). The responsiveness to change of Fr-ODQ was evaluated in a subgroup of patients with reversible OD, excluding patients with >2-year post-traumatic loss of smell. Only patients with an improvement of TDI scores 3 months after the initial evaluations were selected for the responsiveness to change analysis. For these patients, authors evaluated the reduction of Fr-ODQ. Patients were invited to adhere to an olfactory training twice daily.

**Results**
Eighty-nine patients (67 females) with OD and 65 healthy individuals (50 females) completed the study. The characteristics of patients are reported in Table 1. The most prevalent comorbidities of patients included in the study are listed in Table 1.
hypo thyroidism, hypertension and hypercholesterolemia. The causes of OD consisted of post-viral (N = 80), post-traumatic (N = 4), neurological (N = 2) and idio pathic (N = 3) OD. The mean duration of OD was 15.7 ± 8.2 months. Parosmia concerned 52 patients (58.4%) patients. Five patients reported TDI > 37 but they suffered from severe parosmia. The mean Fr-SNOT-22 score of patients was 31.80 ± 17.69 (Table 2).

The Cronbach’s alpha value was 0.827 for the items of Fr-ODQ, which indicated a high internal consistency.

### Table 2
Comparison of Olfactory Questionnaire between patients and healthy individuals

| Olfactory disorders Questionnaire Outcomes                                                                 | Patients         | Controls        | p-value |
|----------------------------------------------------------------------------------------------------------|------------------|-----------------|---------|
| **Parosmia outcomes**                                                                                  |                  |                 |         |
| P1 Food tastes different than it used to before my accident                                            | 2.35 ± 0.93      | 0.41 ± 0.71     | 0.001   |
| P2 I can smell something bad, even when other people can’t                                            | 1.89 ± 1.11      | 0.56 ± 0.79     | 0.001   |
| P3 Some of the smells that I find unpleasant, other people find pleasant                               | 2.08 ± 1.08      | 0.32 ± 0.67     | 0.001   |
| P5 Smells smell different to what they used to before my accident                                      | 2.08 ± 1.08      | 0.33 ± 0.68     | 0.001   |
| Parosmia total score (/12)                                                                             | 8.23 ± 3.49      | 1.60 ± 2.06     | 0.001   |
| **Life Quality Statement Outcomes (/57)**                                                              |                  |                 |         |
| 1 I go to restaurants less often than I used to                                                        | 1.79 ± 1.15      | 0.63 ± 0.88     | 0.001   |
| 4 I am always aware of the changes in my sense of smell                                               | 2.80 ± 0.72      | 0.33 ± 0.62     | 0.001   |
| 11 I don’t enjoy drinks or food as much as I used to                                                   | 2.40 ± 0.92      | 0.58 ± 0.94     | 0.001   |
| 13 I am worried that I will never get used to the changes in my sense of smell                         | 2.14 ± 0.95      | 0.58 ± 0.90     | 0.001   |
| 15 Because of the changes in my sense of smell, I feel more anxious than I used to feel               | 1.94 ± 1.02      | 1.56 ± 1.39     | 0.001   |
| 19 The changes in my sense of smell cause most of my problems                                         | 1.42 ± 1.04      | 0.28 ± 0.58     | 0.001   |
| 22 The changes in my sense of smell annoy me when I am eating                                         | 2.24 ± 1.58      | 0.16 ± 0.57     | 0.001   |
| 26 I visit friends, relatives, or neighbors less often                                                 | 0.94 ± 1.00      | 0.17 ± 0.38     | 0.001   |
| 27 Because of the changes in my sense of smell, I try harder to relax                                  | 1.46 ± 1.14      | 1.01 ± 0.90     | 0.001   |
| 28 Because of the changes in my sense of smell I have weight problems                                 | 1.71 ± 1.18      | 0.28 ± 0.58     | 0.001   |
| 32 I can imagine adjusting to the changes in my sense of smell                                        | 1.07 ± 1.02      | 2.70 ± 0.58     | 0.001   |
| 33 The changes in my sense of smell make me feel isolated                                              | 1.08 ± 1.06      | 0.17 ± 0.38     | 0.001   |
| 34 Because of the changes in my sense of smell I avoid groups of people                               | 0.86 ± 0.90      | 0.16 ± 0.37     | 0.001   |
| 35 The changes in my sense of smell are something I just need to get used to                          | 1.76 ± 0.91      | 2.50 ± 0.80     | 0.001   |
| 37 I eat less than I used to or more than I used to                                                    | 1.39 ± 1.10      | 0.58 ± 0.90     | 0.001   |
| 39 I am scared of getting exposed to certain dangers (e.g., gas, rotten food)                          | 1.85 ± 1.08      | 0.55 ± 0.85     | 0.001   |
| 42 I have problems with taking part in activities of daily life                                       | 0.94 ± 0.85      | 0.27 ± 0.51     | 0.001   |
| 49 The changes in my sense of smell make me feel angry                                                | 1.33 ± 1.06      | 0.25 ± 0.56     | 0.001   |
| 50 My relationship with my wife / husband / partner is affected                                       | 0.89 ± 0.94      | 0.16 ± 0.37     | 0.001   |
| **Life Quality Statement Outcomes (/57)**                                                              | 28.35 ± 13.46    | 5.51 ± 6.76     | 0.001   |
| **Sincerity Statement Outcomes**                                                                     |                  |                 |         |
| 17 Sometimes I have thoughts and ideas I would not want other people to know of                       | 1.24 ± 1.18      | 0.17 ± 0.42     | 0.001   |
| 31 There are some people who I know that I dislike                                                     | 0.87 ± 0.92      | 0.17 ± 0.42     | 0.001   |
| 14 I always keep a promise, no matter what the promise is about or how hard it is for me              | 1.76 ± 0.91      | 2.50 ± 0.79     | 0.001   |
| 23 I am always well behaved                                                                           | 1.81 ± 0.96      | 1.33 ± 1.15     | NS      |
| 36 I have never been late to an appointment or work                                                   | 1.82 ± 0.90      | 1.33 ± 1.14     | 0.001   |
| 48 Sometimes I talk about things I do not understand                                                 | 1.46 ± 1.13      | 0.58 ± 0.90     | 0.001   |
| Sincerity Statement Score (/18)                                                                        | 8.54 ± 4.44      | 3.03 ± 1.40     | 0.001   |
| Total score (/87)                                                                                     | 45.12 ± 18.15    | 10.13 ± 8.92    | 0.001   |

Scale part: 1 (no annoying) to 10-point (extremely)

- How annoying the changes in your sense of smell are to you                                           | 7.21 ± 3.00      | 0.53 ± 1.49     | 0.001   |
- How often you become aware of the changes to your sense of smell                                    | 5.46 ± 3.90      | 0.27 ± 1.06     | 0.001   |
- How severely the changes in your smell affected your professional performance                        | 2.68 ± 2.88      | 2.48 ± 2.48     | 0.001   |
- How severely the changes in your sense of smell affected your recreational activities              | 1.69 ± 2.71      | 0.49 ± 1.08     | 0.001   |
- How severely the changes in your sense of smell affected your private life                          | 6.74 ± 3.05      | 0.31 ± 1.15     | 0.001   |

NS Non-significant
Table 3 Test re-test reliability findings

|                         | Test-retest | p-value |
|-------------------------|-------------|---------|
| Parosmia score          | 0.905       | 0.001   |
| Life Quality Statement score | 0.930       | 0.001   |
| Sincerity Statement score | 0.614       | 0.001   |
| Fr-ODQ total score      | 0.944       | 0.001   |

Fr-ODQ French version of olfactory disorder questionnaire

Table 4 Responsiveness to Change property

| Outcomes                  | Baseline     | 3 mo         | p-value |
|---------------------------|--------------|--------------|---------|
| Parosmia score            | 7.55±3.65    | 7.47±3.57    | NS      |
| Life Quality Statement score | 30.45±14.16  | 34.25±7.47   | 0.011   |
| Sincerity Statement score | 7.05±4.83    | 9.00±3.71    | 0.027   |
| Fr-ODQ total score        | 45.05±19.25  | 50.82±12.71  | 0.008   |
| Threshold                 | 4.27±3.24    | 6.20±4.63    | NS      |
| Discrimination            | 9.93±3.55    | 12.17±2.37   | 0.017   |
| Identification            | 7.91±4.63    | 11.29±2.64   | 0.032   |
| TDI total score           | 19.12±9.08   | 29.50±8.56   | 0.028   |

The evolution of Fr-ODQ total score was focused on patients who reported psychophysical improvement at the threshold, discrimination, and identification testing.

Fr-ODQ French version of olfactory disorder questionnaire

The test–retest reliability was high for total Fr-ODQ scores ($r_s = 0.944, p = 0.001$), Parosmia and Life Quality Statement scores and moderate-to-high for Sincerity Statement score (Table 3). The correlation between Fr-ODQ and Fr-SNOT-22 total score was high ($r_s = 0.498; p = 0.001$), indicating adequate external validity. The mean score of Fr-ODQ was significantly higher in patients compared with controls, which supported an adequate internal validity (Table 4). Seventy-five patients adhered to a 12-week olfactory training protocol for a post-viral OD, consisting of twice daily smell of odor according to the Hummel protocol [13]. The recovery of smell sense occurred after 3.4±4.3 months. Focusing on the 32 patients who had an improvement at the TDI 3 months after the start of the olfactory training, the mean TDI score significantly increased from 19.12±9.08 to 29.50±8.56 ($p = 0.028$); while the Fr-ODQ significantly increased from 45.05±19.25 to 50.82±12.71 ($p = 0.008$), which suggests an adequate responsiveness to change property (Table 4).

Discussion

The recent increase of the prevalence of OD makes the development of olfactory patient-reported outcome questionnaires important. To date, only the Fr-sQOD-NS was adapted for French speaking countries [14] but this questionnaire only reports limited QoL items. In the present study, we developed a French version of the olfactory disorder questionnaire, which reports high internal consistency and test–retest reliability.

The internal consistency of the Fr-ODQ was comparable with those of the German and English versions. Indeed, the internal consistency of the German version of ODQ was 0.54 and 0.93 for negative and positive statements, respectively [7], while the Cronbach value of the English version of ODQ was 0.90 [6].

The test–retest reliability of the Fr-ODQ was particularly high ($r_s = 0.944$) compared with the data of the Frasnelli et Hummel version (0.71 and 0.78 for negative and positive statements) [7]. In the study of Langstaff et al. the test–retest reliability ranged from 0.56 to 0.77 according to the sub-scores of ODQ [6]. In the present study, the external validity was investigated through a correlation analysis between SNOT-22 and Fr-ODQ. Frasnelli et Hummel assessed the external validity through a correlation analysis between Beck Depression Inventory, Mood Inventory and German ODQ questionnaire [7]. They reported significant association between all questionnaires, supporting an adequate external validity. Langstaff et al. did not find significant external validity comparing TDI and ODQ scores [6]. The use of SNOT-22 in the present study limits us in the comparison of our results with those of the literature. We have chosen SNOT-22 because that was the closest questionnaire to the ODQ regarding symptoms and QoL impact. Indeed, there is no other olfactory questionnaire validated in French at the exception of Fr-sQOD-NS [14], which included items of the ODQ. The high internal validity outcomes of the Fr-ODQ corroborated those of the German version in which Frasnelli et Hummel observed significant higher score of ODQ in hyposmia/anosmic patients compared with normosmic individuals [7].

Responsiveness to change is another important parameter in the validation of a patient-reported outcome questionnaire [15]. The originality of the validation of the Fr-ODQ was the assessment of the ‘responsiveness to change’ property. Focusing on patients who reported improvement at the TDI scores (at least 1 point increase), we observed a similar significant improvement of Fr-ODQ total score, suggesting an adequate ‘responsiveness to change’ property.

The primary limitation of this study are the low number of patients and the high proportion of post-viral OD individuals. The characteristics of patients with post-viral OD may be different from the OD of patients with chronic rhinosinusitis with nasal polyps or other etiologies. The high proportion of post-viral OD was related to the onset of the COVID-19 pandemic and the...
increase of the number of anosmic, hyposmic and parosmic patients in the general population. The German and English version of ODQ were both validated before the pandemic and, therefore, included more patients with non-COVID-19 OD. In future studies, authors may use the smell identification test (UPSIT) in addition to TDI to strengthen the olfactory evaluation. The Fr-ODQ could be used in many future French studies from France, Belgium or Canada in which authors will investigate smell function in common conditions, including chronic rhinosinusitis with or without polyps [16, 17], or COVID-19 [18]. The main strengths of this study are the realization of TDI evaluations, allowing the confirmation of the olfactory dysfunction and the evaluation of ‘responsiveness to change’ parameter.

Conclusion
The Fr-ODQ is the first patient-reported outcome questionnaire validated for French speaking patients. Fr-ODQ is reliable and valid for the evaluation of the olfactory dysfunction and the related impact on QoL of French speaking patients.

Supplementary Information
The online version contains supplementary material available at https://doi.org/10.1186/s40463-022-00598-2.

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Author contributions
JLechien: conduction of the study, patient recruitment, drafting of the paper. SLB: conduction of the study, patient recruitment. PB-R: paper proofreading. LV: Statistical analysis. SS: Proofreading of the paper, final approval. All author read and approved by the final manuscript.

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Available on request.

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Ethics approval and consent to participate
The study protocol was approved by the Institutional Ethics Committee (n° CHUSP20032020).

Consent for publication
Patient and healthy individual informed consent was obtained.

Competing interests
The author declare that they have no competing interests.

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References
1. Desiato VM, Levy DA, Byun YJ, Nguyen SA, Soler ZM, Schlosser RJ. The Prevalence of olfactory dysfunction in the general population: a systematic review and meta-analysis. Am J Rhinol Allergy 2020; 1945892420946254.
2. Liu N, Yang D, Zhang T, Sun J, Fu J, Li H. Systematic review and meta-analysis of olfactory and gustatory dysfunction in COVID-19. Int J Infect Dis. 2022;117:155–61. https://doi.org/10.1016/j.ijid.2022.02.004.
3. Boscolo-Rizzo P, Tirelli G, Meloni P, Hopkins C, Madeddu G, De Vito A, Gardena N, Valentinotti R, Tofanelli M, Borsetto D, Lechien JR, Polese J, De Riu G, Vaira LA. Coronavirus disease, (COVID-19)-related smell and taste impairment with widespread diffusion of severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) Omicron variant. Int Forum Allergy Rhinol. 2019. https://doi.org/10.1002/alf.22995.
4. Lechien JR, Cnisia-Estomba CM, Beckers E, Mustin V, Ducarme M, Journe F, Marchant A, Jouffe L, Basillari MR, Cammaroto G, Circiu MP, Hants S, Saussez S. Prevalence and 6-month recovery of olfactory dysfunction: a multicentre study of 1363 COVID-19 patients. J Intern Med. 2021;290(2):451–61. https://doi.org/10.1111/joim.13209.
5. Boscolo-Rizzo P, Menegaldo A, Fabbris C, Spriano G, Borsetto D, Vaira LA, Calvanese L, Pettorelli A, Sonigo M, Frezza D, Bertolin A, Cestaro W, Rigoli R, D’Alessandro A, Tirelli G, Da Mosto MC, Menini A, Polese J, Hopkins C. Six-month psychophysical evaluation of olfactory dysfunction in patients with COVID-19. Chem Senses. 2021. https://doi.org/10.1093/chemse/bjab006.
6. Langstaff L, Pradhan N, Clark A, Boak D, Salam M, Hummel T, Philpott CM. Validation of the olfactory disorders questionnaire for English-speaking patients with olfactory disorders. Clin Otolaryngol. 2019;44(5):715–28. https://doi.org/10.1111/oto.13351.
7. Frasnelli J, Hummel T. Olfactory dysfunction and daily life. Eur Arch Otorhinolaryngol. 2005;262(3):231–5.
8. Choi WR, Jeong HY, Kim JH. Reliability and validity of the Korean version of the questionnaire of olfactory dysfunction. Int Forum Allergy Rhinol. 2018;8(12):1481–5.
9. Jin X, Wang J, Li YJ, Liu JF, Ni DF. Reliability and validity analysis of simplified Chinese version of QOL questionnaire of olfactory disorders. Chin J Otolaryngol Head Neck Surg. 2002;126(1):41–7. https://doi.org/10.1007/s00405-002-121022.
10. de Dorlodot C, Horoi M, Lefebvre P, Collet S, Bertrand B, Eloy P, et al. French adaptation and validation of the sino-nasal outcome test-22: a prospective cohort study on quality of life among 422 subjects. Clin Otolaryngol. 2015;40(1):29–35.
11. Oleszkiewicz A, Schriever VA, Croy I, et al. Updated sniffin’ sticks normative data based on an extended sample of 9139 subjects. Clin Otolaryngol. 2019;42(6):1276–81. https://doi.org/10.1111/coa.13437.
13. Hummel T, Rissom K, Reden J, Hähner A, Weidenbecher M, Hüttenbrink KB. Effects of olfactory training in patients with olfactory loss. Laryngoscope. 2009;119(3):496–9. https://doi.org/10.1002/lary.20101.

14. Leclercq C, Chiesa-Estomba CM, Hori M, Le Bon SD, Hans S, Distinguin L, Chekkouy-Idrissi Y, Circiu MP, Khalife M, Saussez S, Lechien JR. Validity and reliability of the French short version of the questionnaire of olfactory disorders-negative statements (sQOD-NS). Ear Nose Throat J 2021: https://doi.org/10.1177/01455613211032004.

15. Lechien JR, Schindler A, De Marrez LG, Hamdan AL, Karkos PD, Harmegnies B, Barillari MR, Finck C, Saussez S. Instruments evaluating the clinical findings of laryngopharyngeal reflux: a systematic review. Laryngoscope. 2019;129(3):720–36. https://doi.org/10.1002/lary.27537.

16. Kilty SJ, Lasso A. Canadian real-world study of access and clinical results using dupilumab for chronic rhinosinusitis with polyps. J Otolaryngol Head Neck Surg. 2022;51(1):17. https://doi.org/10.1186/s40463-022-00570-0.

17. Vaira LA, Hopkins C, Petrocelli M, Lechien JR, Soma D, Giovanditto F, Rizzo D, Salzano G, Piombino P, Saussez S, De Riu G. Do olfactory and gustatory psychophysical scores have prognostic value in COVID-19 patients? A prospective study of 106 patients. J Otolaryngol Head Neck Surg. 2020;49(1):56. https://doi.org/10.1186/s40463-020-00449-y.

18. Saydy N, Moubayed SP, Bussières M, Janjua A, Kilty S, Lavigne F, Monteiro E, Nayan S, Riché M, Smith K, Sommer D, Sowerby L, Tervik MA, Witterick IJ, Wright E, Desrosiers M. What is the optimal outcome after endoscopic sinus surgery in the treatment of chronic rhinosinusitis? A consultation of Canadian experts. J Otolaryngol Head Neck Surg. 2021;50(1):36. https://doi.org/10.1186/s40463-021-00519-9.

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