Original Article

Reliability and validity of the Turkish version of the questionnaire of olfactory disorders

Belgin Tutar[1], Ziya Saltürk[1], Güler Berkiten[1], Ayşe Enise Göker[1], Melis Ece Arkan[1], Muhammet Enis Ekincioğlu[1], Semih Karaketir[1], Ercan Kulak[2], Yavuz Uyar[1]

[1]*Department of Otorhinolaryngology, Okmeydanı Training and Research Hospital, Istanbul, Turkey*
[2]*Department of Public Health, Marmara University, Faculty of Medicine, Istanbul, Turkey*

ABSTRACT

Objectives: This study aims to test the reliability and validity of the Turkish version of the Questionnaire of Olfactory Disorders (QOD).

Patients and Methods: This prospective study was conducted between June 2018 and January 2019. Patients who presented to Okmeydanı Training and Research Hospital outpatient clinic with a diagnosis of chronic sinusitis and/or septum deviation completed the Connecticut Chemosensory Clinical Research Center smell test. Forty patients (24 males, 16 females; mean age 42.3±13.7 years; range, 18 to 71 years) with olfactory disorders (anosmia, hyposmia) completed the QOD at the time of diagnosis and one day prior to surgery. Forty volunteers (control group) (22 males, 18 females; mean age 38.3±13.4 years; range, 18 to 65 years) without nasal pathology, olfactory dysfunction or a history of head trauma also completed the QOD. The results of the two tests were then compared.

Results: The QOD-parosmia (QOD-P), QOD-statements of QoL (QOD-LQ), and QOD-visual analog scale (QOD-VAS) values were significantly higher in the study group ($p<0.001$). There was no statistically significant change in the QOD-P, QOD-LQ, QOD-sincerity, and QOD-VAS values of the patients with anosmia and hyposmia at the time of diagnosis compared with those one day prior to surgery. In all patients, the Cronbach's alpha coefficient for the QOD-P, QOD-LQ, and QOD-VAS was 0.719, 0.892, and 0.984, respectively, with relatively high internal consistency.

Conclusion: We conclude that the Turkish version of the QOD is a reliable and valid instrument, particularly in patients with parosmia.

Keywords: Olfactory disorder, olfactory dysfunction, olfactory test, reliability, validity.

Anosmia (complete loss of olfactory function) and hyposmia (partial loss of olfactory function) affect 1% and 5% of the general population, respectively.[1] Olfactory dysfunction is a multidimensional problem that can affect daily activities of living (e.g. cooking) and lead to domestic accidents and social problems: personal hygiene and adverse effects on social interactions. In terms of the diagnosis and treatment of olfactory disorders (quantitative and qualitative), the effects of these problems on quality of life (QoL) need to be addressed. In daily practice, olfactory threshold tests and odor discrimination tests are commonly used in cases of olfactory dysfunction and physiologic and anatomic disturbances that can cause such dysfunction are assessed. Few instruments have been reported in the literature that can be used to

Received: December 26, 2019 **Accepted:** May 20, 2020 **Published online:** May 29, 2020

Correspondence: Belgin Tutar, MD. Okmeydanı Eğitim ve Araştırma Hastanesi Kulak Burun Boğaz Kliniği, 34384 Şişli, İstanbul, Türkiye.
e-mail: belgintutar@gmail.com

Doi: http://dx.doi.org/10.5606/Tr-ENT.2020.28291

Citation:
Tutar B, Saltürk Z, Berkiten G, Enise Göker A, Arkan ME, Ekincioğlu ME, et al. Reliability and validity of the Turkish version of the questionnaire of olfactory disorders. Tr-ENT 2020;30(1):26-32.

determine the effects of olfactory dysfunction on QoL.[2-5] The Questionnaire of Olfactory Disorders (QOD) is a subjective tool that was introduced by Hummel and Frasnelli in 2005.[6] The QOD is a combination of psychometric testing (Beck Depression Inventory) and Short Form (SF)-36. The QOD consists of two parts: *(i)* statements [parosmia statements (QOD-P), statements of QoL (QOD-LQ), statements of sincerity (QOD-S)] and *(ii)* visual analog scales (QOD-VAS). The QOD has been translated into several languages and found to be a reliable and valid survey instrument.[7,8] In this study, we aimed to test the reliability and validity of the Turkish version of QOD.

PATIENTS AND METHODS

This prospective study was performed at Okmeydanı Training and Research Hospital between June 2018 and January 2019. The study population consisted of 40 patients (24 males, 16 females; mean age 42.3±13.7 years; range, 18 to 71 years) who were admitted to our outpatient clinic with a diagnosis of septum deviation and/or chronic sinusitis and scheduled for surgery at the Connecticut Chemosensory Clinical Research Center (CCCRC) and 40 healthy volunteers (control group) (22 males, 18 females; mean age 38.3±13.4 years; range, 18 to 65 years) without nasal pathology, olfactory disorders or a history of head trauma. The study protocol was approved by the Okmeydanı Training and Research Hospital Ethics Committee. A written informed consent was obtained from each participant. The study was conducted in accordance with the principles of the Declaration of Helsinki.

The diagnosis of hyposmia or anosmia was dependent on patient history, clinical examination, nasal endoscopy, paranasal sinus computed tomography, and olfactory tests. All patients completed the QOD at the time of diagnosis (one month prior to surgery) and one day prior to surgery. The 40 healthy volunteers also completed the QOD. In the patient group, endoscopic sinus surgery (ESS) was performed in 11 patients (27.5%), septoplasty (SP) in 17 patients (42.5%), and SP plus ESS in 12 patients (30%).

All the participants completed the CCCRC smell test, which consists of an odor detection threshold and odor identification test.

In the butanol threshold test, two glass bottles were presented to the patient in each trial, one containing water and the other containing different dilutions of butanol solutions. The bottles looked the same and were presented at the same time. In each test, the patients were asked to block one nostril and put the top of the solution just under the other nostril. All bottles were presented in a similar way and the participants were asked to choose which of the bottles contained anything other than water. When the selection was wrong, a bottle containing a higher butanol concentration was used together with only water.

After the participant correctly recognized the same butanol concentration five times successfully, the score for that nostril was recorded. The other nostril was tested and the scores for both were averaged to give the exact score. The most potent butanol concentration (bottle 0) was 4% butanol in deionized water. Each subsequent dilution (vials 1-9) was a 1:3 dilution with deionized water. Possible threshold scores ranged from 0 to 9 but all scores 7 and higher were scored as 7 as per the CCCRC test.

As part of the odor identification test, common substances (peanut butter, soap, Vicks, chocolate, coffee, cinnamon, mothballs, and baby powder) with easily identifiable odors were placed in opaque jars. The ability to smell Vicks demonstrates strong trigeminal nerve activity. All participants easily detected Vicks and the responses to the substance were not included in the final score. These eight items were presented in the same order to both nostrils. When an item was presented, the patient was asked to choose from a 20-item list. The list contains the names of the eight test products and 13 distractors. In addition to the names on the list, responses of "no sensation" and "do not know" were permitted. The outcome of the threshold and the identification tests was combined into a total score as an average of the two tests. The CCCRC test scores of 6.00-7.00, 5.00-5.75, 4.00-4.75, 2.00-3.75, and 0-1.75 were classified as normosmia, mild hyposmia, moderate hyposmia, severe hyposmia, and anosmia, respectively.

The English version of the QOD was kindly supplied by Johannes Frasnelli, one of the

developers of the original scale. Two English language and literature graduates translated the scale into Turkish. The scale was then re-translated into English by two experts. A Turkish language and literature specialist then corrected the scale for compatibility with the Turkish language.

A single researcher administered the survey and collected all the data from the patients and healthy volunteers.

Statistical analysis

The IBM SPSS Statistics 22.0 software (IBM Corp., Armonk, NY, USA) was used for the statistical analysis of the data. The fit of the parameters to normal distribution was evaluated using the Shapiro-Wilk test. Student's t-test was used for comparing the quantitative data as well as for descriptive statistical methods (average, standard deviation, and frequency) and for comparing the fit of the data to normal distribution. The Mann-Whitney U test was conducted for the comparison of data of the two groups that did not show normal distribution. The Wilcoxon signed-rank test was used for intragroup comparisons of non-normally distributed parameters. The Fisher-Freeman-Halton test and continuity (Yates) correction were used to compare qualitative data. Significance was assessed at the $p<0.05$ level. Internal consistency was determined using Cronbach's alpha (α) coefficient.

RESULTS

No statistically significant between-group differences were detected in the average age or gender distribution of the participants (both $p>0.05$). In the patient group, 29 (72.5%) had hyposmia and 11 (27.5%) had anosmia. None of the control group had olfactory disorders (Table 1).

Comparison of the QOD scores of the patients with olfactory dysfunction with those of healthy controls revealed that the QOD-P, QOD-LQ, QOD-S, and QOD-VAS results of the study group were significantly higher than in the control group (both one month and one day prior to surgery) (Table 2).

Comparison of the QOD scores of the patients with hyposmia at the time of diagnosis and one day prior to surgery showed that there were no statistically significant changes in the QOD-P, QOD-LQ, QOD-S, and QOD-VAS values one day prior to surgery compared with those at the time of diagnosis ($p>0.05$).

Comparison of the QOD scores of the patients with anosmia at the time of diagnosis and one day prior to surgery revealed that the QOD-P, QOD-LQ, QOD-S, and QOD-VAS values

Table 1. Evaluation of age, gender, surgery and smell test among groups

	Study group			Control group			Total			
	n	%	Mean±SD	n	%	Mean±SD	n	%	Mean±SD	
Age (year)			42.3±13.7			38.3±13.4			40.3±13.6	0.184†
Gender										0.821‡
Male	24	60		22	55		46	57.5		
Female	16	40		18	45		34	42.5		
Surgery										-
ESS	11	27.5		-	-		11	27.5		
SP	17	42.5		-	-		17	42.5		
SP + ESS	12	30		-	-		12	30		
Connecticut smell test										≤0.001*¶
Hyposmia	29	72.5		0	0		29	36.3		
Anosmia	11	27.5		0	0		11	13.8		
Normal	0	0		40	100		40	50		

SD: Standard deviation; ESS: Endoscopic sinus surgery; * Is for p≤0.05; SP: Septoplasty; † Is for p=0.184 (age); ‡ Is for p=0.821 (gender); ¶ Is for p≤0.001 (Conneticut smell test).

Table 2. Evaluation of Questionnaire of Olfactory Disorders-parosmia, -life quality, -sincerity, and -visual analog scale parameters between diagnosis day and one day before surgery

	Study group		Control group		Total		
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median	*p**
QOD-P							≤0.001
The diagnosis day	5.4±4	5	1.9±1.8	2	3.6±3.6	3	
1 day before the operation	5.2±3.8	5.5	-		5.2±3.8	5.5	
DD-OP 1 day *agop*2	0.09		-				
QOD-LQ							≤0.001
When the diagnosis is made	28.4±13.2	27	8.9±2.5	9	18.7±13.6	12	
1 day before the operation	28.4±13.1	27	-		28.4±13.1	27	
DD-OP 1 day *agop*2	0.655		-				
QOD-S							0.931
When the diagnosis is made	7.5±4.6	6	7.1±3.2	7	7.3±3.9	7	
1 day before the operation	7.5±4.6	6	-		7.5±4.6	6	
DD-OP 1 day *agop*2	1.000		-				
QOD-VAS							≤0.001
When the diagnosis is made	5.5±3.3	5	0.3±0.7	0	2.9±3.5	1	
1 day before the operation	5.4±3.2	5	-		5.4±3.2	5	
DD-OP 1 day *agop*2	0.157		-				

SD: Standard deviation; QOD: Questionnaire of Olfactory Disorders; DD: Diagnosis day; OP: Operation; QOD-P: QOD parosmia statements; QOD-LQ: QOD life quality statements; QOD-S: QOD sincerity statements; QOD-VAS: QOD visual analog scale statements; SP: Septoplastyş * Mann-Whitney U test.

at the time of diagnosis showed no significant change as compared with the values one day before surgery (p>0.05) (Table 3).

Regarding internal consistency, the split-half reliability was 0.70. In all the patients, Cronbach's α coefficient for the QOD-P, QOD-LQ, and QOD-VAS was 0.719, 0.892, and 0.984, respectively, with relatively high internal consistency. However, the value for the QOD-S was 0.620 which was relatively low (Table 4).

DISCUSSION

Receptor genes of olfaction constitute the most variable gene family in humans. Humans have the ability to differentiate between millions of fragrances;[9] however, the sense of smell in humans is not as advanced as in many other living organisms. Olfaction plays an important role in human life, both in biologic and cultural terms. The ability to smell gradually decreases with age. Olfactory problems that occur at a young age can have significant negative effects; deterioration of this sensory modality can result in the loss of the ability to identify chemical stimuli and hazards in the environment.[10,11] It can also cause problems in social and professional life. As a result, individuals may feel vulnerable, insecure, and anxious.[2]

Although odor problems can be divided into quantitative and qualitative olfactory diseases, they are generally intertwined. Quantitative olfactory disorders include hyposmia and anosmia. Qualitative olfactory disorders include parosmia (odor distortion) and phantosmia which is an odor sensation in the absence of an odor source.[6]

Common QoL scales used in the clinic include the SF-36 and the World Health Organization (WHO) Quality of Life (WHOQOL)-BREF. These scales can provide some information of QoL and intercultural versions of the scales are

Table 3. Evaluation of changes in smell disorder groups at time of diagnosis and one day before surgery

	When the diagnosis is made		One day before the operation		
	Mean±SD	Median	Mean±SD	Median	*p*
Hyposmia					
QOD-P	5.1±4.0	5	5.0±3.9	4	0.527
QOD-LQ	25.1±11.4	22	25.1±11.3	22	1.000
QOD-S	6.7±4.1	6	6.7±4.1	6	1.000
QOD-VAS	4.4±3.0	4	4.4±3.0	4	1.000
Anosmia					
QOD-P	6.2±4.1	6	5.7±3.7	6	0.059
QOD-LQ	37.2±14.0	38	37.1±14.0	37	0.317
QOD-S	9.7±5.3	9	9.7±5.3	9	1.000
QOD-VAS	8.3±2.1	8	8.1±2.1	8	0.157

SD: Standard deviation; QOD: Questionnaire of Olfactory Disorders; QOD-P: QOD parosmia statements; QOD-LQ: QOD life quality statements; QOD-S: QOD sincerity statements; QOD-VAS: QOD visual analog scale statements; SD: Standard deviation; Wilcoxon signed-rank test.

Table 4. Cronbach's alpha coefficient (n=80)

	QOD-P	QOD-LQ	QOD-S	QOD-VAS
P value	0.757	0.933	0.547	0.993
The number of items	4	19	6	5

QOD: Questionnaire of Olfactory Disorders; QOD-P: QOD parosmia statements; QOD-LQ: QOD life quality statements; QOD-S: QOD sincerity statements; QOD-VAS: QOD visual analog scale statements.

available.[3-5,12] However, they do not adequately analyze the effects of olfactory problems on a patient's QoL and are not specific to olfactory dysfunction.

Nordin et al.[13] administered the SF-36 questionnaire to 320 patients with hyposmia and anosmia and found no correlation between olfactory function scores and SF-36 scores. In addition, they found that the SF-36 was not suitable for obtaining QoL of olfactory dysfunction. The WHOQOL-100 questionnaire was used in some diseases; however, there have been no reports of the use of the WHOQOL-100 questionnaire, particularly in the area of olfactory dysfunction. Therefore, a questionnaire specific to measuring the QoL of patients with olfactory dysfunction and a relevant scale are required.

To specifically analyze the QoL of patients with olfactory dysfunction, Hummel and Frasnelli[6] developed the QOD. Each question on the QOD is assigned a score with 3 denoting strongly agree, 2 denoting agree, 1 denoting disagree, and 0 completely disagree. High scores on the QOD indicate strong olfactory impairment.

The degree of olfactory function can be assessed by questionnaires related to daily life problems. Qualitative disorders such as parosmia are associated with higher rates of depression than quantitative odor disorders. Furthermore, patients with both qualitative (i.e. parosmia) and quantitative odor dysfunction exhibit higher rates of daily life problems compared with patients with only quantitative odor disorders. Thus, as noted previously by Frasnelli and Hummel,[6] routine tests for parosmia are necessary in patients with olfactory dysfunction.

In a study of the validity of the Chinese version of the QOD, Yang et al.[7] reported that

the QOD-LQ was highly reliable, whereas the QOD-P needed to be adopted to reflect Chinese culture. However, the internal consistency and validity of the QOD-P have been proven.[14] Difficulty in defining the expression "parosmia" may explain the low validity of the QOD-P in the Chinese study. Furthermore, because the QOD-P is designed to assess parosmia and phantosmia, the results may not be sufficiently sensitive when combined by consistency analysis.[15,16] The relatively small sample size and cultural adaptation may have had a role in the poor consistency in the Chinese study. Yang et al.[7] concluded that the Chinese version of the QOD was a valid and reliable tool for research on olfactory dysfunction and QoL in a Chinese population.

Korean culture and language differ from both Chinese and European contexts. However, Choi et al.[8] reported that the QOD was a reliable, odor-specific tool to analyze the degree of subjective odor problems in the Korean population.

In the present study, we administered the CCCRC test to detect hyposmia and anosmia by detecting odor disturbances and compared the QOD results of patients with those of healthy volunteers.[17,18] In two studies (Yang et al.[7] and Choi et al.[8]), the QoL questionnaire was compared with the SF-36 in odor validation studies. We did not use the SF-36 because it is a general questionnaire which is not specific to odor. The same patient group was interviewed one month and one day prior to surgery and compared with the healthy control group. Thus, we think that we evaluated the reliability of the survey better. In the group with both hyposmia and anosmia, the QOD-P, QOD-LQ, QOD-S, and QOD-VAS values at the time of diagnosis showed no statistically significant change as compared with those of one day prior to surgery. This shows that the QOD test is very reliable

Neuland et al.[19] and Smeets et al.[14] administered the QOD in Dutch patients reporting olfactory dysfunction. Both studies showed acceptable internal consistency for QOD-LQ and QOD-P scores. However, the internal consistency of the QOD-S score was unsatisfactory in both studies. The QOD-LQ, QOD-P, and QOD-VAS results showed a strong correlation with the SF-36 results, thereby emphasizing the value of the QOD assessment.[14,19] Smeets et al.[14] proposed the use of the QOD (after revision of the score S or no S score) in patients with olfactory dysfunction. In our study, there were no differences in QOD-S scores between healthy controls and patients with subjective olfactory dysfunction. However, we must remember that the healthy groups were normosmia. Answers to QOD-S questions may arise from cultural diversity.

In the present study, the Cronbach α values for the QOD-P, QOD-LQ, and QOD-VAS were 0.719, 0.892, and 0.984, respectively, with relatively high internal consistency. However, the Cronbach α value for the QOD-S was 0.620, which was relatively low and indicated poor internal consistency (Table 4). We think that the low result is due to cultural difference. The findings of the present study are similar to the Korean studies as well as the Chinese study by Yang et al.[7]

This study has some limitations. Patients with olfactory dysfunctions' number is low. New studies can be conducted using this questionnaire in the wider patient group and other diseases that cause olfactory dysfunction.

In conclusion, we may state that the Turkish version of the QOD is a reliable and a valid instrument, particularly in patients with parosmia.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

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