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ORIGINAL RESEARCH

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Validation and cross-cultural adaptation of the Arabic version of the self-reported mini olfactory questionnaire (Self-MOQ)

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Abstract

Background: A simple self-assessment screening questionnaire for olfactory dysfunction is direly needed in Rhinology practice, and this questionnaire should be accessible to affected individuals. The self-reported mini olfactory questionnaire (Self-MOQ), constructed to fill this gap, could be an important tool, especially in the era of telemedicine.

Objectives: The aim of this study was to assess the validity and reliability of the Arabic version of the self-reported mini olfactory questionnaire (Self-MOQ) in patients with olfactory dysfunction.

Methodology: This cross-sectional study included all adult patients who visited a rhinology clinic between January and June 2023 with a complaint of olfactory dysfunction and a control group. The participants completed a questionnaire that included items on demographics, risk factors of olfactory dysfunction, the olfaction VAS, SNOT-22, and Arabic Self-MOQ. The Self-MOQ was forward- and back-translated by qualified professional translators familiar with American English and Arabic.

The reliability of the Arabic Self-MOQ was evaluated using Cronbach's α. The test–retest reliability was assessed by estimating the intraclass correlation coefficient (ICC) for the total Arabic Self-MOQ score and the individual items. The discriminative ability was examined by comparing the scores of the case and control groups. The construct validity was assessed by comparing the Arabic Self-MOQ to the olfaction VAS.

Results: The study sample included 307 respondents (196 cases and 111 controls; 34 undertook the retest). The Cronbach's α coefficients were 0.92 (total Self-MOQ) and considered excellent. The ICC for the total Self-MOQ score was 0.87 (95% CI: 0.757, 0.933; $p < .001$), which indicated good test–retest reliability. Strong correlations were observed between the Self-MOQ items and VAS scores ($r = 0.732$, $p < .001$), ($r = 0.689$, $p < .001$).

Conclusion: The current investigation showed the Arabic version of the Self-MOQ to be a reliable tool for olfactory dysfunction screening.

KEYWORDS
anosmia, hyposmia, olfactory dysfunction, quality of life, self-assessment, validation

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1 | INTRODUCTION

The sense of smell is involved in numerous daily activities, such as eating and communicating, and has vital functions; for example, it is used to detect dangerous odors.[1] There are many causative factors for loss of smell, and sinonasal disease is the most common etiology (62%), followed by post-infectious olfactory dysfunction.[2] Olfactory dysfunction is a common medical problem; it affects 5%–20% of the general population and is underestimated among otorhinolaryngology physicians due to the lack of a clear diagnostic approach and scarcity of evidence on treatment options.[3] Olfactory dysfunction can have a negative impact on quality of life and has been linked to depression, anxiety, loss of pleasure with eating, and relationship issues.[4]

The methods used to assess olfactory dysfunction can be categorized as psychophysical, self-rating, and electrophysiological tests. Psychophysical testing includes odor identification and discrimination tests in which patients are tested for their ability to detect specific aromas and odors. Examples of such tests include the Connecticut Chemosensory Clinical Research Center (CCCRC) Detection Test, the University of Pennsylvania Smell Identification Test (UPSIT), and the Sniffin' Sticks test.[5] Electrophysiological tests such as olfactory event-related potentials (OERPs), and electro-olfactogram (EOG) data.[5] Self-ratings tend to be based on using validated questionnaires to assess the effect of olfactory dysfunction on quality of life, such as the Beck Depression Inventory, the Short Form-36 Health Survey, and the Questionnaire of Olfactory Disorders (QOD).[5] Additionally, the QOD-NS, a specialized instrument for measuring olfactory quality of life, includes subdomains that address various factors such as social interactions, eating experiences, anxiety levels, and annoyance. However, the original QOD-NS is lengthy, consisting of 17 items, which can be overwhelming for patients. As a solution, Mattos et al.[6] have developed a shorter version called the Brief QOD-NS. This condensed questionnaire comprises only seven items, yet it has been proven to be valid and accurate, improving the efficiency of data collection while still effectively assessing olfaction-related quality of life.

In 2019, Zou et al.[7] introduced the Self-Reported Mini Olfactory Questionnaire (Self-MOQ), a simple, easily accessible self-assessment instrument that included questions about daily life activities that involve sense of smell for example: I do not perceive the smell of coffee and fresh bread, with yes and no answers. It is considered a reliable screening tool for olfactory dysfunction. The Self-MOQ provides the most accurate results among all tools used to self-evaluate olfactory dysfunction.[7]

Spoken by over 400 million people, Arabic is the fourth most used language globally and the native language of more than 15 countries.[8] A validated and reliable Arabic-language self-assessment tool, such as the Self-MOQ, is greatly needed in Arabic regions to support screenings for and assessments of olfactory dysfunction. Such a tool should be easily accessible to any individual, for in the era of telemedicine, the use of communication technologies can facilitate the screening of some rhinology issues remotely. Such a tool could also be used to evaluate post-intervention changes and thus the efficacy of treatments.[8,9]

To the best of our knowledge there is no validated Arabic version of the Self-Reported Mini Olfactory Questionnaire (Self-MOQ). The aim of this study was to validate the Arabic version of the Self-MOQ and evaluate its reliability among patients with olfactory dysfunction in Saudi Arabia.

2 | METHODOLOGY

Following the recommendations for standard cross-cultural adaptation, we proceeded to validate the Arabic Self-MOQ. First, we modified some questions in the English version so that they were more culturally representative, and this was approved by the original author of the tool. The English version was then translated by professional linguists (mother language: Arabic) to produce an Arabic version. We then assessed the translated version and made minimal changes for cultural adaptation purposes. The questionnaire was subsequently back-translated into English, and the items were compared to the original Self-MOQ items by qualified professional translators familiar with American English and Arabic. The back-translated version was found to be very similar to the original version, confirming that the original meaning had been preserved. Moreover, we sought the opinion of the original author, and he agreed on the final form. The Arabic version is displayed in Figure 1.

The ethical committee of the College of Medicine, King Saud University, Riyadh, Saudi Arabia approved the research protocol, and informed consent was obtained from the participants.

This cross-sectional study was conducted at King Abdulaziz University Hospital, Riyadh, Saudi Arabia. The study included all patients with complaints of olfactory dysfunction who presented to our rhinology clinic between January and June 2023 and met the inclusion criteria. In addition, control subjects were recruited. Adult participants affected by olfactory dysfunction (as determined by an olfaction Visual Analogue Scale [VAS] score >3) and adult control subjects with normal olfaction (VAS 0–3) were included and invited to fill out a questionnaire featuring items on demographic information and risk factors for olfactory dysfunction. The questionnaire also reproduced the olfaction VAS, Sino-Nasal Outcome Test 22 (SNOT-22), and Arabic Self-MOQ. The sample size was determined by following the methods specified in the paper that introduced the English version of the Self-MOQ and in other recent studies.[7] We determined that a sample size of 10–20 per item was required and thus sought to achieve a distribution in our analysis of 14 subjects per item.[10]

The reliability of the Arabic Self-MOQ was evaluated using Cronbach's α. The test–retest reliability was assessed by estimating the intraclass correlation coefficient (ICC) for the total Arabic Self-MOQ score and the individual items. The discriminative ability of the Arabic Self-MOQ was examined by comparing the scores of the case and control groups. The construct validity was assessed by comparing the Arabic Self-MOQ to the olfaction VAS.

عناصر استبيان الشم المصغر المبلغ عنها ذاتيًا.

يُرجى وضع علامة في كل سؤال ينطبق عليك بشكل عفوي.

1. في محلات العطور، أجد صعوبة في شم العطر.	نعم	لا
2. قد يحصل ألا ألاحظ روائح الحيوانات.	نعم	لا
3. لا أشم رائحة القهوة والخبز الطازج.	نعم	لا
4. لا أشم روائح الآخرين النفاذة كالثوم.	نعم	لا
5. أحب أن أتجول في محل الزهور، لكني لا أشم أي شيء.	نعم	لا
6. لا أشم رائحة عرق الناس كثيري التعرق.	نعم	لا
7. لا يصاحب متعة الأكل لديّ أي متعة للشم.	نعم	لا
8. أفتقد "الرائحة المعتادة "لمخفف الدهانات أو الصمغ.	نعم	لا
9. لا أشم رائحة الإسفلت الجديد في مواقع إنشاء الطرق.	نعم	لا
10. يسبقني الآخرين في ملاحظة الرائحة السيئة للطعام.	نعم	لا
11. لا أشم رائحة جسم زوجي/زوجتي أو القريبين مني.	نعم	لا
12. لا أشم الرائحة العفنة في القبو.	نعم	لا
13. لا أتعرف على رائحة العشب المجزوز حديثًا.	نعم	لا
14. لا أنتبه إلى الرائحة الكريهة في بعض المراحيض العامة.	نعم	لا

تم ترجمة الاستبيان بقسم الأنف والأذن والحنجرة,كلية الطب,جامعة الملك سعود,الرياض,المملكة العربية السعودية. للاستفسار alssaad@ksu.edu.sa

FIGURE 1 The Arabic version of the Self-Reported Mini Olfactory Questionnaire (Self-MOQ).

2.1 | Exploratory factor analysis

Exploratory factor analysis (EFA) was performed to assess the underlying factor structure of the Self-MOQ. Factor extraction was performed using maximum likelihood based on eigenvalues greater than one. Loadings, cross-loadings, and communalities were assessed. The inter-item correlation and reliability (Cronbach's α) of the resultant scores were assessed. The communalities were taken as indicators of the amount of variance in each variable that was accounted for by the resulting factors. Items were removed when the communal values were lower than 0.4. For newly developed items, the factor loading was expected to exceed 0.5, and for established items, loadings >0.6 were desired.[11] Items were also checked for cross-loadings to ensure that no manifest variable loaded (>0.4) on multiple factors. Items that cross-loaded on several factors were omitted from the study.

Oblimin (oblique) rotation was used because it considers the association between the extracted elements. Promax rotation was also attempted. However, the resulting rotated solution did not match the initially proposed factor structure. Factor analysis was initially performed based on retaining factors with eigenvalues greater than one. Initially, all indicators were included in the study. Indicators were eliminated from the study based on communalities or loadings (low loadings or commonalities) and cross-loadings (loading on more than one latent factor).

2.2 | Confirmatory factor analysis

Confirmatory factor analysis (CFA) was performed to assess whether the proposed model of latent constructs was a good fit for the data. The following model parameters were estimated and assessed: convergent and divergent validity and test–retest reliability. Cutoff values were set according to Hu et al. and Koo et al.[12,13]

2.3 | Statistical analysis

Statistical analyses were performed using R v 4.3 (R Core Team 2020). EFA was performed using maximum likelihood. Factors with

eigenvalues greater than one were extracted using oblimin rotation. Cronbach's α coefficients were calculated to determine the questionnaire's reliability. Covariance-based CFA was performed using the lavaan package in R to assess model fit.

The unpaired *t*-test was used to statistically compare the differences in the total Self-MOQ and subscale scores between the case and control groups. Finally, Spearman's correlation coefficient was used to assess the association between the Self-MOQ and SNOT-22 scores. Hypothesis testing was performed at a 5% level of significance.

3 | RESULTS

3.1 | Descriptive statistics

The study sample included 307 respondents (196 cases and 111 controls). Respondents in the case group were more likely to be older than those in the control group ($p < .001$). The distribution of males and females did not significantly differ between the groups ($p = 0.95$). The average SNOT-22 score was significantly higher in the case group compared to that in the control group (47.8 vs. 19.1, $p < .001$). The proportion of respondents who underwent sinonasal surgery was significantly higher in the case group than in the control group ($p < .001$; Table 1). Meanwhile, the etiological factors extracted from the olfactory dysfunction data are presented in Table 2.

TABLE 1 The descriptive statistics for the study sample and a comparison of the Self-Reported Mini Olfactory Questionnaire (Self-MOQ) and SNOT-22 scores of the cases and controls.

	Cases	Controls	
	N = 196	*N* = 111	*p*
Age (years)			<.001
<18	4 (2.04%)	3 (2.70%)	
18–30	42 (21.4%)	65 (58.6%)	
31–40	61 (31.1%)	12 (10.8%)	
41–50	49 (25.0%)	15 (13.5%)	
51–60	25 (12.8%)	10 (9.01%)	
>60	15 (7.65%)	6 (5.41%)	
Sex			.950
Female	95 (48.5%)	55 (49.5%)	
Male	101 (51.5%)	56 (50.5%)	
SNOT-22 total score	47.8 (25.9)	19.1 (21.4)	<.001
Olfaction VAS	6.76 (2.33)	0.43 (0.66)	<.001
Self-MOQ F1	4.27 (2.40)	0.45 (0.95)	<.001
Self-MOQ F2	2.71 (2.13)	0.21 (0.60)	<.001
Self-MOQ total	8.12 (4.87)	0.72 (1.46)	<.001

Note: Analysis was performed using the unpaired *t* test. Self-MOQ F1 was calculated as the sum of items 1, 5, 7, 8, 9, 10, and 13. Self-MOQ F2 was calculated as the sum of items 4, 6, 11, 12, and 14.

3.2 | Exploratory factor analysis

3.2.1 | Number of factors

Factor analysis was performed using the data from the 196 cases who had olfactory dysfunction to provide the variability needed to estimate factor scores. Before the EFA, the Kaiser–Meyer–Olkin (KMO) and Bartlett's sphericity tests were conducted to evaluate the sampling adequacy. It was found that the KMO value was 0.936 and that the Bartlett's sphericity test result was significant ($\chi^2 = 1522.6557$, df = 91, $p < .001$), indicating that the sample met the criteria for EFA. Maximum likelihood factor analysis was performed using oblimin rotation with Kaiser normalization. Item–total correlation analyses were performed on the 14 items of the original version of the Self-MOQ. The results showed that all the items were moderately or highly correlated with the total score ($0.453 < r < 0.779$) as shown in Table 3.

Two factors were obtained using the criterion of an eigenvalue >1 (7.255 and 1.112, respectively).Self-MOQ F1 included items 1, 5, 7, 8, 9, 10, and 13, and Self-MOQ F2 included items 4, 6, 11, 12, and 14. These two factors explained 52.3% of the variance in all 14 items, which was considered adequate. However, the initial analysis showed poor communality for Self-MOQ F2 ($h^2 = 0.23$), meaning that it correlated poorly with the remaining scale items. Item 3 cross-loaded on both factors and was thus eliminated. Thus, only 12 items were included in the second run of the final factor analysis (Table 3). No issues with loadings, cross-loadings, or communalities were observed when items 2 and 3 were eliminated.

3.2.2 | Reliability and validity

The Cronbach's α coefficients were 0.92 (total Self-MOQ), 0.85 (Self-MOQ_F1), and 0.91 (Self-MOQ_F2). This coefficient should have a minimum value of 0.7 for preliminary research. Thus, these values were considered excellent.[14]

3.2.3 | Confirmatory factor analysis

The final factor structure of the Self-MOQ items. All items had loadings >0.5, which was acceptable. The composite reliability of the two factors was 0.846 and 0.906, respectively. The HTMT

TABLE 2 Etiology of olfactory dysfunction.

Etiology of olfactory dysfunction	Cases	<.001
Trauma-related	4 (2.04%)	
Post-viral	11 (5.61%)	
CRS	176 (89.8%)	
Skull-base pathology	5 (2.55%)	

TABLE 3 Pattern matrix of the included items.

	Run 1			Run 2		
	Self-MOQ F1	Self-MOQ F2	H2	Self-MOQ F1	Self-MOQ F2	H2
Self-MOQ1	0.71	−0.17	0.34	0.622		0.487
Self-MOQ2	0.48	0.01	0.23			–
Self-MOQ3	0.44	0.37	0.59			–
Self-MOQ4	−0.09	0.91	0.7		0.914	0.794
Self-MOQ5	0.47	0.16	0.37	0.472		0.593
Self-MOQ6	0.00	0.81	0.65		0.800	0.779
Self-MOQ7	0.61	0.10	0.48	0.626		0.661
Self-MOQ8	0.56	0.08	0.39	0.571		0.588
Self-MOQ9	0.75	0.07	0.66	0.745		0.763
Self-MOQ10	0.63	−0.05	0.35	0.602		0.544
Self-MOQ11	0.09	0.74	0.67		0.721	0.805
Self-MOQ12	0.10	0.77	0.73		0.750	0.849
Self-MOQ13	0.70	0.09	0.59	0.727		0.738
Self-MOQ14	0.27	0.53	0.58		0.522	0.765
Cronbach's α				0.85	0.91	

Note: Maximum likelihood was used for model estimation. Factor extraction was performed using oblimin rotation.

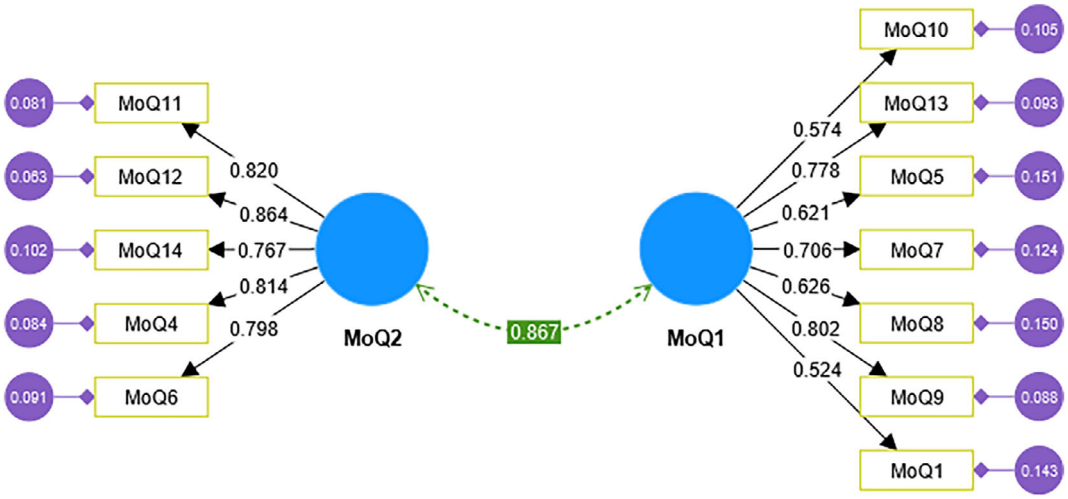

FIGURE 2 Confirmatory factor analysis results. Loadings are shown on the arrows heading from the factors to the individual items. The correlation between both factors is shown in the red rectangle.

value was 0.866, which was lower than the proposed cutoff value of 0.9 (Henseler et al.).[15] Thus, discriminant validity was established between the two factors. A strong correlation was observed between the two factors ($r = 0.867$, $p < .001$), as shown in Figure 2.

The following results suggested that the model was a good fit for the data: CFI (comparative fit index) and TLI (Tucker–Lewis index) >0.9, RMESA (root mean square error of approximation) <0.08, and SRMR (standardized root mean square residual) <0.06.

3.2.4 | Test–retest reliability

Thirty-four respondents undertook the retest. The ICC for the total Self-MOQ score was 0.87 (95% CI: 0.757, 0.933; $p < .001$), indicating good test–retest reliability. The result of McNemar's test was not statistically significant for any of the items, which indicated that the responses did not change significantly between the two time points. This finding supported the acceptability of the test–retest reliability. The paired t-test analysis showed that the Self-MOQ scores did not significantly differ between the time points.

3.3 | Comparison of the self-reported mini olfactory questionnaire (Self-MOQ) scores of the case and control groups

When the average total Self-MOQ scores of the case and control groups were compared, it was found that they were significantly different (8.12 vs. 0.72, $p < .001$). Similar results were observed when the Self-MOQ F1 and Self-MOQ F2 values were compared. The average SNOT-22 score also significantly differed between the groups ($p < .001$), as shown in Table 2.

3.4 | Correlation between the Self-MOQ and SNOT-22 scores

The total scores of the Self-MOQ and SNOT-22 were positively correlated, although the magnitude of the correlation was moderate ($r = 0.426$, $p < .001$).as shown in Figure 3.

3.5 | Construct validity

Pearson's correlation was used to assess the construct validity through the association between the Self-MOQ aggregated scores (Self-MOQ F1 and Self-MOQ F2) and the VAS score for the sense of smell. A strong correlation was observed between Self-MOQ F1 and the VAS score ($r = 0.732$, $p < .001$). A similar correlation was found between Self-MOQ F2 and the VAS score ($r = 0.689$, $p < .001$). A positive correlation was also found between both factors (Self-MOQ F1 and Self-MOQ F2) and item 12 of the SNOT-22 ($r = 0.663$ and 0.635, respectively; $p < .001$), as shown in Table 4. These results suggest that the Self-MOQ is a valid instrument for assessing the sense of smell.

4 | DISCUSSION

The use of subjective methods to detect and assess olfactory dysfunction has become common practice in many ENT centers, and

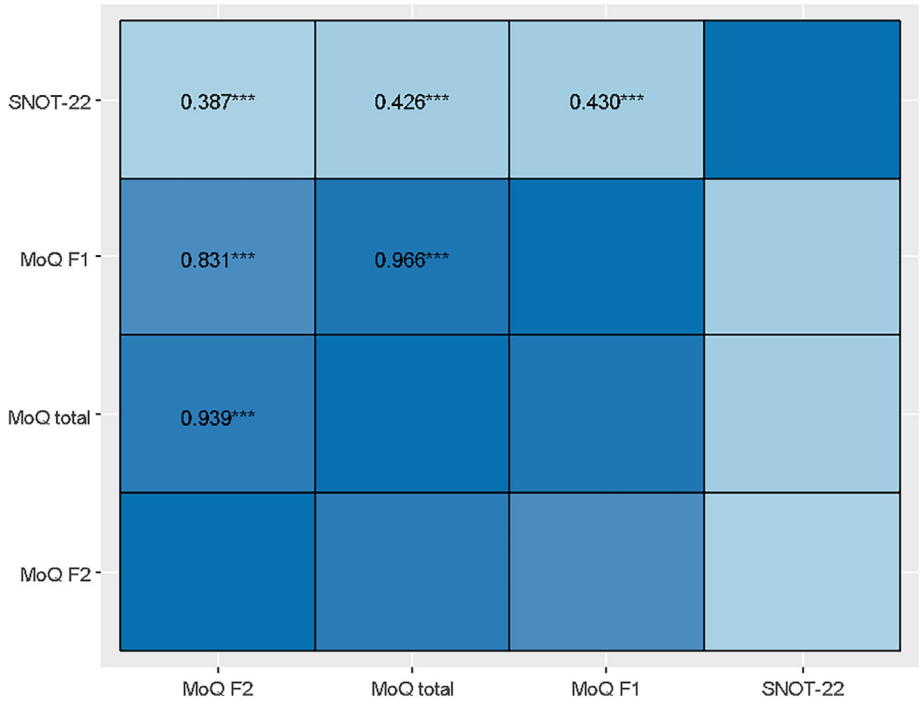

FIGURE 3 Correlation between the Self-Reported Mini Olfactory Questionnaire (Self-MOQ) and SNOT-22 scores.

TABLE 4 Instrument validity.

	Self-MOQ F1	Self-MOQ F2	Self-evaluation of sense of smell (VAS)	SNOT-22	Decreased sense of Taste/smell
Self-MOQ F1					
Self-MOQ F2	0.831***				
Self-evaluation of sense of smell (VAS)	0.732***	0.689***			
SNOT-22	0.430***	0.387***	0.505***		
Decreased sense of Taste/Smell (SNOT-item 12)	0.663***	0.635***	0.713***	0.724***	

Note: Correlations were computed using the Pearson method with listwise deletion. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

instruments such as the QOD, Self-MOQ, and Hyposmia Rating Scale (HRS) are considered fast, reliable, and cost-effective non-invasive tools that do not cause patient discomfort.[16]

Frasnelli et al. developed the QOD to detect the quality-of-life impairment that parosmia patients endure and reported that parosmia patients demonstrated the greatest quality-of-life impairment, followed by hyposmia and anosmia patients.[17,18] It has also been used to show that patients with olfactory dysfunction have a higher prevalence of depression than the general population.[17,18] Applying the QOD quickly became a standard procedure in the ENT community; however, the main disadvantage of the questionnaire is that it focuses on qualitative olfactory dysfunction (parosmia, phantosmia) rather than quantitative dysfunction (hyposmia, anosmia), and it is also too long and time consuming for patients to complete.[17,18]

Other novel questionnaires include the Taste and Smell Tool for Evaluation (TASTE) and the Olfactory Dysfunction Outcomes Rating (ODOR). The TASTE was designed by Niklassen et al.[16] to evaluate olfactory and gustatory impairment simultaneously and validated using eight chemosensory-related domains (Cronbach's $\alpha = 0.65$–0.86). However, there were some limitations in the study; for example, a limited number of healthy participants were included, and not all the domains in the questionnaire were distinct.[16]

In their recent study, Lee et al.[19] concluded that the original QOD has some weaknesses, such as its length and language difficulties, as well as the low number of participants used in the initial study. This led them to develop a new instrument—the ODOR—a questionnaire with 28 items divided into five domains. Their study showed good initial results for the questionnaire; however, it has some limitations, such as the participants being enrolled in other prospective studies at the same center, and further research is required to evaluate the validity of the questionnaire.[19]

In 2019, the Self-MOQ was developed by Zou et al.[7] The original version contained 14 true/false items, and after some refinement, the final five-item version was produced. The items are written as personal statements and cover issues encountered in daily life (e.g., "I like to look around the flower shop, but I cannot smell anything").[7] Zou et al.[7] used the Self-MOQ and Sniffin' Sticks test to perform a comparative analysis and found a negative correlation between the results of the two instruments; hence, the Self-MOQ was concluded to be an effective method for screening for and measuring olfactory dysfunction. However, they did not assess the test–retest stability or the effectiveness of the Self-MOQ in different cultures and languages.

A recent systematic review assessed 21 questionnaires related to olfactory dysfunction.[19] The reliability and validity of the questionnaires were examined, as well as the items in each of the questionnaires and the time needed to complete them. The authors found that an advantage of the QOD was its good validity and reliability, including when it was translated into other languages, such as Mandarin and Korean. They also found that the Self-MOQ had the advantages of being shorter and easier to complete, without compromising the validity or reliability of the questionnaire.[20]

When evaluating the reliability and validity of a newly translated questionnaire, several parameters should be analyzed, such as internal consistency and test–retest reliability. The internal consistency is assessed using Cronbach's α, which indicates the intercorrelation of items in a questionnaire. Ideally, the coefficient should have a value of 0.7–0.9.[14,21] Values lower than this range indicate inadequate consistency, and values higher than 0.9 indicate that the items may be too similar and not diverse enough. In this study, the Cronbach's α value for our translated questionnaire was 0.92. The test–retest reliability can be assessed using the ICC, with values above 0.8 being sufficient. Here, the total ICC for the Arabic Self-MOQ was 0.87.

This is the first time that the Self-MOQ has been translated into a language other than English and consequently validated. In this study, this Arabic version of the Self-MOQ had good reliability and validity. To our knowledge, there is no standard psychophysical test for olfactory dysfunction in Saudi Arabia. Thus, we chose to use the olfaction VAS as a reference when determining the validity of the Arabic Self-MOQ. This is a limitation of this study.

Based on our findings, we recommend that further research be conducted on the Self-MOQ. It is not only a valuable resource in the screening of patients for olfactory dysfunction but also a helpful tool in the research on olfactory dysfunction and related conditions.

5 | CONCLUSION

The current investigation showed the Arabic version of the Self-MOQ to be a reliable tool for olfactory dysfunction screening. Having access to a short, reliable questionnaire, such as the Self-MOQ, can save time and allow easier detection of olfactory dysfunction than relying on more extensive objective methods.

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