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ORIGINAL CONTRIBUTION

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Translation and validation of the "Smell Diskettes" Olfaction Test into Arabic*

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Abstract

Objective: This study aims to translate and validate the "Smell Diskettes" screening tool from English into Arabic. The significance of this study stems from the lack of reliable and rapid olfaction screening tests available to Arabic speaking patients and health-care practitioners.

Methods: This is a prospective cohort, multi-center study. A forward-backward translation of the olfaction screening test was done to translate the text into Arabic. Data was collected from two groups: a control group (n=125) of which 84 % were females (n=105) and a mean age of 22.4 of subjectively normosmic individuals from Alfaisal University and a patients group (n=82) of which 35.4% females (n = 29) with a mean age of 38.2, all of whom were diagnosed with olfactory disturbances related to rhinological pathologies, from King Abdulaziz University Hospital (KAUH) in Riyadh, Saudi Arabia. One of the limitations we faced due to convenience sampling and COVID-19 pandemic restrictions was the inability to perform a "test-retest" on study subjects.

Results: The study included 207 subjects, out of whom 82 (40%) were patients from the rhinology clinic at King Abdulaziz University Hospital (KAUH) and 125 (60%) were recruited as controls from Alfaisal University. The average olfaction scores for the control group and the patients' group were 7/8 and 5/8, respectively.

Conclusion: This study has determined that the Arabic-language version is a valid and useful instrument used in clinical practice and for research purposes. The development of this tool will allow more patients in Arabic-speaking countries to be screened for olfactory disturbances.

Key words: Arabic translation, olfaction, screening

Introduction

Olfactory function is considered one of the major diagnostic factors in Rhinology and, by extension, general Otolaryngology practice. Olfaction impacts not only an individual's quality of life but also contributes towards one's safety in terms of identifying environmental and occupational hazards, such as smoke and gas leaks [(1)].

Due to the abovementioned reasons a reliable and culturally acceptable screening tool that can indicate whether a pathology is present or not is needed to distinguish between normal (normosmia) or abnormal (hyposomia or anosmia) which if found would promote physicians to investigate further using extended tests to reach a diagnosis and treat accordingly.

In recent years, different quantitative olfaction measurement tools have been developed, including, Including, but not limited to the Threshold Discrimination and Identification " Sniffin

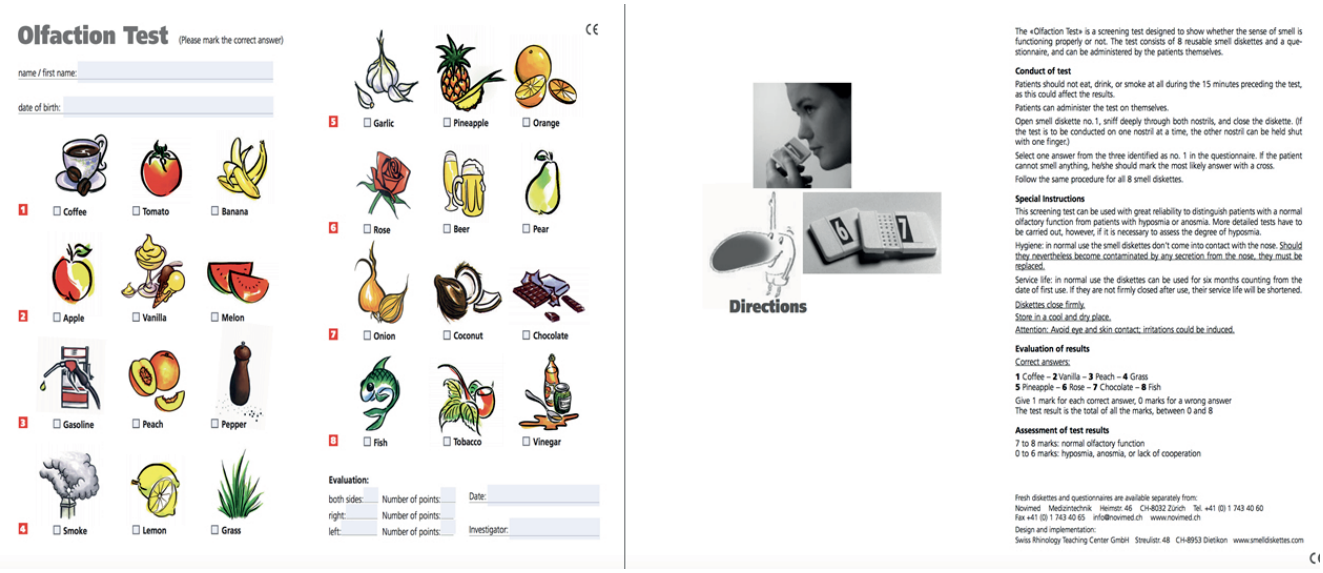

Figure 1. Original "Smell Diskettes" Test.

Sticks", which is a considered to be validated, widely used test and was previously adapted into Arabic language [2]. It is comprised of 3 tests which are odor threshold, odor discrimination and odor identification, with the result presented as TDI score, a combination of the previously mentioned components [3].

Secondly, the University of Pennsylvania Smell Identification Test (UPSIT), which is another validated widely used olfactory function test. The test consists of microencapsulated odorants that are scratched, and the participants would mark their response. This test has been translated into the Arabic language, where 14 odors from the original test were replaced by more familiar odors to the Arab population [4].

Finally, the "Smell Diskettes' test, which is pre-existing olfactory screening method, used to differentiate normosmic from hyposmic and anosmic individuals [5]. The test yields a score that helps stratify patients into different categories. The "Smell Diskettes" test was developed in Zurich, Switzerland (Figure 1), where a patient is exposed to several 5x6 cm discs that have different odors embedded in them. The test is designed as a triple forced multiple-choice test where a patient chooses between one of three possible odors and then is given a score from 0 to 8. A participant scoring 7 or 8 is labeled as normosmic, while a score of 6 and lower is considered hyposmic or anosmic [5].

The major differences among the abovementioned tests, is that TDI and Smell Diskettes tests, are reusable, and the test is conducted by experienced examiners [6], unlike the UPSIT test which is non-reusable and self-administered by the patients themselves [7].

In addition to the (SST), (UPSIT) and the "Smell Diskettes", many olfactory function tests have been validated across several countries including but not limited to, "Scandinavian odor smell test", "Barcelona smell test" (BAST-24) and "Connecticut chemosensory research center test" [8].

The main uses of these olfaction tests include, but not limited to, pre and postoperative olfaction assessment, especially in Rhinology cases. Secondly, to monitor changes over time, especially after pharmacological intervention. Thirdly, to support disability compensation claims. Finally, to identify quantitative (Example: anosmia, hyposmia) or qualitative smell disorders (example: parosmia) [5,7].

The "Smell Diskettes" test is already available and validated in multiple languages, including English and German, but not in Arabic. History taking and clinical evaluation without language barriers will improve the quality of care delivered to patients and avoid errors in clinical evaluation. For the aforementioned reasons, an Arabic version of the "Smell Diskettes" test must be validated to be used for an Arabic-speaking patient population. This translation and validation aim to provide an additional olfaction assessment tool, locally approved in Saudi Arabia, with the advantages of rapidity, objectivity, and reusability.

Methods

This is a prospective cohort, multi-center study that aims to validate the "Smell Diskettes" test in the Arabic language.

A forward-backward translation method was used by three expert rhinologists who are native Arabic speakers and independent native English speakers to make sure that uniformity was maintained between the original English text (Figure 1) and the translated Arabic version (Figure 2). The processes started by having experienced ENT specialists, who were native Arabic speakers and professional English speakers, translate the English test to Arabic. Subsequently, independent native English speakers with professional knowledge of Arabic, translated the test back to English to ensure validity.

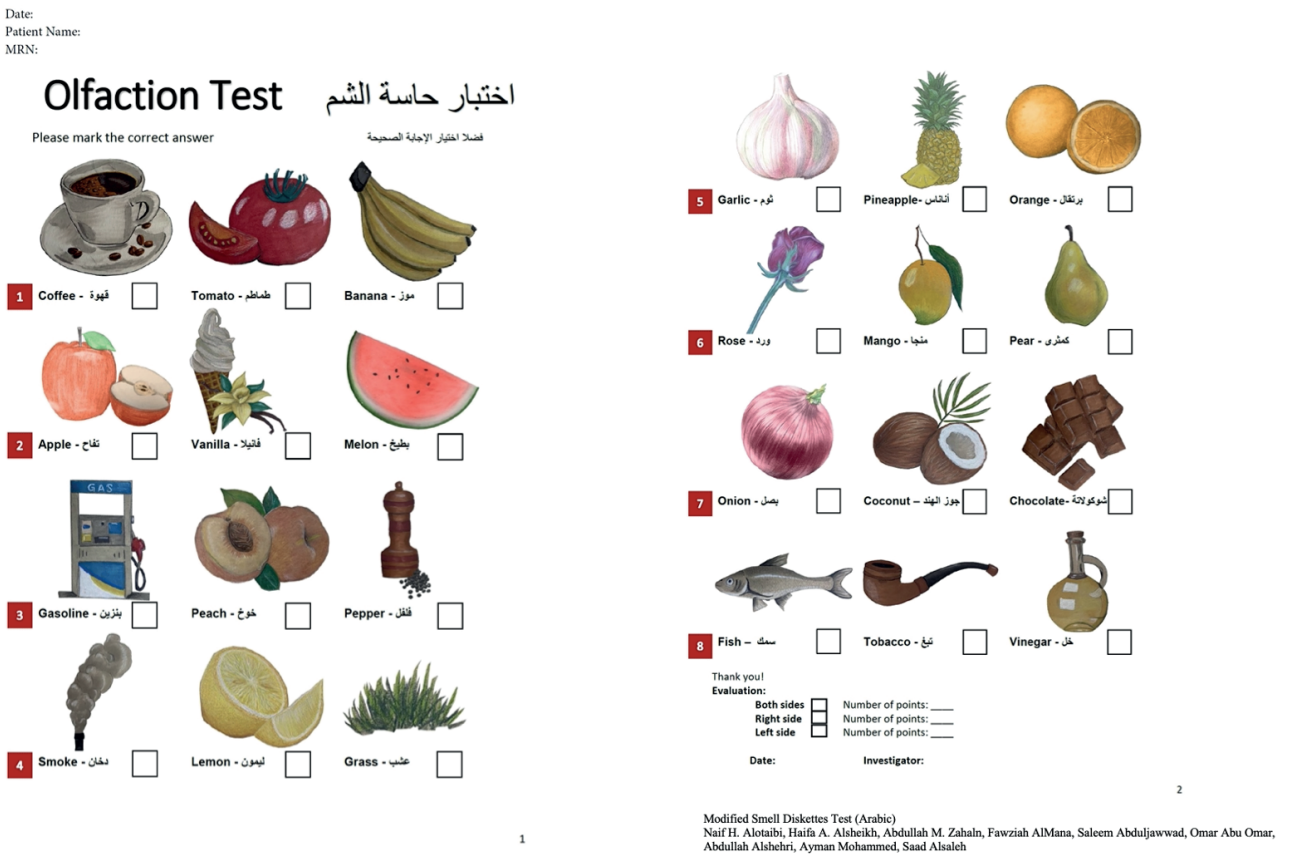

Figure 2. Arabic Translation of the "Smell Diskettes" Test.

A total of 207 participants underwent the Arabic version of the "Smell Diskettes" olfaction test, 125 from the control group and 82 from the patient group. The control group consisted of healthy adults from Alfaisal University's student body, faculty, and employees, and the patient group included patients from King Abdulaziz University Hospital (KAUH) in Riyadh. The inclusion criteria of the control group included native Arabic speakers of any nationality, gender, and subjectively normosmic with no known olfactory disturbances. Convenience sampling was used with announcements to participate in the experiment. The inclusion criteria of the patient group included native Arabic speakers of any nationality, gender, and currently diagnosed with rhinological disorders. While the exclusion criteria for both control and patient groups included individuals with communication disabilities, younger than 16 years of age, pregnant women (due to uncertainty regarding hyperosmia) [9], psychiatric patients, and non-native Arabic speakers.

Two "Smell Diskettes" kits were used by trained Alfaisal University faculty members to conduct the screening test among all participants. Alongside the test, demographic (e.g., age, gender) data was collected from the participants, and for the patient group, their principal rhinological diagnosis, then finally their olfaction score after the test. Following data collection, statistical analysis was done using SPSS version 25 to categorize and group patients and find relevant associations. [Spss I. IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version. 2017;25.]

Ethical considerations

Ethical approval was obtained from the Institutional Review Board (IRB) at the College of Medicine at Alfaisal University and King Saud University. Informed consents were collected from all participants, and all test details were explained to participants before they consented to join the study. All participants were informed of their right to withdraw at any time during the study's duration with no consequences, as participation was entirely voluntary.

Results

Control group

In the control group, 125 participants completed the Arabic version of the "Smell Diskettes" screening test, of which 84% were females (n = 105), and 16% were males (n = 20). The ratio of men to women was 1:5.25. Ages ranged from 18 to 57, with a mean age of 22.6, in which 84% (n = 105) of participants were in the 18-25 age range, 10.4% (n = 13) were aged 26-35, and 5.6% (n = 7) of participants were above 36 years of age.

The control group participants were recruited from a university campus which can explain why the majority (84%) are between

Table 1. Primary diagnosis of patients in the patient group in descending order, with number and percentage of patients in each pathology, and their respective average score for each category.

Diagnosis	Frequency	Percent (%)	Average olfaction score (out of 8)
Chronic Sinusitis with polyps	31	37.8	4.3
Chronic Sinusitis without polyps	13	15.9	5.9
Allergic Rhinitis	12	14.6	5.3
Deviated Nasal Septum	8	9.8	6.6
Fungal Sinusitis	2	2.4	2.5
Bacterial Sinusitis	1	1.2	7
Turbinate Hypertrophy	1	1.2	5
Others	14	17.1	4.5

18-25 years of age.

Olfaction scores of the control group ranged from 3 to 8, as shown in Figure 3, with a mean of 6.54. Out of the 125 participants, 7 participants scored 8 (or 5.6%), 68 participants scored 7 (or 54.4%), 38 participants scored 6 (or 30.4%), 10 participants scored 5 (or 8%), 1 participant scored 4 (or 0.8%), and 1 participant scored 3 (or 0.8%), finally, none of the participants in the control group scored in 0, 1, or 2.

It is important to note the association between age and olfaction score, as 89.1% of the normosmic population, including all participants with a perfect score (n=7), belonged to the youngest age group. Conversely, most participants who belonged to the age range of 35 and above scored a 6 or below (n = 6).

Out of the 8 odors used, 7 were identified by more than 75% of subjects in the control group and thus, can be considered as familiar odors in Saudi Arabia, these odors are: peach (99.2%), vanilla (99.2%), rose (93.6%), coffee (89.6%), chocolate (82.4%), grass (78.4%) and pineapple (75.2%). However, one odor (fish) was identified by only 14.4% of participants.

Patient group

In the patient group, 82 patients completed the Arabic version of the "Smell Diskettes" screening test, of which 35.4% of patients were females (n = 29) and 64.6% were males (n = 53). The ratio of men to women was 1: 0.55. Ages ranged from 16 to 76 with a mean age of 38.2, in which18% of patients belong to the 16-25 age range (n = 15), 24% of patients were aged 26-35 (n = 20), 29% of patients were aged 36-45 (n = 24), 25% of patients were aged 45 and above (n = 20), and finally, 4% of patients non-specified (n = 3). All participants in the patient group were diagnosed with rhinological pathologies with or without an effect on their olfactory abilities, as shown in Table 1.

The most common pathology among patients was chronic sinusitis with polyps, occurring in 37.8% of patients (n = 31). Other pathologies present in this patient group include -in descending order- chronic sinusitis without polyps, allergic rhinitis, deviated nasal septum, fungal sinusitis, bacterial sinusitis, turbinate hypertrophy, and other rhinological pathologies. It is interesting to note that the most common rhinological disorders that typically present to a primary care provider are allergic rhinitis and acute sinusitis [10]. However, since King Abdulaziz University Hospital (KAUH) is a highly specialized clinic, a higher percentage of patients will present with advanced rhinological disorders, as opposed to a primary care clinic.

Olfaction scores of the patient group ranged from 0 to 8, as shown in figure 3, with a mean of 4.8. With the score of 8 in 2 patients, (n=2 or 2.4%), score of 7 in 25 patients (n=25 or 30.5%), score of 6 in 16 patients (n=16 or 19.5%), score of 5 in 14 patients (n=14 or 17.1%), score of 4 in 3 patients (n=3, 3.7%), score of 3 in 4 patients (n=4, 4.9%), score of 2 in 5 patients (n=5, 6.1%), score of 1 in 3 patients (n=3, or 3.7%), and finally 10 patients with a score of 0 (or 12.2%).

Discussion

Patients diagnosed with chronic sinusitis/rhinosinusitis with polyps were found to have quite low olfaction scores due to prolonged inflammation of the sinuses coupled with obstruction of olfactory cleft and impeding airflow. Similarly, these patients were found to have low SIT (Smell Identification Test) scores preoperatively [11]. Therefore, the "Smell Diskettes" test remains relevant as it acts as a screening tool to find hyposmic individuals, and according to our results, the Arabic-language version has proven to be able to distinguish between normosmic and hyposmic individuals.

The "Smell Diskettes" test was previously used in a prospective study, which included 184 patients undergoing different rhinological surgical interventions at the otolaryngology – head and neck surgery department at the university of Zurich [12]. The preoperative testing showed that 10.3% and 1.1% of patients were hyposomic or anosmic respectively, while the postoperative testing showed that hyposmia and anosmia were 8.2% and 1.3% respectively. One finding of the study was that surgery induced hyposmia in 2.5% of patients while in 3.4% it resolved after surgery [12].

Another attempt to utilize the "Smell Diskettes" test was done by Donegani et al to assess persistent hyposmia or anosmia in 22 patients after SARS-CoV-2 infection following their recovery. A total of 19 patients submitted the "Smell Diskettes" test as 3 patients were excluded due to different reasons, and results showed that 14 patients are still suffering from hyposmia following their SARS-CoV-2 infection with olfaction test scores ranging from 2 to 6 and the highest number of patients (5) scoring 4 out of 8 on the test [13].

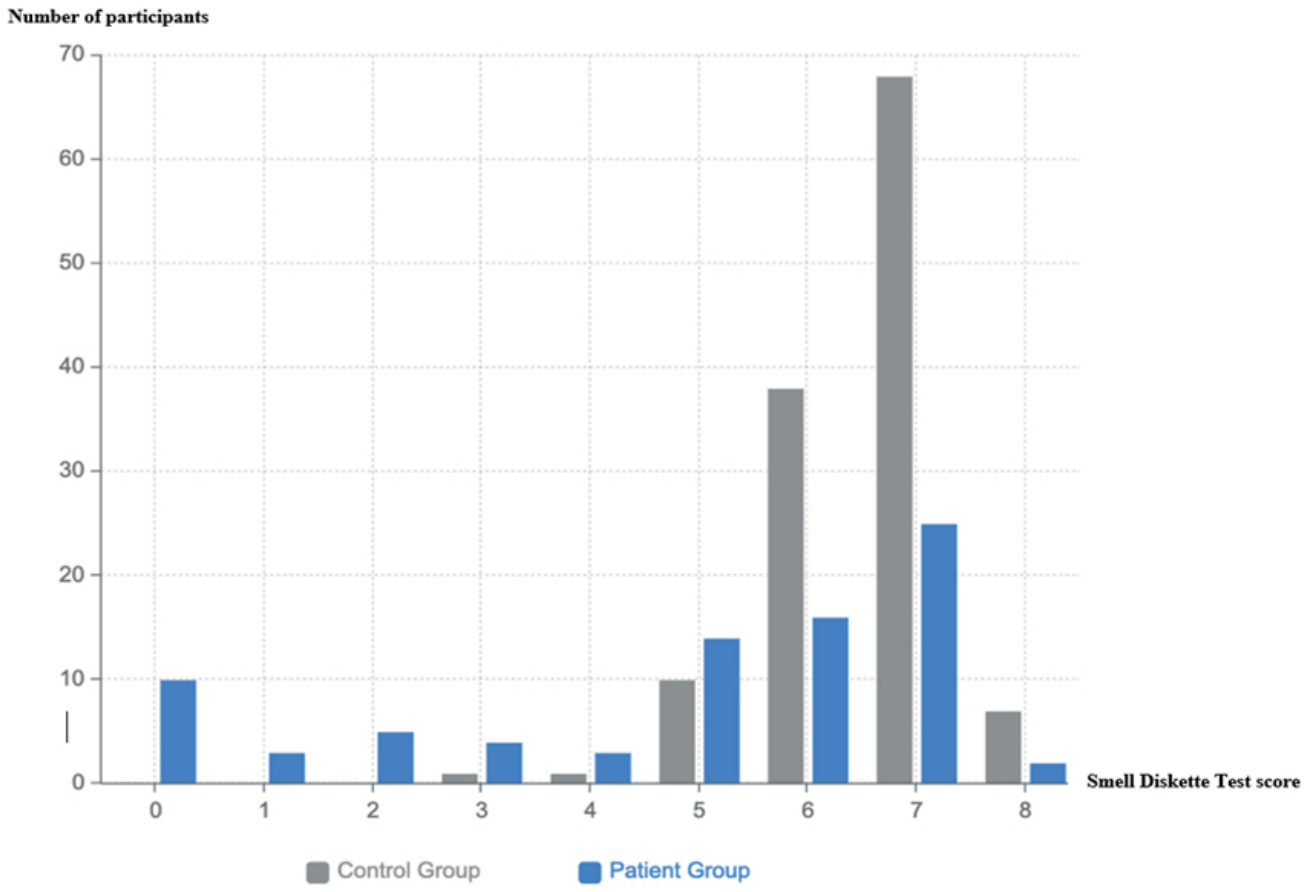

Figure 3. Smell Diskette Olfaction Test Scores of contral and patient groups.

The "Smell Diskettes" Test has many uses beyond olfaction pathologies screening, as reported by Manestar et al., in a study aiming to determine the minimum airflow rate required for olfactory stimulation in laryngectomized patients [14]. It can also be used to evaluate olfactory function post-operatively in patients who underwent endoscopic transnasal transsphenoidal approach for pituitary adenoma, as olfactory disturbances have been reported post-operatively [15]. Such studies are important for both surgeons and patients, to achieve a better quality of life. With increasing age, decreased olfactory function is common but not necessarily noticeable unless tested [16]. Therefore, we must consider that since the control group of participants had a mean age of 22.6 (with a range of 18-57) and the patient group had a mean of 38 (with a range of 16-76), a slightly normal decrease in olfaction is to be expected in the older population, regardless of the group they belong to as shown in our results, which validates the applicability of our version of the "Smell Diskettes" Test. Also, despite all patients in the diseased group having rhinological pathologies, there was an observable pattern of decreased olfactory function with increasing age.

According to Brinner et al., there is a 99.74% chance that a patient who scores 7 or 8 is normosmic, and a score of 0 to 5 highly correlates with hyposmia and anosmia [5]. Thus, a score of 6/8 exists at a threshold point where despite the increased likelihood of hyposmia, there is a small possibility that such patients are normosmic. This fact helps explain why 30.4% of patients in the control group (n = 38) scored a 6/8.

According to the European Position Paper on Rhinosinusitis and Nasal Polyps published in 2020, it is vital to consider that these olfaction assessment tests cannot merely be applied to every language or community since cultural differences may influence a subject's performance. As a result, these tests yield more accurate results when modified to suit local society to be applied in a clinical or research setting [17]. As shown in Niklassen et al.'s study where after modification of their olfaction screening test to suit their Danish population, correct identification increased from less than 75% to 92.2% overall [18]. Furthermore, as variety in results can be attributed to odor familiarity among different populations, another study conducted in Saudi Arabia validating the University of Pennsylvania Smell Identification Test (UPSIT) concluded that the odor of fish was the least identifiable, with only 15% of participants correctly identifying it. Parallel to our results, with only 14.4% of our control group participants

correctly identified fish, thus the role of environmental factors needs to be further studied [4].
Furthermore, 207 subjects were divided into a patient group (n = 82) and a control group (n = 125). The patients group included patients with multiple different diagnoses. Future trials should keep this in mind and increase the number of participants involved for more statistically significant patterns to be observed. Future studies may choose to distinguish between hyposmia and anosmia to stratify the collected data further. Our study focused on screening for hyposmia; however, to assess the prevalence of patients with complete anosmia accurately, more advanced tests must be used [5,6].

Our study will help to bring one of the reliable and wildly used olfactory function test to a new population to screen for hyposmia or anosmia, this will help to achieve a higher standard of health care by removing linguistic barriers, making it available to the Arabic speaking population. This study opens doors for further research in the same field such as a comprehensive compression between all available Arabic smell tests.
Also, this study helped to identify an odor that had a lower identification percentage, fish odor was only identified in 14.4% of patients which is similar to another study from Saudi Arabia as well that had a similar finding while translating the (UPSIT) into the Arabic language [4]. These findings might play a role in including or (most likely) excluding fish odor from future, culturally tailored Arabic smell tests.

This is the first study validating the use of the Arabic version of "Smell diskette" olfaction screening test. Our results indicate that this instrument is valid in both groups, however, the following study limitations remain present. First, we were not able to match the patient and control group in gender and age, due to convenience sampling and the COVID-19 pandemic restrictions which explains why a "test-retest" was not done, Secondly, the control group was not tested for olfaction with another method, which keeps the possibility of an underlaying subclinical olfactory disorder present. Lastly, control group recruitment took place at a university campus which explains why most participants fall between 18-25 years of age.

Conclusion

This study has determined that the Arabic-language version is a valid and useful instrument that can be used in clinical practice and for research purposes. The development of this tool will allow more patients in Arabic-speaking countries to be screened for olfactory disturbances. Our results can act as a foundation for future studies to be conducted on the validation of olfaction screening tests in the Arabic language.

Authorship contribution

NHA: preparation, conducting, and administration of the research, including conducting interviews, data coding, analysis, writing the research results and publication, and dissemination of research report. HAA: Data analysis, reviewing research results, feedback on research drafts, and research publication. AMZ: Conducting experiments, data analysis, reviewing research results, and feedback on research drafts. FAM: Data analysis, reviewing research results, feedback on research drafts, and research publication. SAB: conducting experiments, data analysis, and reviewing research results. OAO: Conducting experiments, data analysis, and reviewing research results. AA: Conducting experiments, data analysis, and reviewing research results. AM: Conducting experiments, data analysis, reviewing research results, and feedback on research drafts. SAL: Responsible for the preparation, conduct, and administration of the research, including conducting interviews, feedback on research drafts, and dissemination of research report.

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Ethics approval and consent to participate

No approval or consent needed.

Consent for publication

Informed consents were collected from all participants, and all test details were explained to participants before they consented to join the study. All participants were informed of their right to withdraw at any time during the study's duration with no consequences, as participation was entirely voluntary.

Availability of data and materials

On request, all data and study protocol can be made available.

Conflict of interest

None declared.

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