Validity of the Arabic version of the University of Pennsylvania smell test on a Saudi population

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Background: The University of Pennsylvania smell identification test (UPSIT) is the most widely used test in the world. However, identification of the odorants can be affected significantly by the cultural background. Presently modified versions of UPSIT are available in more than 12 languages.

Objective: This study was designed to determine whether the Arabic version of the UPSIT is effective and applicable for the Saudi population.

Participants and methods: Overall, 80 healthy volunteers (20 from each of the four regions of Saudi Arabia) between 19 and 50 years of age were selected. Exclusion criteria included any history of smell impairment, otolaryngology diseases that may impair olfaction, previous nasal or skull base surgery, smoking, any neurological diseases, or head trauma. The Arabic version of the UPSIT was administered and the test was scored.

Result: The mean score among the Saudi volunteers was 28.42±4.4; this is below what is considered normal for the North American population. Women scored significantly better than men (P=0.02). The scores across the four regions of Saudi Arabia were not significantly different (P=0.77). Fourteen odors were correctly identified by less than 70% of the volunteers in the study.

Conclusion: The average score of Arabic-UPSIT for healthy Saudi volunteers was far below the average score of the original English version. The lower average score and the high percentage of wrong identification of odors indicate that the current version of the Arabic-UPSIT is not a suitable test for the Saudi population. A larger study after changing few odors will provide more insight.

Keywords: odor, odor identification, olfaction, smell, University of Pennsylvania smell identification test.

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Introduction

Smell is a chemical sense with which an individual can sense the environment for diverse information and serves as an important early warning system for the detection of fire and a polluted environment. Thus, it is not surprising that Deems et al. [1] found that 68% of patients who presented with primarily olfactory problems reported that their dysfunction significantly altered their quality of life, 46% indicated that the disorder changed either their appetite or body weight, and 56% complained that it influenced their daily living and/or psychological well-being.

Olfactory disorders can occur as a result of a wide range of nasal and sinus diseases, neurological and neuropsychiatric diseases, following surgical interventions, or head trauma. [2] The decline in olfactory capability with age is well established. [3]

The University of Pennsylvania Smell Identification Test (UPSIT) is a widely used test that is considered the gold standard with which other tests of olfactory function have been compared. It is commercially known as the smell identification test (Sensonics Inc.). [4,5] The test is sensitive to the influences of a wide range of variables, including age, [6] sex, [7] environmental pollution, [8] and numerous diseases, [9] and has now been translated into over a dozen languages, including Arabic. [10] It is well established that cultural factors, which are sometimes quite subtle, can influence test scores on odor identification tests. [11,12] Cultural and socioeconomic factors have necessitated changes in the original version of the UPSIT and in keeping with this, the odorant items and also the response alternatives have been changed in a number of foreign-language versions to make the test scores more congruent with North American norms [5] and to prevent the cultural bias.

Similarly, the Arabic version of UPSIT was created by changing the language and odors to be more familiar for Arab nation. Although the Arabic version of the UPSIT has been available for some time, no attempt has been made in the past to assess its validity in the Arabic population.

The present study attempts to assess the validity of the Arabic version of the UPSIT in the Saudi population. There are significant cultural differences within the four regions of Saudi Arabia and to ensure adequate representation of the entire population, equal numbers of participants were chosen from all four regions.

Material and Methods

Participants

The study was approved by the ethical committee of the institution (Qatif Central Hospital). The participants were recruited from all four regions in the Kingdom of Saudi Arabia. One hundred and thirty one volunteers, representing the four main regions of Saudi Arabia, were included.

After an informed consent was obtained, a detailed assessment of medical and social history was performed. The volunteers were also asked about the history of travel (within and outside the kingdom of Saudi Arabia). The primary inclusion criterion was that the participant had to be between 19 and 50 years of age.

Exclusion criteria included any history of smell impairment, otolaryngology diseases that may impair olfaction, previous nasal or skull base surgery, smoking, any neurological diseases, or head trauma. All volunteers underwent an endoscopic nasal examination and patients with any active nasal disease were excluded from the study.

The final study group included 80 participants, 20 from each region (east, west, south, and north).

The Arabic version of the UPSIT was administered to all the volunteers and the results were scored. The test was performed by otolaryngology residents or trained nurses to ensure that the volunteers understood the test and also reported any difficulty if any. Microencapsulated odorants were scratched, options were read aloud, and the participants' responses were marked. In the Arabic version of the UPSIT, the language was changed to Arabic and 14 odors from the original were replaced by odors that are more familiar with the Arabic population as shown in Table 1.

The participants were scored and categorized further to test the suitability of the odors for use in the test; the ability to identify each odorant was also evaluated as the percentage of participants correctly identifying each odorant. The cutoff point criterion used by Doty in the validation of each odor was 70% of correct rates (3, 10, and 11). Odorants that were identified by less than 70% of the population were considered inaccurate as they confounded.

The four regions of Saudi Arabia were tested separately and the results were analyzed separately to assess regional variations if any.

Statistical analysis

Data are presented as number (%), mean, and SD. Statistical analyses were carried out using SPSS 17 for Windows (SPSS Inc., Chicago, Illinois, USA).

Results

A total of 80 volunteers were included. There were 20 volunteers from each region of Saudi Arabia. The study group included 38 women and 42 men with a mean age of 31.1 years. The participants did not report any difficulty in understanding and answering the test.

The mean score in our population was 28.4±4.4. This score was considered moderate microsmia in the original classification of UPSIT (Table 2).

Although women scored significantly better than men (29.5±4.2 vs. 27.3±4.3, P=0.026), the average score for both was below what is considered normal in healthy individuals.

The score across the different regions of Saudi Arabia showed no significant difference (P=0.77) despite cultural differences between these regions.

Twenty six odors were correctly identified by at least 70% of the volunteers, whereas 14 odors were identified correctly by less than 70% of the respondents (Table 3). Children powder was correctly identified by 97.5% of the volunteers, whereas the odor of fish was the least identifiable and only 15% of participants correctly identified it.

Most of the volunteers traveled less than one time per year (81.3%). Contrary to expectations, the frequency of travel did not have a significant effect on the UPSIT score (P=0.53).

Table 1 Odors in both the English and the Arabic version of the University of Pennsylvania smell identification test

Items	Odors (Arabic version)	Odors (English version)
1	Pizza	Pizza
2	Gum	Bubble-gum
3	Peppermint oil	Methanol
4	Fish	Cherry
5	Motor oil	Motor oil
6	Mint	Mint
7	Banana	Banana
8	Clove	Clove
9	Leather	Leather
10	Coconut	Coconut
11	Onion	Onion
12	Drink fruit	Fruit punch
13	Children powder	Licorice
14	Cheese	Cheddar cheese
15	Cumin	Cinnamon
16	Benzene	Gasoline
17	Strawberry	Strawberry
18	Garlic	Cedar
19	Chocolate	Chocolate
20	Walnut	Gingerbread
21	Grapefruit	Lilac
22	Rubber framework	Turpentine
23	Peach	Peach
24	Coffee	Root beer
25	Dill pickle	Dill pickle
26	Pineapple	Pineapple
27	Apple	Lime
28	Orange	Orange
29	Pine	Winter green
30	Watermelon	Watermelon
31	Jasmine flower	Paint thinner
32	Grass	Grass
33	Smoke	Smoke
34	Cardamom	Pine
35	Grape	Grape
36	Lemon	Lemon
37	Soap	Soap
38	Natural gas	Natural gas
39	Rose	Rose
40	Peanut	Peanut

Table 3 List of UPSIT-40 items on the Arabic version and percentages of participants who correctly identified each item

Items	Odors (Arabic version)		%
1	**Pizza**		**50**
2	Gum	86.3	
3	Peppermint oil		70
4	**Fish**		**15**
5	**Motor oil**	**52.5**	
6	Mint		90
7	Banana	83.8	
8	Clove	87.5	
9	**Leather**	**68.8**	
10	Coconut	91.3	
11	onions	91.3	
12	**Drink fruit**	**53.8**	
13	Children powder	97.5	
14	**Cheese**	**23.8**	
15	**Cumin**		**40**
16	Benzene	78.8	
17	Strawberry		70
18	Garlic		85
19	Chocolate	86.3	
20	**Walnut**	**48.8**	
21	**Grapefruit**		**65**
22	Rubber framework	92.5	
23	Peach	96.3	
24	Coffee	87.5	
25	**Dill pickle**	**23.8**	
26	Pineapple	86.3	
27	Apple	71.3	
28	**Orange**	**63.8**	
29	Pine		70
30	Watermelon	91.3	
31	Jasmine flower	48.8	
32	Grass	77.5	
33	Smoke	82.5	
34	**Cardamom**		**45**
35	Grape	73.8	
36	Lemon	91.3	
37	Soap		75
38	Natural gas		90
39	**Rose**	**53.8**	
40	peanut	87.5	

Items in bold represent the odors that were correctly identified by less than 70% of the population.

Table 2 Classification scheme of level of smell according to the University of Pennsylvania smell identification test guidelines

Levels of smell	Number of male participants (Score range)	Number of female participants (Score range)
Anosmia	2 (6–18)	0 (6–18)
Severe microsmia	11 (19–25)	7 (19–25)
Moderate microsmia	14 (26–29)	17 (26–30)
Mild microsmia	13 (30–33)	9 (31–34)
Normosmia	2 (<33)	5 (<34)

Discussion

The UPSIT is one of the most widely acceptable tests worldwide for the evaluation of the sense of smell. Although having a gold standard olfactory test would be ideal for comparing results obtained from different centers across the globe, however cultural differences make it difficult to establish a universal standard test. Odorants used in any olfactory test must be selected on the basis of the cultural background of the tested population and their familiarity with odorants.

The present study was carried out to assess the validity of the Arabic version of UPSIT among the Saudi population. Wide cultural variations exist between the different regions of Saudi Arabia and taking this into consideration, we separately analyzed the results from the different regions. An attempt was made to select volunteers on the basis of strict adherence to the criteria from the specified regions. Traveling frequently within and outside the country results in familiarity with different cultures and this might have confounded the results of the study. To avoid this bias, participants from a particular region and residing in the same region were carefully chosen and those volunteers who reported frequent travel were excluded. Thus, volunteers chosen from a particular region were truly representative of the region.

The decline in the olfactory function with age is well established and to eliminate this bias, we carefully selected only those volunteers who were between 19 and 50 years of age.

The test was administered by an ENT resident doctor and a qualified nurse after explaining the test in detail and there was no report of any difficulty in understanding the test.

We used Cronbach's α reliability test on questions 1 to 40 and the reliability was 0.681. The mean score among the Saudi population was 28.4, which is lower than the mean score in American and Australian populations when tested using the original version (mean=36 and 34, respectively). [13]

This score is significantly lower than the mean score in the Brazilian, Taiwan, and Japanese populations (35, 33.1, and 34.9, respectively), obtained when tested using the modified versions of UPSIT. [14–16] The low scores in the Saudi population are only comparable with the scores obtained in the Italian population (mean=28.22) tested by the Italian version. [17] However, a significant proportion of the participants in the Italian study were older than 50 years of age and 16% were smokers. The above two factors could have resulted in a low overall score in the Italian population. Our study is unique in that we have carefully selected participants to eliminate possible bias.

The same cutoff criterion as that used by Doty for the validation of odors (70% of correct response) was applied to our study; [18] 14 odors were correctly identified by less than 70% of the volunteers. Seven out of these 14 odors were from the original version of UPSIT and the other seven

were the new odors that were introduced into the Arabic version of UPSIT. Three odors (4: fish, 14: cheese, 25: pickle) were identified by less than 30% of the respondents.

Although both fish and cheese odors are very common for the Arabic population, the inability to correctly identify them is confusing (Table 2).

As the mean score of the volunteers was significantly lower than normal, it poses questions in terms of the validity of the Arabic version of the UPSIT. Our study population was chosen carefully to eliminate the effect of age, smoking, and existing or previous medical conditions that might alter the test results. Despite this, only five participants in our study could be classified as normosmic on the basis of the test. The low scores on the Arabic version of UPSIT pose questions in terms of the suitability of using this version in its present form.

A possible explanation for this low score could be that the odors that are familiar to Arabic population such as fish, cardamom, pine, walnut, and cheese, the concentration, or the configuration of the odorants is low, posing difficulties in their identification. Another possibility could be that the choices were similar and the volunteers had difficulty in differentiating between them.

Further studies on a larger number of participants need to be carried out to clarify these points and if persistently low scores are obtained, the role of the environmental factors needs to be considered.

Conclusion

The Arabic version of the UPSIT, when applied on healthy volunteers from Saudi Arabia, resulted in low scores in the majority of the participants. Fourteen odors according to the study are inaccurate as they were correctly identified by less than 70% of the participants. We suggest testing the original UPSIT on the Saudi population and applying the Arabic version of UPSIT on a larger number of participants before substituting the odors that yield a low rate of correct answers to improve the validity of the test.

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Conflicts of interest

There are no conflicts of interest.

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