

## Cultural adaptation of an olfactory identification test: the Greek version of Sniffin' Sticks\*

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### SUMMARY

**Objective:** Sniffin sticks battery is a well-validated olfactory test in German speaking population. However adaptation of this test in the cultural background of a country is mandatory before use.

**Materials and Methods:** In total 258 subjects were tested in two stages. The first stage included assessment of 60 healthy subjects with the exact translation of Sniffin' Sticks list and recognition of problematic items. In the second stage a modified list after linguistic changes was tested in a representative for the Greek population study group of 198 healthy subjects. Their results were correlated with a sample of 198 Germans of similar age and sex distribution from the German normative data of Sniffin' Sticks.

**Results:** The use of the initial list showed decreased odour identification (<70%) of 6 items (anis, turpentine, liquorice, apple, lemon, cinnamon). After the appropriate changes the results of the modified list presented significantly increased identification of all problematic items. Identification ability of Greek population showed significant correlation with the German study group having similar behaviour regarding age and gender differences.

**Conclusion:** This study provides cultural adaptation of the Sniffin' Sticks olfactory identification test and normative data for the Greek population.

*Key words:* olfaction, smell, identification, screening test, adaptation

### INTRODUCTION

Psychophysical olfactory tests serve as quick screening tools for olfactory dysfunction in the daily clinical life<sup>(1)</sup>. One of the best-validated psychophysical olfactory test is the "Sniffin' Sticks" test battery (Burghart, Wedel, Germany) which is based on pen-like odour dispensing devices<sup>(2)</sup>. It consists of tests for odour threshold, discrimination, and identification. Previous work has established its test-retest reliability and validity<sup>(3)</sup>. The Sniffin' Sticks test battery has already been used in a large number of studies, and is a part of the everyday rhinological clinical practice in many European countries<sup>(4)</sup>. The use of this test is recommended by the "Working Group Olfaction and Gustation" of the German Society for Otorhinolaryngology, Head and Neck Surgery. While normative data have been established<sup>(3)</sup> they are mainly based on the German-speaking population. However identification tests are known to be culture - specific. Tests used in North America, for example, contain odours which are unfamiliar to continental Europeans or

Asians (e.g. root beer or wintergreen)<sup>(5)</sup>. The odours tested and their verbal descriptors should therefore be adapted to the subjects' cultural background in order to obtain reliable olfactory results. The present study assesses the use of the Sniffin' sticks identification test to the Greek population. The familiarity with odour items and the verbal descriptors was assessed and the identification ability of Greek healthy subjects for the original version of the test was measured. After cultural adaptation a modified version of the test's item list was produced. This was subsequently used in order to obtain normative data of odour identification for the Greek population.

### MATERIALS AND METHODS

#### *Participants - Ethics*

Odour identification data were obtained from 258 subjects. None of the subjects had a history of any major olfactory disturbance, cognitive impairment, smoking or medication intake affecting olfaction. Investigations were performed according to

the Declaration of Helsinki for research on human subjects. Institutional ethics approval was obtained and the participants provided informed consent for the study

#### *Olfactory identification test*

Psychophysical testing of olfactory function was performed by means of the Sniffin' Sticks identification test following described standard methodology<sup>(4,6)</sup>. Odorants were presented in commercially available felt-tip pens (length: 14 cm, diameter: 1.3 cm). For odour presentation the cap is removed by the researcher for approximately 3 sec. The pen's tip was placed approximately 2 cm in front of the two nostrils for approximately 2 sec before the pen was capped again. Odour identification was assessed by means of 16 common odours. For each odour the tested person is forced to choose the correct odour from a list of 4 descriptors. The interval between odour presentations is 20 sec. The identification score ranges from 0 to 16.

#### *Translation procedure*

The translation procedure followed the established forward-backward translation procedure<sup>(7)</sup>, with independent translations and counter-translation. Independent forward translations into Greek were performed by two independent bilingual physicians and their lists were pooled to a common version. Two other physicians, native German speakers fluent in Greek translated this provisional Greek version back into German. This backward translation was found to be nearly identical to the source document. A cognitive debriefing process was then used for the cultural adaptation of the questionnaire<sup>(7)</sup>. This process was carried out and found no areas of problematic language.

#### *Cultural adaptation – first stage*

Sixty subjects were tested with the accurate translation of the Sniffin Sticks list regarding odour identification ability.

Subjects were asked to identify the presented odour following the described previously methodology. In addition subjects were asked to report every item and descriptor used in the Sniffin Sticks test they were not familiar with (16 items- 42 descriptors). Identification ability is expressed with percentages correct items. Percentages lower than 70% were considered as not acceptable<sup>(8)</sup> and the terms used (items and descriptors) as problematic.

#### *The modified test*

The Sniffin' sticks list of descriptors was adapted according to our findings. In this procedure we changed the terms of problematic items when a more clear term could be used. When a new term was not available we changed the rest of the descriptors for easier identification. For example when a fruity odour is not identified and the descriptors are similar fruity odours this item can be easier identified when the descriptors are completely different (e.g cheese or fish).

#### *Cultural adaptation – second stage*

The new list was tested in 198 healthy subjects. The age and sex distribution of these subjects was based on the last Greek census (2001), in order to obtain normative values of olfactory identification ability for the Greek population. Based on previous studies which documented changes of olfactory identification ability in relation to age<sup>(3,5,6,9)</sup>, subjects were separated into four age groups (A-D): group A: under 20 years, group B: 21-40 years, group C: 41-60 years, group D: older than 60 years. The Greek data were analysed in comparison with a comparable sample (198 subjects) from the German normative data of University of Dresden<sup>(9)</sup>. This sample had the same demographic characteristics regarding age and sex distribution with our study group allowing correlation analysis for matched pairs.

Table 1. Identification of 16 odours included in Sniffin Sticks test pre- and post- cultural adaptation. The problematic items are marked in bold.

Odour Items	% Females		% Males		% Total	
	identification		identification		identification	
	pre	post	pre	post	pre	post
1. orange	96.8	96.6	96.4	98.1	96.6	97.4
2. shoeleather	88.2	83.1	83.3	82.3	86.2	82.8
3. <b>cinnamon</b>	88.2	81.9	58.3	71.8	69.1	74.6
4. peppermint	100	97.7	100	97.2	100	97.4
5. banana	100	85.3	100	88.1	100	86.8
6. <b>lemon</b>	82.3	77.5	50.1	67.9	68.9	72.2
7. <b>liquorice</b>	58.8	93.2	66.6	87.1	62.1	89.8
8. <b>turpentine</b>	23.5	67.3	25.8	77.0	25.0	71.5
9. garlic	94.1	76.4	91.6	81.7	93.1	79.2
10. coffee	76.4	88.7	91.6	83.5	82.7	85.8
11. <b>apple</b>	35.3	61.7	66.6	67.9	48.6	65.1
12. cloves	100	71.9	91.6	72.5	96.5	72.2
13. pineapple	88.2	83.1	83.3	74.3	86.2	78.2
14. rose	100	89.8	100	94.5	100	92.4
15. <b>anis</b>	70.4	89.8	65.0	89.9	68.6	89.8
16. fish	100	100	100	98.1	100	98.9

*Statistical analysis*

Results were analyzed using SPSS version 12.0 for Windows (SPSS Inc., Chicago, IL, USA). Descriptive statistics are presented within the body of the text as identification percentages for each item and mean values ± standard deviation (SD) for the Sniffin’ Sticks identification score.

Greek normative data is presented in comparison with the German normative data. To explore odour identification in relation to age, sex and ethnicity, data were submitted to analyses of variance (multivariate ANOVAs) with “between subject factors”, age (age groups A-D), sex (male/female) and country (Greece, Germany) and corrected with Bonferroni post-hoc tests. Pearson correlation analysis applied for the matched pairs between Greece and Germany regarding their odour identification results. The alpha level was set at 0.05.

**RESULTS**

Analysis of data from the initial list showed significantly decreased identification in 6 items. Specifically turpentine, apple, lemon, anis, cinnamon and liquorice had an identification percentage lower than 70% (Table 1).

The terms used for the description of 3 items were replaced with terms more familiar to the Greek population. Specifically turpentine is presented as painter oil, anis as ouzo (very popular Greek product which contains anis) and liquorice was replaced by the word used for another Greek grappa.

In the cases of apple, lemon and cinnamon as their descriptive Greek words are well recognised, the rest of the three incorrect descriptors changed with clearly different terms. The items apple and lemon are not accompanied by fruits and the item cinnamon has not honey as a descriptor. All changes are presented in Table 2.

The application of the modified list showed good identification results (>70%) for all items (Table 1). The comparison analysis of the modified Greek list results with the German data is presented below:

Table 2. List of changes in the terms used for correct and incorrect descriptors for the adapted Greek version of Sniffin Sticks.

The changes in incorrect descriptors are in italics.

Correct descriptors:

Anis	→	Ouzo
Liquorice	→	Greek grappa
Turpentine	→	Painter oil

Incorrect descriptors:

Melon <i>peach orange</i> apple	→	Melon <i>fish cheese</i> apple
Mustard cherry <i>menthol</i> turpentine	→	Mustard cherry <i>peppermint</i> painter oil
<i>Honey</i> vanilla chocolate cinnamon	→	<i>Cheese</i> vanilla chocolate cinnamon
Peach <i>apple grapefruit</i> lemon	→	Peach <i>onion peppermint</i> lemon

Table 3. Effect and interactions of factor “country” in odour identification results.

<b>Country</b>	F = 3.22	p = 0.07
<b>Country * age group</b>	F = 0.46	p = 0.71
<b>Country * sex</b>	F = 1.42	p = 0.94

*Effects of country*

There is no significant effect of the factor country (F = 3.22, p = 0.07) in odour identification results. In addition there is no interaction between the factors country and age group (F = 0.46, p = 0.71) and no significant interaction between factors country and sex (F = 1.42, p = 0.23) (Table 3). Moreover correlation analysis for the matched pairs from Greece and Germany was statistically significant (Pearson,  $r^{98} = 0.19$ , p = 0.008).

*Effect of age*

Our results showed an increasing identification ability from the childhood to the age of 20-40 years and then a gradual decline in the other age groups (Figure 1). The comparison with the results of the German sample as seen in Figure 1, showed a similar effect of age in both ethnic groups. Post-hoc testing indicated differences (p < 0.001) between groups A and B, A and C, B and C, B and D, and C and D. No significant differences were found between groups A and D.

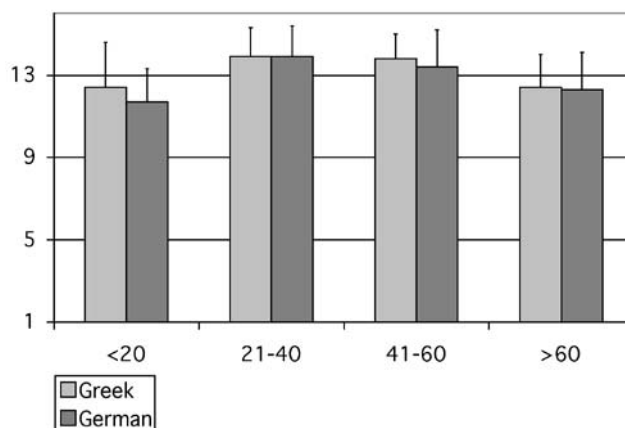


Figure 1. Age-related changes of Sniffin’ sticks identification results in Greek and German population.

*Effect of sex*

No significant main effect of the factor “sex” was found for the identification score (F = 0.10, p = 0.92). In addition there was no significant interaction between factors “sex” and “age group” although women scored slightly higher than men in 3 of the 4 age groups A, B and D. (F = 0.11, p = 0.95).

**DISCUSSION**

Cultural differences between countries make difficult a universal form of an olfactory identification test<sup>(10,11)</sup>. Sniffin’ Sticks test is a standardized and validated olfactory test in Northern Europe.

However for its application in Southern Europe it is imperative to take into account cultural issues that affect familiarity with odours and linguistic aspects of the test deployment<sup>(12)</sup>. Our study clearly showed that Sniffin' Sticks test requires cultural adaptation when it is applied in a country with different cultural background than Germany. The number of problematic items in the first stage of the study indicates that a non-adapted form of the test does not provide standardized results. This means that a subject can easily have a wrong diagnosis of hyposmia although he/she is normosmic. This can decrease significantly the validity of the test. Considering that the screening form of this test is only odour identification<sup>(8)</sup> test the validity of the test can be dramatically compromised.

Cultural adaptation is a prerequisite procedure before the establishment of normative data for routine clinical use of the test in every country. This allows for a standardized clinical evaluation of patients with olfactory disorders<sup>(13)</sup>.

The cross-cultural adaptation involves two steps: First the assessment of conceptual and linguistic equivalence and second the evaluation of measurement properties<sup>(14)</sup>. Conceptual equivalence refers to equivalence in relevance and meaning of the same concepts being measured in different cultures and/or languages. Linguistic equivalence refers to equivalence of question wording and meaning in the formulation of items and response choices. It is characteristic that this procedure may have completely different results in every country. Specifically as seen in our study a significant number of linguistic changes were necessary, however in Italy no changes were performed<sup>(15)</sup>. Although the Italian study used the 12 item-screening test, their identification ability results were closer to the German population, showing a similar odour identification behavior. However in another study of Italian population with a different screening test validated in the American population<sup>(16)</sup>, subjects were not familiar with 6 odours. The need for cultural adaptation is influenced by the items included in a test and cultural characteristics of each country. Each country develops a unique odour familiarity and identification map, which is dynamic and is strongly influenced by several factors including food preparation and use of some odours in everyday life, immigration, neighboring countries etc. These topographical changes may explain the different results of the Greek population as for example Greek diet has more eastern influence compared with the Italian.

The Greek population showed similar olfactory identification ability with the German population after the adaptation procedure of the test. Specifically the age groups in both countries revealed the same pattern of age-related changes of olfactory function with a clear decrease in olfactory function after the age of 20-40 years old. Subjects of group A presented low odour identification results because of the development of odour cognition in childhood. In the rest three age groups, subjects of group D had the lower scores as a result of aging.

The present results also suggest sex-related differences in the perception of odours. Regarding sex differences females exhibited tendencies for better results in age groups B and C. Various factors have been discussed in the literature as accounting for the increased olfactory sensitivity in females, including hormonal effects<sup>(17)</sup>, verbal skills<sup>(18)</sup> and congenital factors<sup>(19)</sup>. Although the origin of these sex-related differences is still controversial, clinicians should always consider this fact in the analysis of olfactory test results.

Evaluation of olfactory ability with the use of Sniffin' Sticks test has been adopted by numerous clinics / practitioners all over Europe<sup>(4)</sup>. There are more than 100 peer-reviewed publications listed in Medline which are based on the use of the Sniffin' Sticks<sup>(9)</sup>. Standardized use of this test following cultural adaptation will enhance our insight in olfactory disorders and will help to create larger multicentre clinical data.

Whatever a clinical olfactory test is consisting of, it should reliably distinguish between anosmic, hyposmic, and normosmic subjects, in every country in which it is used. Thus, the test should be used after validation with cross-cultural adaptation. This study provides the Sniffin' Sticks cultural adaptation for the Greek population and normative data acquired for clinical use.

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