

THE ASSESMENT OF SENSE OF SMELL IN A ROMANIAN NORTHERN POPULATION: NORMATIVE VALUES USING “SNIFFIN’STICKS” OLFACTION TEST

IULIU VLAD CATANA¹, SIMONA NEGOIAS², ALMA MANIU¹, MARCEL COSGAREA¹

¹Iuliu Hațieganu University of Medicine and Pharmacy, Department of Otorhinolaryngology, Emergency County Hospital, Cluj-Napoca, Romania

²Carl Gustav University of Dresden Medical School, Department of Otorhinolaryngology, Smell and Taste Clinic, Dresden, Germany

Abstract

Objective. A modern and well-developed chemosensory nasal test in Europe is the “Sniffin’Sticks” with normative data collected from various countries. The test contains penlike odor devices for testing the olfactory threshold, discrimination and identification. The final result of the test consists in a composite threshold-discrimination-identification (SDI) score. The study aims to obtain normative data for the “Sniffin’Sticks” olfactory test in Romania.

Material and Methods. 148 subjects (73 women, 75 men; mean age 44.6 years) with a reported normal olfactory function were included in this prospective clinical trial. The “Sniffin’Sticks” test was used to assess the olfactory function.

Results. Normative olfactory data were obtained in the normal Romanian population in relation with age and sex. The older subjects performed evaluation tasks less in all the tests and females performed better than males.

Conclusion. The “Sniffin’Sticks” combined olfactory scores of the healthy Romanian subjects are comparable with the normative data presented in other studies in different populations.

Keywords: olfaction, Sniffin’Sticks, olfactory function, olfactory discrimination, olfactory identification, olfactory threshold.

Introduction

There is no data about the number of Romanians with smell disorders. In it’s estimated that in Italy about 500 000 people and 1.4% of US adults are affected by smell problems [1,2]. Olfactory testing is important in clinical practice for otorhinolaryngologists and neurologists therefore simple, rapid and reliable tests are necessary for a better evaluation [3]. The most frequently used psychophysical tests for evaluation of the olfactory function are the University of Pennsylvania Smell Identification Test (UPSIT) [4], the Connecticut Chemosensory Clinical Research Center Test (CCCRC) [5] and the “Sniffin’ Sticks” Test [6].

“Sniffin’ Sticks” olfaction test is composed of three tests, odor identification (OI), odor discrimination (OD) and odor threshold (OT) [5,7]. The test produces a composite (TDI) final score from summing all the three tests and was well described and validated initially in Germany [6,7,8,9]. The battery test has been validated in several

countries [1,3,10,11,12]. The two versions of OI test (12 or 16 sticks) were modified on several studies including the Romanian population, because of the people’s different cultural background from Germany [13,14,15,16,17,18]. There is a proven effect of weather and environment on the olfactory function with people form the Mediterranean climate having a better TDI score in comparison with one’s living in the central-northern Europe [3]. Romania is in the south-east region of Europe and with a temperate climate different from the Mediterranean and more close to the central-northern Europe.

The aim of the study was to assess the olfactory function in a Romanian population to establish normative data using the “Sniffin’ Sticks” test in a temperate-continental country.

Material and methods

Subjects and Ethical considerations

This study was performed prospectively in 148 Romanian subjects (73 women, 75 men; mean age

Adress for correspondence: iuliu_catana@yahoo.com

44.6 years, range 13-80) with no subjective complains of smell problems. All the subjects were examined in the Otorhinolaryngology Department of University of Medicine and Pharmacy (UMF) Iuliu Hațieganu, Cluj-Napoca, Romania. The subjects were divided in three groups according age: 54 subjects aged <35 years, 36 subjects aged 36-55 years and 57 subjects >55 years.

A complete ENT-endoscopic examination with a full detailed history of each subject was performed. The exclusion criteria were: rhinosinusitis, nasal polyposis, allergic rhinitis, surgery on the nasal septum, turbinates or paranasal sinuses, upper respiratory tract infections (URTI), asthma, head trauma, neuro-psychiatric disorders (Parkinson, Alzheimer, schizophrenia, etc.), endocrine disorders and exposure to toxic chemicals (tobacco, alcohol and drugs). The study was approved by the local Medical Ethical Committee of the UMF in accordance with the principles of the Declaration of Helsinki/Hong Kong. All the subjects included in the study were volunteers and they received full explanations about the study with a final written consent.

Sniffin' Sticks olfactory test

The extended test used in the study (Burghardt, Wedel, Germany) contains 112 reusable felt-tipped pens ('sticks') with a removable cap for OT, OD and the "new descriptors" for OI [17]. The test was done in a well-ventilated and quiet room using sterile gloves with no contamination of external odors. The subject has to sniff each stick that has a length of 14 cm and an inner diameter of 1.3 cm and contains the odorant (4 mL) dissolved in propylene glycol (antibacterial substance). The examiner removed the cap and placed the tip of the each stick at 2 cm in front of the nostrils without touching the skin. The presentation time was 3 seconds and only once for each stick with an interval of 30 seconds between them to avoid olfactory desensitization. A complete olfactory testing with "Sniffin' Sticks" test range from 20 to 40 minutes in the bilateral mode. The scores of OT, OD and OI were related to age and sex.

Odor threshold testing

The OT test was performed with the subject blindfolded and using a single-staircase of 16 odor-triplets. From all 3 sticks, 1 odor stick containing *n-butanol* odor and the other 2 sticks were odorless. In the triple-forced

choice procedure the stick containing *n-butanol* must be recognized by the subject. The 16 odor sticks were presented in ascending concentration (starting with 4% and 1:2 dilutions) and using a randomized order between the 3 sticks. Two consecutive correct identifications of the *n-butanol* stick reverse the staircase to a one step lower concentration. The threshold was defined as the mean of the last four of seven staircase reversal points with a score range from 0 to 16 [6].

Odor discrimination testing

The OD test was determined using 16-triplets of sticks (2 containing the same odor and one stick with a *different odor*) presented in a randomized order. The subjects were blindfolded and they had to identify the stick with the different odor. The score range also from 0 to 16 (a correct answer received 1 point).

Odor identification testing

The OI test used 16 sticks with different odorants using a multiple choice procedure. The subjects sniff the each stick and then chose the correct *item* from a label with the 4 descriptors. The score range from 0 to 16.

The results of the 3 tests were summed to a final composite threshold, discrimination, identification score (TDI) [19] with a range from 0 to 48.

Statistical analysis

SPSS version 16.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis of the data. Pearson's and Spearman's correlation were used for analyzing the relationship between age and OT or TDI scores respectively between age and OI or OD scores. ANOVA for repeated measures was used for all the subjects.

Results

In Table I, the mean OT, OD, OI and TDI scores for the study group are shown. The 10th percentile values of the all normal subjects was 11.00 for OI, 10.00 for OD, 5.5 for OT and 29.5 for TDI and its used to separate the normosmia from hyposmia.

The descriptive statistics of olfactory function in the study group in relation to their age and gender are shown (Table II). Regarding gender women were more sensitive and presents better scores than men but without a statistically significant level ($p < .05$).

Table I. Descriptive statistics of normative values of olfactory function obtained in healthy subjects in Romania.

	Odor Identification	Odor Discrimination	Odor Threshold	Composite (TDI) Score
Mean	13.24	12.29	8.60	34.13
Std. dev.	1.65	1.95	2.84	4.14
Range (min)	7	8	2.5	17.5
Range (max)	16	16	14.75	46.25
10 th percentile	11	10	5.5	29.5
25 th percentile	12	11	6.5	31.625
50 th percentile	13	12	8.5	33.625
75 th percentile	14	14	10.75	36.75
90 th percentile	15	15	12.65	39.9

The relationship between the mean scores for OI, OD, OT, TDI and age are illustrated in Figure 1, 2, 3 and 4.

Age was significantly and inversely correlated with OI, OD, OT and TDI after the Pearson's and Spearman's correlations (Table III). According to Pearson's statistical correlation, age was significantly correlated with the composite TDI score (Pearson's correlation $r=-0.358$, $p<0.004$). ANOVA revealed a statistically significant effect of age on OI and TDI ($r=5.61$, $p=0.005$; $r=4.81$, $p=0.009$).

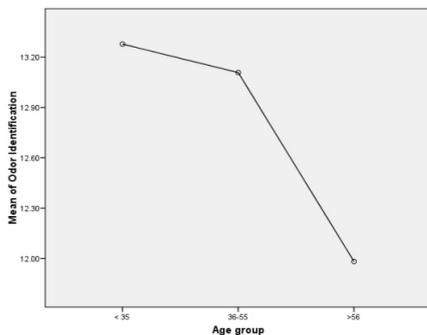


Fig.1. OI.

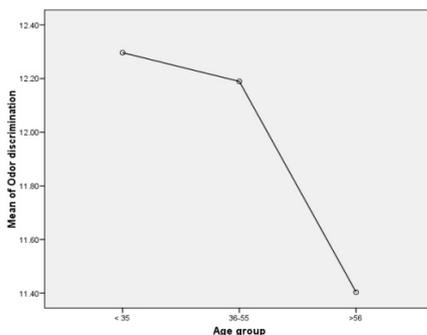


Fig. 2. OD.

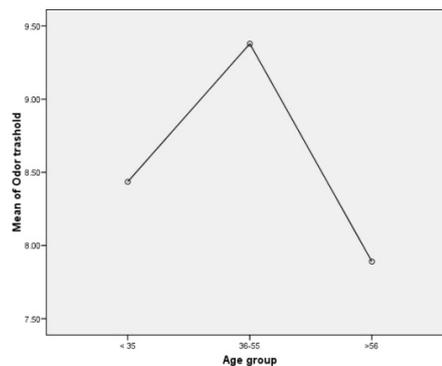


Fig. 3. OT.

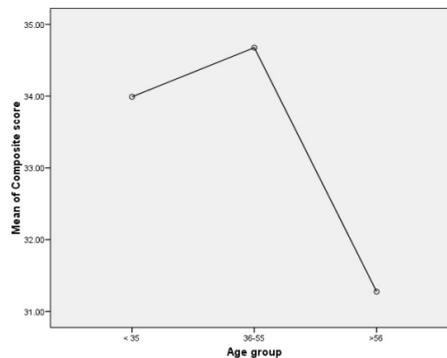


Fig. 4. TDI.

Discussion

Our study provides normative values of the “Sniffin’Sticks” olfactory test in the northern population of Romania related to subject’s age and gender. The impact of weather and environment on the olfactory function is important with a proven effect on all the age groups, especially of the mild Mediterranean climate [3]. In different

Table II. Olfactory Function of Healthy Subjects in Romania in Relation to Their Demographic Attributes (Mean values ± 1 std. dev.)

n	Variable (n)		Odor Identification* \bar{x}	Odor Discrimination* \bar{x}	Odor Threshold*	Composite (TDI) Score* \bar{x}	
73	Gender	Female	13.32	12.41	9.18	34.93	
			+/-	1.71	2.03	2.77	4.40
		Male	13.16	12.17	8.04	33.36	
75	Age		+/-	1.59	1.88	2.82	3.75
		<35 years	13.69	12.61	8.52	34.80	
			+/-	1.52	1.99	2.85	3.64
36	36-55 years		13.53	12.56	9.61	35.68	
			+/-	1.61	1.80	2.91	4.35
		>55 years	12.63	11.86	8.08	32.61	
57			+/-	1.64	1.95	2.69	4.00

Table III.

	Age	Odor Identification* \bar{x}	Odor Discrimination* \bar{x}	Odor Threshold*	Composite (TDI) Score* \bar{x}
<i>Pearson</i> Correlation p				-0.214	-0.358
				0.337	0.004
<i>Spearman</i> Correlation p		-0.227	-0.204		
		0.005	0.013		
<i>ANOVA</i> p		5.61	2.71	2.06	4.81
		0.005	0.070	0.132	0.009

studies the normative data of “Sniffin’Sticks” in Greece including the OT, OD, OI and TDI were higher comparing with those from central-northern Europe, Australia and Taiwan [3,10]. Our normative data were obtained in a temperate climate with different environmental conditions but more related to those from the central-northern Europe [8]. The climates of Cluj-Napoca [20], where our study was made is more cold and wet with cold winters in comparison with the one from Athens and Alexandroupolis [21] which is warm and with rainy winters resulting in a different impact on the olfactory performance. This temperate climate determines an increased number of sinonasal diseases like in Taipei [22] or Dresden [23] with lower olfactory scores for the “Sniffin’Sticks” test in comparison with the Mediterranean climate. In subjects older than 55 years of age an additional effect of smoking on the olfactory function was present in our study because the percentage of smokers.

Conclusion

The normative data of the “Sniffin’Sticks” olfactory test in northern population of Romania showed significant differences compared to data from the Greece study and minor differences compared with the central-northern European population studies.

References

1. Parola S, Liberini P. Assessing olfaction in the Italian population: methodology and clinical application. *Ital J Neurol Sci*, 1999; 20:287-296.
2. Hoffman HJ, Ishii EK, MacTurk RH. Age-related changes in the prevalence of smell/taste problems among the United States adult population: Results of the 1994 disability supplement to the National Health Interview Survey. *Ann NY Acad Sci*, 1998; 855:716-722.
3. Katotomichelakis M, Balatsouras D, Tripsianis G, Tsaroucha A, Homsioğlu E, Danielides V. Normative values of olfactory function testing using the ‘Sniffin’Sticks’. *The Laryngoscope*, 2007; 107:114-120.
4. Doty RL, Shaman P, Kimmelman CP, Dann MS. University of Pennsylvania Smell Identification Test: a rapid quantitative olfactory function test for the clinic. *Laryngoscope*, 1984; 94:176-178.
5. Cain WS, Rabin MD. Comparability of two tests of olfactory functioning. *Chem Senses*, 1989; 14:479-485.
6. Hummel T, Sekinger B, Wolf SR, Pauli E, Kobal G. „Sniffin’sticks“: olfactory performance assessed by the combined testing of odor identification, odor discrimination, and olfactory threshold. *Chem Senses*, 1997; 22:39-52.
7. Kobal G, Hummel T, Sekinger B, Barz S, Roscher S, Wolf S. “Sniffin’Sticks”: screening of olfactory performance. *Rhinology*, 1996; 34:222-226.
8. Hummel T, Kobal G, Gudziol H. et al. Normative data for the “Sniffin’ Sticks” including tests of odor identification, odor discrimination, and olfactory threshold: an upgrade based on a group of more than 3,000 subjects. *Eur. Arch. Otorhinolaryngol*, 2007; 264:237-243.
9. Wolfensberger M, Schnieper I, Welge-Lussen A. Sniffin’Sticks: a new olfactory test battery. *Acta Otolaryngol*, 2000; 120:303-306.
10. Yuan BC, Lee PL, Lee YL, et al. Investigation of the Sniffin’Sticks olfactory test in Taiwan and comparison with different continents. *J. Chin. Med. Assoc*, 2010; 73:483-486.
11. Mackay-Sim A, Grant L, Owen C, et al. Australian norms for a quantitative olfactory function test. *J. Clin. Neurosci*, 2004; 11:874-879.
12. Boesveldt S, Verbaan D, Knol DL et al. Odour identification and discrimination in Dutch adults over 45 years. *Rhinology*, 2008; 46:131-136.
13. Konstantinidis I, Printza A, Genetzaki S et al. Cultural adaptation of an olfactory identification test: the Greek version of Sniffin’Sticks. *Rhinology*, 2008; 46:292-296.
14. Shu CH, Yuan BC, Lin SH, et al. Cross-cultural application of the “Sniffin’Sticks” odor identification test. *Am. J. Rhinol*, 2007; 21:570-573.
15. Shu CH, Yuan BC. Assessment of odor identification function in Asia using a modified “Sniffin’Sticks” odor identification test. *Eur. Arch. Otorhinolaryngol*, 2008; 265:787-790.
16. Neumann C, Tsioulos K, Merkonidis C, Salam M, Clark A, Philpott C. Validation study of the “Sniffin’ Sticks” olfactory test in a British population: a preliminary communication. *Clin. Otolaryngol*, 2012; 37:23-27.
17. Catana I, Negoias S, Maniu A, Porojan M, Cosgarea M. A modified version of “Sniffin’Sticks” odor identification test: The Romanian cultural adaptation. *Clujul Medical*, 2012; 85(2):218-223.
18. Eibenstein A, Fioretti AB, Lena C et al. Olfactory screening test: experience in 102 Italian subjects. *Acta Otorhinolaryngol*, 2005; 25:18-22.
19. Kobal G, Klimek L, Wolfensberger M, et al. Multicenter investigation of 1036 subjects using a standardized method for the assessment of olfactory function combining tests of odor identification, odor discrimination, and olfactory threshold. *Eur Arch Otorhinolaryngol*, 2000; 257:205-211.
20. National Administration of Weather. Climate of Northern Romania. Website. http://www.meteoromania.ro/annm/?page_id=114. Accessed November 2012.
21. Hellenic National Meteorological Service. Climate of Greece. Website. http://www.hnms.gr/hnms/english/index_html. Accessed November 2012.
22. Central Weather Bureau. Climate Statistics. Website. <http://www.cwb.gov.tw/eng/index.htm>. Accessed November 2012.
23. EuroWheater Website. Climate of Dresden. <http://www.eurometeo.com/english/home>. Accessed November 2012.