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Mexican Screening Test for Olfactory Dysfunction using Essential Oils

Mandujano-González Alberto

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Abstract

Introduction: Olfaction is important for us to relate to the environment. Approximately 25

Index terms— olfactory disorders, olfactory loss, screening, diagnosis.

Olfactory disorders are classified into qualitative problems (dysosmias, i.e., altered olfactory perception) and quantitative problems (where the intensity of olfactory perception is affected and includes hyposmia and anosmia) 2 .

Of people over 40 years of age, 25% have some olfactory disorder, which increases with age, reaching a prevalence of 40-62% in people over 80 years of age 3 ,4. The causes of these conditions are: nasosinusal alterations, post-infectious olfactory dysfunction, presbymosmia, post-traumatic, secondary to medication, chronic smoking and alcoholism, neurodegenerative diseases, metabolic and genetic diseases 5,6 .

The presence of olfactory alterations has an impact on the quality of life of sufferers, generating depression, social isolation, feelings of vulnerability, selfesteem problems and causing insecurity, since up to 60% of those affected report difficulty in noticing a gas leak or the presence of smoke. Eating habits, personal hygiene and sexual performance are affected **??**,8,9. Olfactory impairment is a predictor of mortality, since subjects > 60 years of age with anosmia are 3 times more likely to die at 5 years than normosmic patients 10 .

Existing tests for screening for hyposmia are variable, including pens such as the Sniffin Sticks (SS) test 11,12 , booklets such as the University of Pennsylvania Smell Identification Test (UPSIT) or disks that give off scents 13,14 . They are expensive, not very accessible in Mexico and require training to perform them. These tests have been standardized in populations culturally very different from the Mexican population, so the type of aromas 15,16,17 their familiarity and therefore their identification are different in Mexico. This makes it difficult to detect patients and to know the prevalence of hyposmia in our population.

So far no studies have been conducted on the usefulness of using commercial essential oils in the detection of hyposmia, which are readily available, inexpensive, and easy and quick to use.

In Mexico there is no standardized test for the screening of olfactory alterations, so this work proposes the development and validation of a test of essential oils for this purpose.

1 Introduction

he ability to smell allows us to enjoy food, relate to others and even protect ourselves from danger. Moreover, because of its connections with the limbic system, it allows us to evoke intense emotions and memories 1 .

T II.

2 Materials and Methods

A descriptive study was carried out, in which two groups were created, one with subjective hyposmia of different etiologies and another age and gender matched control group made up of healthy people who denied symptomatic hyposmia.

The patients were recruited at the National Rehabilitation Institute-LGII within the period June 2021-March 2022.

The case group included subjects older than 18 years with hyposmia caused by nasal conditions: attic septal deviation, acute sinusitis, chronic sinusitis with and without polyps, nasal tumors, upper airway infections including COVID 19 corroborated by PCR, Parkinson's disease.

All subjects underwent nasal endoscopy to corroborate the presence of nasal conditions. Subjects with active smoking and those with a history of nose and sinus surgery were excluded.

The following scales were applied to each case with olfactory alterations: Sinonasal Outcome 22 (SNOT 22) **??**9,20, **??**1 and Questionnaire of Olfactory Disorders-Negative Statements (QOD NS), 22,23 and an endoscopic scale was used to evaluate the state of the olfactory cleft: The olfactory cleft endoscopy scale (OCES). 24 To evaluate the olfactory function, the University of Pennsylvania Smell Identification Test (UPSIT) and the Sniffin Sticks test, the identification subset with 16 aromas, were applied. In this same consultation, the test with essential oils was applied to each participant. The order of the olfactory evaluation was as follows: UPSIT, essential oil test, Sniffin Sticks.

Between each test a 5-minute break was taken to prevent olfactory memory from influencing the results and to allow for mental relaxation of the participants.

In a previous investigation, this test of commercial essential oils was standardized 25 . This test consists briefly in the use of 5 aromas: lemon, chocolate, cinnamon, coffee, mint and a control with no odor (Image 1).

The interpretation of this test will be only if the patient correctly or incorrectly identified each aroma, therefore it fluctuates between 0-5, if the subject obtains 0=anosmia, 1,2,3= hyposmia and 4,5 points= normosmia (Image 2). (Image 2).

The statistical package Prisma was used. Statistical significance was considered with a $p<0.05$.

For olfactory function, each participant obtained three scores derived from the tests used: number of essential oils correctly identified, score on the University of Pennsylvania Smell Identification Test and score on the Sniffin Sticks test and also obtained an olfactory diagnosis from each test: Normosmia, hyposmia or anosmia.

Fisher's exact test was used to compare the numbers of anosmic, hyposmic and normosmic subjects with scores of 0-5 correctly identified oils, these results were compared with the UPSIT and Sniffin Sticks scores.

Sensitivity and specificity of test results were determined by performing 2 x 2 contingency tables.

3 III.

4 Results

A total of 33 subjects were analyzed, 17 in the case group and 16 in the control group. The case group consisted of 7 women and 10 men, the age range was 18-82 years with a mean age of 41 years. The control group consisted of 7 women and 9 men, the age range was 18-81 years with a mean age of 46 years.

Regarding the cause of hyposmia in the case group, 2 had no identifiable cause, 5 were due to COVID 19, 3 due to nasosinus conditions, 4 due to Parkinson's disease and 3 due to cranioencephalic trauma.

The presence of nasal alterations, tumors or infectious diseases was ruled out in all the controls by nasal endoscopy. The mean score on the endoscopic evaluation scale of the olfactory sulcus "OCES", in the cases, was 1.1 points in the right nostril and 1.2 in the left nostril.

Regarding quality of life, in the group of cases, the range of scores was 8-33 points, with a mean of 25, which in percentage of affection of 1-100 translates into 14%-57.8%.

For the Sniffin Sticks test the scores were 1 -15 in the case group and for the controls 11-15.

In the UPSIT test the score in the case group was 9-29 and in the controls from 25 to 40. With this test in the group of cases all had some degree of hyposmia and in the group of controls 4 had mild microsmia, 2 with moderate and 1 with severe, the subjects with mild and moderate microsmia had no alterations in the other two tests and the one with severe hyposmia was normal in the Sniffin Sticks test and with hyposmia in the essential oils test.

For the essential oils test, a score of 4 and 5 points was taken as normal, hyposmia 1-3 and anosmia 0. An additional point was added to be taken into account in the final score; for each aroma, the intensity with which each aroma was perceived was questioned and if the subject did not perceive an aroma or if 3 of the aromas were perceived with slight intensity, one point was subtracted from the total number of correctly identified aromas (this variant was called modified oils test in the analysis).

Table **??** shows the olfactory results obtained with the different tests, sensitivity, specificity, positive and negative predictive value and confidence interval calculated with Fisher's test.

5 IV.

6 Discussion

The screening test for olfactory disorders with essential oils proved to be an option with acceptable sensitivity and specificity. Figures ranging from 0.88-0.93 and 0.41-0.77 respectively.

In 2018 in Barcelona Campabadal et al. determined the sensitivity and specificity of the UPSIT test Spanish version in a population with Parkinson's disease: 97 subjects, and healthy controls: 65 and determined that the sensitivity was 81.4% and specificity 100% with a cut-off point ? 25 points. 26 Hummel and his team in 1997 created the Sniffin Sticks test, applied it to a group of 104 healthy subjects (52 women, 52 men, mean age 49.5 years, range 18-84 years) and compared it to an established measure of olfactory performance; the Connecticut Clinical Chemosensory Research Center Test, CCCRC 27 . The use of the different subsets separately has been found to have a sensitivity and specificity of 84%. 28 Sorokowska et al. in 2019 conducted a multicenter study

in Germany with 333 subjects with olfactory disturbances of different etiologies, aged 12-88 years. In whom they evaluated the clinical utility of employing a test created by the researchers "Q-Sticks test", a test composed of the aromas of clove, coffee and roses. Their test obtained a sensitivity of 91.8% and a specificity of 92% 29 .

A retrospective study was carried out in Germany in 2016 with 613 subjects with an age range of 18-96 years, they included subjects with olfactory disturbances (464) of different etiologies and controls (149), to whom they applied the Sniffin Sticks olfactory identification subset containing 16 scents. All participants underwent nasal endoscopy and medical history. They created a score for each aroma based on the following division: % of subjects with normosmia who correctly identified it between % of subjects with identifiable cause of hyposmia who correctly identified it and called it "odor specificity score", then using a calculated ABC analysis which is a classification method used in economics, which allows identifying items that have an important impact on an overall value they selected 3 aromas. Cinnamon, fish and banana were correctly identified by the largest number of normosmic subjects, with this battery of tests they obtained a sensitivity of 80.4%, specificity of 84.3% and a negative predictive value of 91.3% 30 .

It is important to mention that, during the analysis of the test results, we noticed the differences between the tests at the time of interpreting their results, i.e., the UPSIT test graduates the level of hyposmia into mild microsmia, moderate or severe hyposmia, while the Sniffin Sticks and the essential oils test only identifies normosmia, hyposmia or anosmia. Because of these differences, subjects who obtained normosmia in the last two tests, but mild microsmia in the UPSIT test were considered to have normosmia, thus obtaining different figures for sensitivity, specificity, negative predictive value and positive predictive value.

In addition, when taking into account the intensity of aroma perception in the oil test; "modified oil test" increased all the parameters analyzed.

The essential oil screening test we propose is an effective method, easily accessible, cost-effective and quick to apply. With respect to its sensitivity and specificity, it is very similar to that shown by other tests, thus determining its non-inferiority.

The great limitation of this study is the low number of samples; however, due to the favorable behavior of the data, it can be inferred that by increasing the number of subjects, similar results will be obtained.

V.

7 Conclusion

This is a first step in the detection of olfactory disorders in Mexico; however, future research is needed to extend the level of diagnosis, in order to obtain a test with which to follow up patients or even determine the efficacy of certain treatments.

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