



## Rethinking olfactory nerve assessment: A critical review of alcohol swabs versus essential oils

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### Abstract

The olfactory nerve, essential for sensory perception, plays a vital role in detecting and interpreting odorants. Its assessment is traditionally conducted using ethanol swabs, which are widely regarded for their simplicity and accessibility. However, the use of alcohol in clinical olfactory testing presents notable limitations, including discomfort for patients and potential inaccuracies in results. Alcohol, as a nociceptive intranasal odorant, can stimulate the trigeminal nerve (cranial nerve V) rather than the olfactory nerve (cranial nerve I), thereby bypassing or confounding the intended sensory pathway. This unintended activation may compromise the reliability of the assessment and obscure true olfactory deficits. This review evaluates the limitations of alcohol in olfactory assessments and proposes essential oils as a viable alternative. Essential oils, such as peppermint, lavender, and eucalyptus, offer a diverse range of recognizable scents with favorable safety profiles. Unlike alcohol, these oils do not irritate the nasal mucosa and are less likely to trigger the trigeminal nerve, ensuring a more targeted and accurate evaluation of olfactory function. Furthermore, essential oils provide the added benefit of patient comfort, which may improve cooperation and compliance during testing. A shift toward the use of essential oils in olfactory testing could significantly enhance the accuracy and patient experience of clinical assessments. However, to establish essential oils as a standard in medical practice, further research is required. Studies should focus on standardizing testing protocols, optimizing concentrations, and evaluating cost-effectiveness to ensure their widespread and effective adoption.

**Keywords:** Olfactory Assessment; Essential Oils; Patient Comfort; Diagnostic Accuracy; Standardization

### 1. Introduction

Olfaction, the chemical sensation of gaseous odorants, is a critical sensory modality that significantly influences human quality of life and serves as an early diagnostic marker for various neurological and systemic disorders (Branigan & Tadi, 2023). Mediated by the olfactory nerve (cranial nerve I), this intricate chemosensory process integrates a network of neuroanatomical structures, neurotransmitters, and cortical pathways, contributing to involuntary memory formation, emotional processing, and taste (Bystrova & Kolesnikov, 2021).

From an evolutionary perspective, olfaction has been vital for survival, enabling the detection of environmental threats, fostering social connections, and ensuring food safety. Clinically, disruptions in olfactory function are often linked to upper respiratory infections, neurodegenerative diseases such as Parkinson's and Alzheimer's, and endocrinological conditions like Kallmann's syndrome (Chen et al., 2022). Other causes, including persistent anosmia following viral infections, trauma, or intracranial pathologies such as meningiomas, further highlight the diagnostic importance of olfactory assessments (Davidson & Murphy, 1997).

Despite its clinical significance, olfactory testing in routine practice remains limited and is frequently reliant on alcohol-based methods, such as the Alcohol Sniff Test (AST). Alcohol swabs are widely used due to their simplicity, accessibility,

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and ability to elicit a strong and recognizable olfactory response (Davidson & Murphy, 1997). However, the irritant properties of alcohol and its ability to stimulate the trigeminal nerve (cranial nerve V) often compromise diagnostic accuracy and patient comfort, particularly in individuals with nasal mucosa sensitivity (Garefis et al., 2024). These drawbacks underscore the need for alternative testing methods that provide accurate, patient-friendly assessments.

Emerging evidence suggests that essential oils, such as peppermint, lavender, and eucalyptus, may represent a superior alternative for olfactory testing. These oils elicit distinct and consistent olfactory responses while avoiding mucosal irritation or trigeminal nerve stimulation (Zago Wang et al., 2021). Additionally, their therapeutic properties, including calming and stimulating effects, offer advantages in enhancing patient compliance and comfort during assessments. Comparative studies have demonstrated that essential oils may yield more precise evaluations of olfactory function, avoiding the confounding factors associated with alcohol-based methods.

However, alcohol swabs remain prevalent in clinical practice due to entrenched habits, cost-effectiveness, and the absence of standardized protocols for essential oils in olfactory assessments. While alcohol testing offers simplicity and practicality, the discomfort and potential inaccuracies it introduces limit its utility in providing a comprehensive evaluation of olfactory dysfunction. This review seeks to explore the limitations of alcohol-based olfactory assessments, examine recent studies comparing alcohol and essential oils, and advocate for the development and standardization of essential oil-based methods. By addressing these gaps, the adoption of essential oils could redefine best practices in clinical olfactory assessments, enhancing both diagnostic accuracy and patient experience.

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## 2. Related Literature and Research Gap

Olfactory testing has historically relied on alcohol swabs, particularly in the form of the Alcohol Sniff Test (AST), due to their strong and recognizable scent, which facilitates quick assessments (Davidson & Murphy, 1997). This method, however, presents notable limitations. Alcohol's irritant properties can stimulate the trigeminal nerve (cranial nerve V), potentially bypassing the olfactory nerve (cranial nerve I) and confounding diagnostic outcomes (Garefis et al., 2024). Furthermore, the discomfort associated with alcohol-based testing, especially in patients with nasal mucosa sensitivity, often reduces compliance and patient satisfaction.

Emerging studies highlight essential oils as a promising alternative in olfactory testing. Essential oils such as peppermint, lavender, and eucalyptus are known to produce predictable olfactory responses with minimal irritation (Zago Wang et al., 2021). For instance, peppermint oil provides robust responses at low concentrations, while lavender's calming properties may enhance patient cooperation. These oils also avoid trigeminal nerve stimulation, offering a more targeted assessment of olfactory function. Despite these advantages, essential oils remain underutilized due to the lack of standardized protocols and entrenched reliance on alcohol-based methods.

Comparative research underscores the potential of essential oils to improve both diagnostic accuracy and patient experience. However, there is a significant gap in the clinical integration of these alternatives. Factors such as cost, accessibility, and standardization of essential oil-based testing protocols remain unaddressed, limiting their widespread adoption.

This review aims to bridge this research gap by advocating for the clinical adoption of essential oils as a standardized, patient-friendly alternative for olfactory assessments. By leveraging their therapeutic and diagnostic benefits, essential oils could significantly enhance current practices in olfactory testing. Further research is needed to validate these findings and develop protocols that integrate essential oils into routine clinical assessments.

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## 3. Materials and Methods

This is a scientific research paper designed to assess the efficacy and safety of essential oils compared to alcohol swabs in clinical olfactory assessments. A prospective, double-blind, randomized controlled trial will be conducted to compare the two methods using both subjective and objective measures.

### 3.1. Participant Selection

Participants will be recruited from a tertiary teaching and referral hospital, ensuring a diverse sample of individuals across different age groups, genders, and clinical profiles. Inclusion criteria will include adults aged 18–65 years with no history of severe nasal trauma, chronic respiratory illness, or neurodegenerative diseases that could independently impair olfactory function. Exclusion criteria will include participants with known allergies to alcohol or essential oils, active upper respiratory infections, or recent nasal surgeries. A total sample size of 200 participants (100 per group)

will be targeted, based on a power analysis to detect significant differences in olfactory outcomes with a power of 0.8 and alpha level of 0.05.

### 3.2. Group Allocation and Blinding Procedures

Participants will be randomly assigned to one of two groups using a computer-generated randomization sequence:

- *Group A: Exposed to alcohol swabs.*
- *Group B: Exposed to essential oils (peppermint, lavender, and eucalyptus) at standardized concentrations.*

Both the participants and the researchers conducting the assessments will be blinded to the type of stimulus administered. Essential oils will be diluted to concentrations equivalent in perceived intensity to alcohol swabs, ensuring a fair comparison. The administration process will involve opaque containers for both alcohol and essential oil stimuli, labeled only with a study ID.

### 3.3. Data Collection

Data will be collected through:

- **Subjective Measures:** Participants will rate their comfort levels, scent recognition, and overall experience using a 10-point Likert scale.
- **Objective Measures:** Olfactory nerve function will be assessed through standardized neurophysiological tests, including odor detection thresholds, recognition accuracy, and nerve response rates using electro-olfactography.

### 3.4. Statistical Analysis

The collected data will be analyzed using both descriptive and inferential statistics.

- Descriptive statistics (means, medians, standard deviations) will summarize subjective ratings and objective outcomes for each group.
- Inferential statistics will include:
  - Independent t-tests or Mann-Whitney U tests for comparing group differences in subjective ratings.
  - Chi-square tests for categorical data, such as scent recognition accuracy.
  - Repeated-measures ANOVA to evaluate changes in outcomes over time.
  - Multivariate regression models will be used to control for potential confounding factors, such as age, gender, or pre-existing medical conditions.

### 3.5. Controlling for Confounding Factors

To ensure robust findings:

- Participants will be stratified by age and gender during randomization to ensure balanced distribution across groups.
- Pre-existing conditions, such as mild olfactory dysfunction or allergies, will be documented and included as covariates in the regression analysis.
- Environmental factors, such as room temperature and humidity, will be standardized during testing to prevent variations in olfactory stimulus perception.

### 3.6. Ethical Considerations

The study will be conducted in accordance with the Declaration of Helsinki, with ethical approval obtained from the hospital's Institutional Review Board. All participants will provide written informed consent prior to enrollment. Safety monitoring will ensure that participants experience no adverse reactions to alcohol or essential oil stimuli.

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## 4. Results (Planned)

The study hypothesizes that essential oils will outperform alcohol swabs in both subjective and objective measures of olfactory assessment. Based on the current literature:

- Alcohol swabs are expected to cause mucosal discomfort and potentially bypass olfactory nerve function by stimulating the trigeminal nerve (Garefis et al., 2024).
- Essential oils, such as peppermint, lavender, and eucalyptus, are anticipated to elicit more distinct and pleasant olfactory responses, with peppermint demonstrating robust detection even at low concentrations (Zago Wang et al., 2021).
- Lavender oil's calming properties may enhance participant compliance, while eucalyptus oil's strong, non-irritant scent profile is expected to yield consistent results (Bystrova & Kolesnikov, 2021).
- These findings will be analyzed and presented in detail to evaluate the clinical viability of essential oils as a standardized alternative to alcohol swabs in olfactory testing.

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## 5. Discussion

While the Alcohol Sniff Test remains a widely used method for olfactory assessments, its limitations regarding patient comfort and reproducibility are becoming increasingly evident. The irritant properties of alcohol can cause discomfort, leading to inconsistent responses, particularly in individuals with olfactory dysfunction. This has prompted researchers to explore alternatives that provide more reliable and comfortable testing experiences. Essential oils have emerged as a promising solution, offering identifiable scents with minimal irritant effects, making them a viable alternative for olfactory assessments. For instance, lavender oil is known for its calming properties, which have been shown to enhance patient compliance and cooperation during testing. Meanwhile, peppermint and eucalyptus oils have demonstrated consistent neural activation patterns, eliciting reliable olfactory responses even at low concentrations (Zago Wang et al., 2021). These oils are also less likely to cause discomfort or irritation compared to alcohol, thus improving the overall patient experience.

Standardizing the use of essential oils in clinical practice could significantly improve the accuracy and patient satisfaction of olfactory assessments. The distinctive and pleasant aromas of these oils not only make the tests more comfortable but also provide clearer results. However, several challenges must be addressed before essential oils can be widely adopted in clinical settings. Key considerations include determining the optimal concentrations for testing and ensuring cost-effectiveness, especially in resource-limited environments. Ongoing research will be crucial in overcoming these challenges and determining the most effective ways to integrate essential oils into routine clinical assessments.

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## 6. Conclusion

Alcohol-based olfactory assessments, while commonly used, present significant limitations in terms of patient comfort and diagnostic accuracy. The irritant properties of alcohol can cause discomfort and lead to inconsistent results, particularly in individuals with olfactory dysfunction. In contrast, essential oils offer a more pleasant and distinct scent profile, providing a promising alternative that could enhance both patient comfort and the reliability of diagnostic outcomes. Future studies should prioritize the standardization of essential oil use across diverse patient populations to establish them as a reliable, clinically accepted alternative for olfactory testing, ensuring consistent, accurate assessments.

### *Recommendations*

The recommendations should focus on the following key areas:

- **Standardization of Essential Oils in Olfactory Testing:**-Future research should aim to establish standardized protocols for using essential oils in olfactory assessments. This would include determining optimal concentrations for various oils (such as peppermint, lavender, and eucalyptus), identifying the most effective delivery methods (e.g., vaporization, direct application), and ensuring consistency across different clinical settings.
- **Clinical Trials to Compare Efficacy and Safety:**-Conduct large-scale, multicenter clinical trials to directly compare essential oils with alcohol swabs, evaluating patient comfort, scent recognition accuracy, and neural activation responses. The trials should include diverse patient populations, including those with olfactory dysfunction, to ensure generalizability of findings.
- **Cost-Effectiveness Analysis:**- A cost-effectiveness study should be undertaken to determine the feasibility of integrating essential oils into routine clinical practice, particularly in resource-limited settings. This would assess both the financial costs of essential oils and any potential savings from improved patient compliance and more accurate diagnostic results.

- **Patient and Provider Education:**- Healthcare providers should receive training on the safe and effective use of essential oils for olfactory testing. Additionally, patients should be educated on the potential benefits of essential oils as a more comfortable and accurate alternative to alcohol-based tests.
- **Exploration of New Essential Oils:** - Further studies could explore the efficacy of other essential oils, assessing their safety profiles and potential to elicit reliable olfactory responses, particularly in patients with specific conditions (e.g., anosmia, ageusia).
- **Development of Guidelines for Clinical Adoption:**-The development of evidence-based guidelines for incorporating essential oils into clinical olfactory assessments would be crucial for ensuring consistency and safety across different healthcare settings. These guidelines should also address ethical concerns related to the use of scented substances in clinical environments.

By addressing these recommendations, future research can help establish essential oils as a reliable, effective, and patient-friendly alternative for olfactory testing in clinical practice.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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