

Comparative Effects of Lemongrass and Lavender Oil Inhalation on Audio and Visual Reaction Time in Healthy AdultsSuman Sharma¹, Harshit Punamiya², Saroj Choudhary³, Charu Taneja⁴, Prem Singh⁵¹Assistant Professor, Department of Physiology, ESIC Medical College and Hospital Faridabad²Assistant Professor, Department of Physiology, Government Medical College, Nagaur, Rajasthan³Associate professor, Department of Physiology, Pacific Medical College & Hospital, Udaipur, Rajasthan⁴Associate Professor, Department of Anatomy, Government Medical College, Nagaur, Rajasthan⁵Associate Professor, SPC, Government College, Bhim, Rajsamand, Rajasthan, India

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Abstract**Background:** Aromatherapy is increasingly being explored for its effects on cognitive performance and psychological well-being. Lemongrass and lavender essential oils are known to exert distinct neurophysiological effects; however, their influence on reaction time remains inadequately studied.**Aim:** To compare the effects of inhalation of lemongrass and lavender essential oils on audio reaction time (ART) and visual reaction time (VRT) among healthy young adults.**Methods:** This quasi-experimental study included 60 healthy participants aged 18–20 years. Participants were divided into lemongrass oil and lavender oil groups (n=30 each). Baseline ART and VRT were recorded using the RTM-608 Reaction Time Apparatus. Following 30 minutes of aromatherapy exposure, reaction times were reassessed. Data were analyzed using paired and independent t-tests.**Results:** Lemongrass oil significantly reduced VRT (0.70±0.29 to 0.63±0.26 msec; p=0.02) and ART (1.01±0.46 to 0.79±0.29 msec; p=0.001). In contrast, lavender oil significantly increased VRT (0.62±0.20 to 0.74±0.18 msec; p=0.01) and ART (0.76±0.25 to 0.91±0.31 msec; p=0.04).**Conclusion:** Lemongrass oil enhanced alertness and psychomotor performance, whereas lavender oil produced a calming effect associated with prolonged reaction times.**Keywords:** Aromatherapy, Lemongrass oil, Lavender oil, Visual reaction time, auditory reaction time, Cognitive performance.**DOI:** 10.25258/ijcpr.18.3.296

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Introduction

Reaction time is the interval between the presentation of a sensory stimulus and the initiation of an appropriate motor response. Audio and visual reaction times are widely used measures of central nervous system processing speed, sensorimotor coordination, attention, and alertness. Faster reaction times indicate efficient neural processing and improved cognitive performance, whereas prolonged reaction times may result from fatigue, anxiety, stress, or decreased concentration. [1,2]

Stress is a common problem among young adults and has been shown to adversely affect cognitive functions, psychomotor performance, and overall well-being. Consequently, there is growing interest in non-pharmacological interventions that can reduce stress and enhance cognitive performance. Aromatherapy, the therapeutic use of essential oils, has emerged as a complementary approach for

improving psychological and physiological health. The inhalation of essential oils stimulates olfactory receptors, which transmit signals to the limbic system and hypothalamus, thereby influencing emotions, memory, autonomic functions, and stress responses. [3,4] Lavender (*Lavandula angustifolia*) essential oil is known for its anxiolytic and calming properties, primarily attributed to constituents such as linalool and linalyl acetate. Studies have demonstrated its beneficial effects on anxiety, stress reduction, and mood enhancement. [5] Lemongrass (*Cymbopogon citratus*) essential oil contains bioactive compounds such as citral and geraniol, which possess antioxidant and anxiolytic properties and may promote mental alertness and relaxation. [6]

Although the individual effects of lavender and lemongrass oils on mood and psychological well-

being have been reported, comparative studies evaluating their influence on objective neurophysiological parameters such as audio and visual reaction time are limited. Therefore, the present study was undertaken to compare the effects of inhalation of lavender and lemongrass essential oils on audio-visual reaction time and perceived stress among healthy young adults. The findings may provide evidence for the use of aromatherapy as a simple and cost-effective strategy for improving cognitive performance and reducing stress.

Material & Methodology

This quasi-experimental study was conducted in the Department of Physiology, Tertiary care hospital, Rajasthan, after obtaining approval from the Institutional Human Research Ethics Committee. Written informed consent was obtained from all participants prior to enrollment.

A total of 60 healthy volunteers aged 18–25 years were recruited and randomly allocated into two groups: Group L (Lavender oil, n=30) and Group LG (Lemongrass oil, n=30). Participants with a history of respiratory illness, upper respiratory tract infection, hearing impairment, visual defects, neurological disorders, psychiatric illness, allergy to essential oils, or those receiving medications affecting cognitive functions were excluded from the study.

Baseline audio reaction time (ART) and visual reaction time (VRT) were recorded in a quiet room using the RTM-608 Reaction Time Apparatus (Medicaid Systems, Chandigarh, India). Before recording, participants were familiarized with the equipment and testing procedure. Visual stimuli consisted of randomly presented red, green, and yellow lights, while auditory stimuli included tones of 250 Hz, 500 Hz, and 750 Hz. Three readings for each stimulus were recorded, and the mean value was considered for analysis. Following baseline assessment, aromatherapy was administered using a ceramic aroma diffuser containing 40 mL of water and 10–12 drops of either lavender or lemongrass essential oil. The diffuser was activated five minutes before participant entry to ensure uniform

distribution of aroma. Participants remained seated in the room for 30 minutes and were instructed to avoid mobile phone use, music, conversation, or other activities that could influence autonomic activity.

Immediately after the intervention, ART and VRT were reassessed using the same protocol. Perceived stress was evaluated before and after exposure using the Perceived Stress Scale (PSS-10).

Data were analyzed using IBM SPSS version 20.0. Results were expressed as mean±standard deviation. Paired t-test was used for within-group comparisons, while independent t-test was applied for between-group comparisons. A p-value <0.05 was considered statistically significant.

Result

In the lemongrass oil group, inhalation of the aroma for 30 minutes resulted in a significant reduction in both visual reaction time (VRT) and auditory reaction time (ART). The mean VRT decreased from 0.70±0.29 msec to 0.63±0.26 msec (p=0.02), while the mean ART decreased from 1.01±0.46 msec to 0.79±0.29 msec (p=0.001), indicating improved alertness and faster sensorimotor responses. (Table1)

In contrast, participants exposed to lavender oil demonstrated a significant increase in reaction times following aromatherapy. The mean VRT increased from 0.62±0.20 msec to 0.74±0.18 msec (p=0.01), whereas the mean ART increased from 0.76±0.25 msec to 0.91±0.31 msec (p=0.04). These findings suggest a relaxation-associated slowing of psychomotor performance.

Comparison of the mean changes between the two intervention groups showed that lemongrass oil significantly improved reaction times, while lavender oil prolonged them. The reduction in VRT and ART observed with lemongrass oil was significantly greater than the changes observed following lavender oil inhalation (p<0.001). Thus, lemongrass oil appeared to enhance cognitive alertness and reaction speed, whereas lavender oil exerted a calming effect reflected by delayed audio and visual reaction times.(Table 2)

Table 1: Comparison of visual and auditory reaction time before and after Aromatherapy exposure

Group	Exposure	Mean VRT ± SD (msec)	p- value	Mean ART ± SD (msec)	p- Value
Lemon grass Oil	Pre- Exposure	0.70 ± 0.29	0.02	1.01 ± 0.46	0.001
	Post- exposure	0.63 ± 0.26		0.79 ± 0.29	
Lavender Oil	Pre- Exposure	0.62 ± 0.20	0.01	0.76 ± 0.25	0.04
	Post-Exposure	0.74 ± 0.18		0.91 ± 0.31	

P<0.05 considered statistically significant.

Table 2: Comparison of changes in visual and auditory reaction time following Lemon grass and lavender oil inhalation

Parameter	Lemon grass Oil (n=30) Mean Change (Post-pre) ± SD	Levender Oil (n=30) Mean Change (Post-pre) ± SD	p- value
Visual reaction Time (VRT)	-0.07 ± 0,03	+0.12 ± 0.02	<0.001 **
Auditory Reaction time (ART)	-0.22 ± 0.17	+ 0.15 ± 0.06	<0.001 **

* Independent t-test comparing mean change between groups. ** Highly significant (p<0.001).

Discussion

The present study compared the effects of 30-minute inhalation of lemongrass and lavender essential oils on visual reaction time (VRT) and auditory reaction time (ART) among healthy young adults. The findings revealed that lemongrass oil significantly reduced both VRT and ART, whereas lavender oil significantly increased reaction times. These contrasting effects suggest that lemongrass enhances alertness and psychomotor performance, while lavender promotes relaxation and reduces central nervous system arousal.

The reduction in reaction times observed following lemongrass oil inhalation may be attributed to its major bioactive constituents, including citral, geraniol, and limonene. Torres et al. (1996) [7] reported that lemongrass oil exerts stimulatory effects on the central nervous system, thereby enhancing cognitive performance and alertness. Tognolini et al. (2006) [8] further demonstrated that citral is the principal active component of lemongrass oil and may contribute to its neurostimulatory actions. The olfactory pathway provides a direct connection between inhaled aromatic compounds and the limbic system, which regulates emotion, attention, and arousal (Ennis et al., 2015; Lv et al., 2013) [3,4]. Previous studies by Yamaguchi (1990) [9] and Kikuchi et al. (1991) [10] demonstrated increased autonomic activity and enhanced brain stimulation following exposure to lemon-based fragrances. Similarly, Smith (2001) [11] reported that lemon aroma improved alertness, mood, and cognitive performance. These findings support the significant reduction in ART and VRT observed in the present study following lemongrass exposure.

In contrast, inhalation of lavender oil significantly prolonged both ART and VRT. Lavender contains linalool and linalyl acetate, compounds known for their anxiolytic and sedative properties. Moss et al. (2003) [12] reported that lavender aroma influences cognition and mood by producing a calming effect, which may slow reaction times. Sayorwan et al. (2012) [13] demonstrated that lavender inhalation decreases autonomic nervous system activity and promotes relaxation. Koulivand et al. (2013) [14] suggested that lavender enhances GABAergic neurotransmission, increasing inhibitory tone within the nervous system.

Furthermore, Bavarsad et al. (2023) [15] reported that linalool interacts with glutamatergic NMDA receptors and other neurotransmitter systems, contributing to reduced arousal and increased relaxation. Shimizu et al. (2008) [16] also observed that lavender oil influences attention and cognitive processing during prolonged tasks. Overall, the findings suggest that lemongrass oil may be beneficial in situations requiring enhanced alertness and rapid responses, whereas lavender oil may be useful for stress reduction and relaxation. These effects are likely mediated through olfactory-limbic interactions and modulation of neurotransmitter systems involved in arousal and cognition.

Conclusion

The study demonstrated that inhalation of lemongrass and lavender essential oils produces distinct effects on cognitive performance as assessed by audio and visual reaction times. Lemongrass oil significantly reduced reaction times, indicating enhanced alertness, attention, and psychomotor performance. In contrast, lavender oil prolonged reaction times, suggesting a calming and relaxing effect on the central nervous system. These findings highlight the potential of lemongrass oil for improving cognitive alertness and lavender oil for promoting relaxation and stress reduction. Further studies with larger sample sizes are recommended to explore the long-term neurophysiological effects of these essential oils.

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