UNIVERSITY OF TORONTO | Civil + Mineral Engineering | Department of Psychology

Du B, Schwartz-Narbonne H, Tandoc M, Heffernan EM, Mack ML, Siegel JA. 2021. The impact of emissions from an essential oil diffuser on cognitive performance. Early view in *Indoor Air*. DOI: 10.1111/ina.12919

Abstract

Essential oil products are increasingly used in indoor environments and have been found to negatively contribute to indoor air quality. Moreover, the chemicals and fragrances emitted by those products may affect the central nervous system and cognitive function. This study uses a double-blind between-subject design to investigate the cognitive impact of exposure to the emissions from essential oil used in an ultrasonic diffuser. In a simulated office environment where other environmental parameters were maintained constant, 34 female and 25 male university students were randomly allocated into four essential oil exposure scenarios. The first two scenarios contrast lemon oil to pure deionized water, while the latter two focus on different levels of particulate matter differentiated by HEPA filters with non-scented grapeseed oil as the source. Cognitive function was assessed using a computer-based battery consisting of five objective tests that involve reasoning, response inhabitation, memory, risk-taking, and decision-making. Results show that exposure to essential oil emissions caused shortened reaction time at the cost of significantly worse response inhabitation control and memory sensitivity, indicating potentially more impulsive decision-making. The cognitive responses caused by scented lemon oil and non-scented grapeseed oil were similar, as was the perception of odor pleasantness and intensity.

Main findings

1. Using essential oil in an ultrasonic diffuser, even with deionized water, can emit a large amount of particulate matter and VOCs.
2. The emitted fragrances and pollutants can have a significant impact on cognitive function, potentially encouraging more impulsive decision-making.
3. The cognitive effects of scented lemon oil or non-scented grapeseed oil are in a similar direction and not likely caused by the perception of odor intensity and odor pleasantness.

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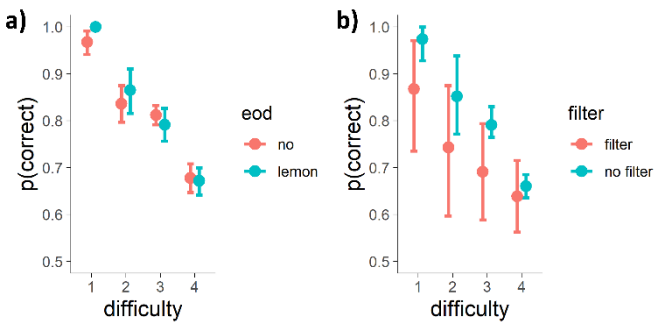

Figure 1: Correct rate vs. matching difficulty in the Abstract Matching test, a) in lemon oil tests and b) in grapeseed oil tests.Error bars show bootstrapped 95% confidence intervals.

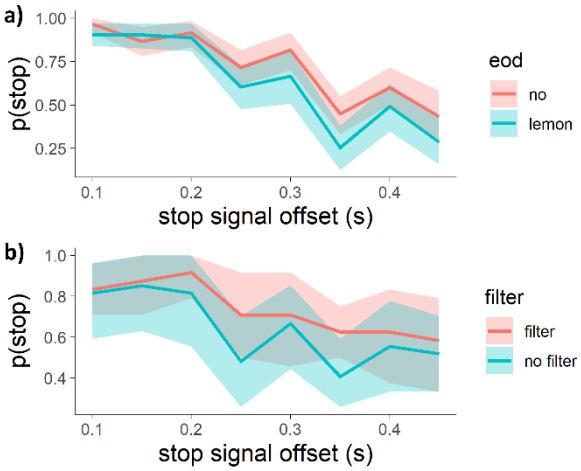

Figure 2: Possibility of inhibiting responses vs. stop-signal offset in the Stop-Signal Reaction Time test, a) in lemon oil tests and b) in grapeseed oil tests. Shaded area shows the 95% confidence intervals.

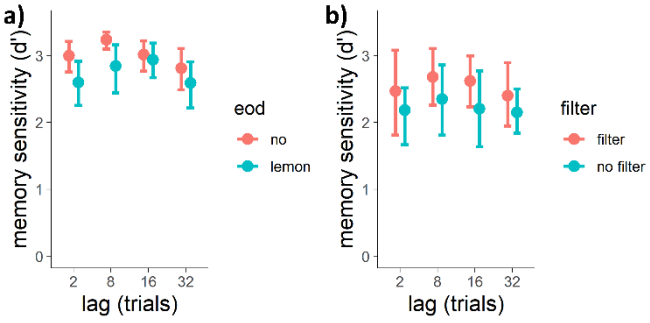

Figure 3: Memory sensitivity (d') vs. recall lags, a) in lemon oil tests and b) in grapeseed oil tests. Error bars show the 95% confidence intervals.