Psychophysiological Effects of Orange Aroma Inhalation during a Short-term Cognitive Stressor

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The effects of two different concentrations of orange aroma on peripheral and cardiac autonomic nervous system activity were investigated under a short-term cognitive stressor in a highly reproducible manner using an olfactometer. In a within-subjects experiment, 19 male university students performed a 30-min calculation task under three aroma conditions: 1% orange, 20% orange, and scentless air (control). Each aroma was intermittently delivered using a proprietary olfactometer in a counter-balanced order. Along with a visual analogue scale (VAS) comprising seven items (nervousness, effort, concentration, tiredness, irritation, boredom, and fed up), the nose tip temperature and the cardiac activity on electrocardiograms were recorded throughout each experiment. Regardless of the aroma condition, significant decreases in nose tip temperature ($p < 0.001$) and the high-frequency (HF) component of heart rate variability ($p < 0.01$), and a significant increase in heart rate (HR) ($p < 0.001$) were observed during the task. These results indicated a typical acute stress response. However, the increase/decrease in HR and HF were significantly lower with 1% orange compared to 20% orange and the control condition ($p < 0.01$), indicating an inhibition of sympathetic nervous system elevation and parasympathetic nervous system suppression by 1% orange. However, none of the VAS scores showed a significant difference between the two doses ($p > 0.05$). There were also no significant differences between the two doses either in terms of preference or perceived strength ($p > 0.05$). The findings suggest that mild orange essential oil inhalation inhibits the cardiac stress response, but with no significant effect on the subjective stress.

Keywords: Heart rate, Heart rate variability, Nose temperature, Olfactometer, Orange aroma, Stress