

論文内容の要旨

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An Evaluation of the Psychophysiological Effects of Aromas in Alleviating Acute Stress Response

(香りによる急性ストレス反応の緩和効果に関する生理心理評価)

We conducted a series of experiments to investigate the psychophysiological effects of aromas under a short-term cognitive stressor, in a highly reproducible manner using an olfactometer. Each experiment consisted of a 10-min initial rest period, a 30-min calculation task, and a 15-min recovery period. Within-subject design was employed where male university students ($n=19$, 6, and 19 in Exp.1,2, and 3 respectively) performed the calculation under each aromatic or control stimulus presented in counter-balanced/ randomized order. Each stimulus was intermittently delivered (first 20s of each 1-min interval) via a cannula placed under the nostrils and connected to a customized olfactometer. Dose-dependent effects of 1 and 20% Orange were investigated in Exp.1 whereas eight different aromas: Chocolate, Strawberry, Green tea, Apple, Citrus ginger, Chamomile, Cedarwood, and Musk were investigated in a preliminary investigation (Exp.2). Based on the findings of Exp.2, Apple and Chamomile were further investigated in Exp.3. Along with a visual analogue scale (VAS) for psychological assessment, cardiac activity on electrocardiograms, and peripheral activity using skin temperature and skin conductance level (SCL) were recorded throughout each experiment. These measures indicated that the calculation task functioned as an acute stressor. Remarkably, the increase/decrease in heart rate (HR) and high-frequency (HF) component of heart rate variability during the task were significantly smaller with 1% Orange (compared to 20% and Control). Suppressed increase/decrease in HR and HF were also observed in Exp.2 with Cedarwood, Strawberry, Green tea, Apple, and Citrus ginger (compared to Control). These results indicated an inhibition of sympathetic nervous system elevation and parasympathetic nervous system suppression. Demonstrating a remarkable suppression in the increase/decrease in HR and HF, Exp.3 verified the efficacy of Apple in alleviating cardiac stress response. However, the psychological measures in terms of VAS demonstrated no significant benefit of the above aromas as demonstrated through cardiac parameters. Discrepancies were also observed between the subjective impressions and the physiological responses. Moreover, the effects demonstrated through peripheral responses were inconsistent with those through cardiac responses, e.g. there were no significant differences in nose temperature between the two doses of

Orange, negative effects were observed with Cedarwood and Apple on SCL (Exp.2) and with Apple on skin temperature (Exp.3).

Overcoming the limitations in past aroma studies brought by conventional passive exposure administration methods, the study successfully introduced a proprietary olfactometer ensuring well-controlled aroma administration. While contemporary studies on discrepant psychophysiological effects are in a preliminary stage and such effects are frequently and merely attributed to the large variation in experimental design and aroma administration method, our study investigated various psychophysiological effects through a series of well-controlled experiments, employing an olfactometer. Investigations on the differences based on age and gender is a direction for prospective research which will enable to overcome the limited generalizability of our findings resulted due to the homogeneous study sample. In conclusion, the study verified the efficacy of mild Orange and Apple aromas in inhibiting cardiac stress response. Further, the presence of a dose-dependent effect and a stimulus-specific nature of aroma which leads to discrepant psychophysiological effects were revealed.