Effects of *Pelargonium graveolens*(Geranium) Essential Oil on Heart Rate Variability During Paced Breathing at Resonance Frequency

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Research Article

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Abstract

The present study examined whether presenting a pleasant odor during paced breathing at resonance frequency (RF) enhances autonomic nervous activity, as assessed by heart rate variability (HRV) and baroreflex sensitivity (BRS), in 28 healthy college students. Electrocardiogram, respiration, and noninvasive continuous blood pressure were recorded during 5 min of paced breathing at RF, followed by two successive 5-min periods of paced breathing at RF with geranium essential oil in the odor group or purified water in the placebo group. The amplitude of the low-frequency (LF) component of HRV increased significantly during paced breathing at RF in the odor group, whereas it remained unchanged in the placebo group (p = .001). A gradual increase in R-R interval, indicating a decrease in heart rate, was also observed in the odor group during paced breathing at RF (p < .001). BRS did not change significantly across measurement sessions in either group. These results suggest that olfactory stimulation induced by a pleasant odor during paced breathing at RF enhances cardiac parasympathetic nervous activity. The findings provide a rationale for the adjunctive use of pleasant odors in HRV biofeedback treatment.

Introduction

Paced breathing at resonance frequency (RF) is an essential procedure in heart rate variability (HRV) biofeedback (Lehrer, 2007; Vaschillo et al., 2011). The cardiovascular system has a distinct natural oscillation at approximately 0.1 Hz, known as RF (van de Vooren et al., 2007; Vaschillo et al., 2011). When the frequency of a stimulus matches the RF of a system, the system oscillates with a larger amplitude (Bueche, 1972). Accordingly, paced breathing at RF produces large increases in HRV (Vaschillo et al., 2002, 2006) and baroreflex gain (Lehrer et al., 2003). Paced breathing is thought to stimulate the resonance process inherent in the cardiovascular system, thereby strengthening autonomic nervous function (Vaschillo et al., 2011). In fact, continuous practice of paced breathing at RF has been shown to ameliorate several stress-related symptoms associated with autonomic dysfunction, including asthma, depression, anxiety, fibromyalgia, and sleep disorders (Ebben et al., 2009; Hassett et al., 2007; Karavidas et al., 2007; Lehrer et al., 2004; McLay & Spira, 2009; van der Zwan et al., 2019). The baroreflex plays an important role in the mechanisms underlying the clinical effects through which paced breathing at RF affects autonomic nervous function (DeBoer et al., 1987; Lehrer et al., 2003). Because respiration causes HRV at the relevant frequency, that is, respiratory sinus arrhythmia (Hirsch & Bishop, 1981), respiratory sinus arrhythmia caused by paced breathing at RF occurs in the low-frequency (LF; 0.04–0.15 Hz) range of HRV. Moreover, respiratory sinus arrhythmia induced by paced breathing at RF merges with HRV related to blood pressure (BP) fluctuations at a rate of 0.1 Hz, that is, Mayer waves (Madwed et al., 1989), resulting in a large increase in HRV (Lehrer, 2007; Shaffer & Meehan, 2020). Under this condition, the baroreflex is efficiently stimulated and is thought to enhance homeostasis through autonomic nervous regulation (Vaschillo et al., 2002, 2006). Furthermore, paced breathing at RF may improve emotional regulation via the nucleus tractus solitarii (NTS) (Mather & Thayer, 2018).

Given that paced-breathing practice is conducted continuously, ensuring that individuals can perform it comfortably is essential. Because paced breathing at RF requires individuals to maintain breathing at a

slower rate than the normal resting respiratory rate (e.g., 12–20 breaths/min; Guyton, 1986; Sherwood, 2006), individuals in the early sessions of HRV biofeedback treatment often find it difficult to pace their breathing, leading to adverse experience (Lehrer et al., 2003, 2007). Although several methods have been proposed to reduce discomfort during slow-paced breathing (e.g., de Souto Barbosa et al., 2023: Norweg et al, 2023), positive emotion induction may serve as an important psychological factor that improves discomfort related to slow-paced breathing. Allen and Friedman (2011) reported that dyspnea was alleviated by presenting cues that evoke positive emotion during slow-paced breathing at 6 cycles/min, such as positive images from the International Affective Picture System presented in synchrony with breathing. However, their findings demonstrated only a subjective reduction in dyspnea, and no significant changes were observed in cardiac autonomic nervous indices, such as LF magnitude or heart period. Therefore, the effects of positive emotion induction during slow-paced breathing on autonomic nervous function remain unclear.

Odor exposure has been shown to induce positive affect and autonomic activity. Masaoka et al. (2012) examined participants' preferred odors and the autobiographical memories associated with them and subsequently presented the corresponding odors during the experiment. Their results showed that when positive emotion was elicited by odor in conjunction with memory retrieval, respiratory rate decreased significantly, accompanied by activation of certain brain regions related to emotion, such as the parahippocampus and amygdala. Furthermore, simply presenting an odor can elicit positive affect and increase autonomic nervous activity. Sakakibara et al. (2025) examined respiratory frequency, HRV, and baroreflex sensitivity (BRS) during odor presentation, specifically geranium essential oil, and compared these responses with those observed in a control condition in which participants watched a video of playful puppies, a stimulus also considered to elicit positive emotion. The results showed that the amplitude of respiratory sinus arrhythmia and BRS increased during odor presentation when respiratory frequency was statistically controlled, despite positive affect being elicited in both conditions. These findings suggest that odor presentation accompanied by positive emotion enhances parasympathetic autonomic nervous responses.

However, previous studies demonstrating the potential influence of odors on autonomic nervous activity have examined these effects under spontaneous breathing (Duan et al., 2007; Ghibaudo et al., 2025; Sakakibara et al., 2025; Watanabe et al., 2015; Yoshimoto et al., 2021). Consequently, the impact of odors accompanied by positive affect on cardiovascular responses during paced breathing at RF has not yet been investigated. The present study aimed to examine whether presenting a pleasant odor during paced breathing at RF, as used in HRV biofeedback, enhances autonomic nervous function, as assessed by HRV and BRS. For this purpose, participants first performed paced breathing at RF alone to obtain baseline HRV and BRS data. They were then randomly assigned to either an odor group, in which geranium essential oil was presented during paced breathing at RF, or a placebo group, in which purified water was presented during paced breathing at RF. In this study, each individual's RF was determined based on a protocol established in previous research (Lehrer et al., 2000, 2013).

Method

Participants

A sample size of 28 was determined using G*Power (Version 3.1.9.7) for a repeated-measures ANOVA with both within- and between-subjects interactions. The calculation assumed a medium effect size (*f* = .25), an alpha level of .05, statistical power of .80, two groups, three measurement points, a within-measure correlation of .50, and a nonsphericity correction of 1. Healthy nonsmoking undergraduate and graduate students (12 men and 16 women, aged 19–28 years) were recruited on campus through the university's research participant management system (SONA SYSTEMS, Sona Systems, Ltd.). These participants were then randomly assigned to either the odor group (6 men and 8 women) or the placebo group (6 men and 8 women). Because attitudes toward odors, such as odor preference and recognition, have been reported to differ by gender (Bamba & Mitsuda, 2024), participants were randomized to ensure an equal ratio of men and women across groups.

All participants provided written informed consent. None had a history of cardiovascular, pulmonary, renal, or metabolic disorders or had taken any medication in the 2 weeks preceding the study. In addition, none of the participants had previous experience with HRV biofeedback. The study was approved by the Research Ethics Committee of Aichi Gakuin University (No. 25-10). Before the experiment, participants were instructed to refrain from strenuous exercise and alcohol consumption on the day before the experiment and to avoid caffeine on the day of the experiment. Experimental measurements were conducted between 10:00 AM and 12:00 PM. Participants who completed all measurement sessions received a 4,000-yen gift card (QUO CARD, QUO CARD Co., Ltd.) as compensation.

The research plan, including participants, experimental conditions, procedures, data analysis, and statistical analysis, was registered with the Open Science Framework (OSF), and the experiment was conducted after registration (registered October 5, 2025; https://osf.io/kefna/overview).

Apparatus and Measurement Variables

The experiment was carried out in a sound-attenuated, air-conditioned chamber maintained at 23–24°C. Participants were seated in a comfortable chair throughout the measurements. A CM5-lead electrocardiogram (ECG) was recorded, and respiratory activity was measured using a strain-gauge pneumogram sensor (DC pneumogram sensor AP-C034-013[S], Miyuki Giken) attached around the chest wall. These signals were acquired with an 8-channel polygraph (BA1008, Digitex Institute). Noninvasive continuous blood pressure (BP) was assessed using the vascular unloading technique (Peňaz, 1973) with a CNAP Monitor 500 system (CNSystems). This system detects changes in finger blood flow using an inflatable cuff placed around the finger and converts these oscillations into a continuous pulse pressure waveform and beat-to-beat arterial BP values (Fortin et al., 2013). The reliability and accuracy of this method for continuous BP measurement have been documented previously (Jagadeesh et al., 2012; Jeleazcov et al., 2010). A double finger cuff was attached to the index and middle fingers of the participant's left hand, and an additional cuff was placed on the upper arm. BP calibration was performed immediately before each measurement. ECG, respiration, and beat-to-beat BP signals were

digitized at 1 kHz using an analog-to-digital converter (ATP-32F, Contec) and saved on a personal computer (Compaq nx6310, HP).

Condition

In the odor group, 0.05 mL of geranium essential oil was applied to a scent strip, which was positioned approximately 15 cm from the participant's nose. Participants were instructed to perceive the scent passively during the measurement. The geranium essential oil used in this study was obtained by steam distillation from the whole plant of rose geranium (*Pelargonium graveolens*) cultivated in Minami-Aso Village, Kumamoto Prefecture, Japan (ACRO INC.). In the placebo group, the same volume of purified water was applied to a scent strip and positioned at the same distance from the participant's nose. Both conditions were administered while participants performed paced breathing at RF. Participants were instructed to perceive any odor passively if they noticed one, and no information regarding the nature of the scent was provided.

Procedure

Resonance Frequency Evaluation

Each individual's RF was evaluated according to Lehrer's protocol (Lehrer et al., 2000, 2013). During this session, participants were instructed to breathe in synchrony with a visual pacemaker (EZ-Air, Thought Technology) at each of the following frequencies: 6.5, 6, 5.5, 5, and 4.5 cycles/min. The pacemaker moved up and down for 2 min at each frequency, progressing from 6.5 to 4.5 cycles/min. Fast Fourier transform (FFT)-based spectral analysis, described below, was performed on the HRV data obtained from each 2-min paced-breathing segment. Each individual's RF was defined as the breathing frequency that produced the highest LF magnitude, that is, the highest power, among the tested frequencies.

One week after each participant's RF was evaluated, the experimental session involving odor presentation was conducted. Upon arrival at the laboratory, participants completed the Multidimensional Assessment of Interoceptive Awareness (MAIA), a validated self-report instrument that assesses multiple facets of interoceptive awareness. This measure was included to explore potential differences between the odor and placebo groups because we were concerned that interoception might be related to the HRV response (Arai et al., 2024). Subsequently, participants were instructed to breathe in synchrony with a visual pacemaker for several minutes at frequencies set 0.5 breaths per minute above and below the RF determined in the previous evaluation session. This procedure was used to confirm resonance characteristics, such as the maximal amplitude of the LF spectral peak and the smoothness of heart rate oscillations, using dedicated PC software (emWave PC, HeartMath). After a 10-min adaptation period, during which the respiration, ECG, and continuous BP sensors were attached, measurements were conducted with participants seated for 5 min each during baseline, Trial 1 (T1), Trial 2 (T2), and Trial 3 (T3). In T1, all participants performed 5 min of paced breathing at their individual RF. In T2, participants in the odor group performed 5 min of paced breathing at their RF while geranium essential oil was presented. The same procedure was repeated in T3. Participants were allowed to rest for a few minutes

between measurement periods. In the placebo group, participants performed 5 min of paced breathing at their RF in T2 and T3 while purified water was presented. During the paced-breathing sessions (T1–T3), participants were instructed to breathe abdominally and exhale through pursed lips.

Immediately after each measurement period, participants completed a short-form self-report measure assessing relaxation (Sakakibara et al., 2014), as well as emotional valence and arousal (Russell et al., 1989). The self-report relaxation scale consisted of 15 items comprising three subscales: physiological tension, psychological relaxation, and cognitive anxiety. Physiological tension and cognitive anxiety were reverse scored. Each item was rated on a 5-point scale, and a total relaxation score was calculated by summing the subscale scores, with higher scores indicating a greater subjective state of relaxation. Valence, ranging from pleasant to unpleasant, was rated on a scale from 10 to 90, with higher scores indicating greater pleasantness. Arousal was also rated on a 10–90 scale, with higher scores indicating greater wakefulness.

Finally, participants rated their impressions of the geranium essential oil in the odor group or purified water in the placebo group using a 7-point adjective rating scale. The adjective pairs included like–dislike, pleasant–unpleasant, light–heavy, bright–dark, clear–vague, strong–weak, uneasy–calm, simple–sophisticated, sleepy–wakeful, and energetic–depressed (Morinaka et al., 2001).

Data Reduction

The ECG recordings were visually inspected on the display with markers showing the detected R-wave peaks. Ectopic beats and errors in R-wave detection were identified across the entire waveform and corrected manually using Analog Recorder Pro (G1 system). R-R intervals were then extracted, and the mean R-R interval, standard deviation of normal-to-normal intervals (SDNN), and root mean square of successive differences between R-R intervals (RMSSD) were calculated for each measurement period. To prepare the data for spectral analysis, the beat-to-beat R-R interval series was linearly interpolated and resampled at 4 Hz to generate an evenly spaced time series. Fast Fourier transform (FFT) analysis with a Hanning window was then applied to the 5-min baseline period and each paced-breathing session in the experimental session. The power and peak frequency of the R-R interval data were examined in the low-frequency (LF; 0.04–0.15 Hz) and high-frequency (HF; 0.15–0.40 Hz) bands. Power spectral density was integrated within each frequency band to obtain LF and HF power. These values were then converted to mean amplitudes ([2 × power]^1/2) to reduce skewness and bring the distribution closer to normal (Hayano et al., 2005).

Baroreflex sensitivity (BRS) was calculated using the spontaneous sequence method (Parlow et al., 1995). The noninterpolated R-R interval data were paired with the systolic pressure amplitude of the preceding beat. Computer-based analysis (Tonam2C, GMS) was used to identify sequences of three to seven consecutive beats in which systolic pressure and the subsequent R-R intervals increased or decreased together. The minimum criteria were set at 1 mm Hg for BP changes and 2 ms for R-R interval changes (Duschek et al., 2007). For each measurement period, BRS was defined as the average regression slope across all identified sequences and expressed in ms/mm Hg.

Statistical Analysis

The effects of group (odor and placebo) and time (T1, T2, and T3) were evaluated using repeated-measures analysis of variance (ANOVA) with the Greenhouse–Geisser correction (Greenhouse & Geisser, 1959). Post hoc comparisons were conducted using Bonferroni tests to identify the source of significant effects. Differences in adjective ratings and MAIA scores between the odor and placebo groups were examined using *t* tests. A probability value of less than .05 was considered statistically significant. Statistical analyses were performed using SPSS Version 30. Data are presented as means ± SD in the text and in Tables 1, 2, and 3 and as means ± SE in Figure 1.

Results

Resonance Frequency in the Odor and Placebo Groups

The mean RF was 0.087 ± 0.009 Hz in the odor group and 0.093 ± 0.003 Hz in the placebo group. There was no significant difference in RF between the two groups, $t(26) = 1.476$, $p = .153$.

Effects of Paced Breathing on HRV and BRS

To evaluate the effects of the experimental manipulation on HRV and BRS, baseline and T1 were compared using paired t-tests. In this analysis, SDNN was used as an overall index of HRV (Shaffer & Ginsberg, 2017). Significant increases were observed in both SDNN and BRS, SDNN: t (27) = -10.879, $p < .001$; BRS: t (27) = -2.659, $p = .013$. Mean SDNN increased from 43.5 ± 20.2 ms at baseline to 87.0 ± 26.6 ms at T1, and mean BRS increased from 14.0 ± 7.9 ms/mmHg to 18.7 ± 9.5 ms/mmHg. These results indicate that paced breathing at RF appropriately enhanced HRV and BRS during the T1 measurement session.

Effects of Odor Presentation During Paced Breathing at RF

Figure 1 shows changes in LF amplitude and BRS from the T1 to T3 measurement sessions. LF amplitude in the odor group increased gradually across these sessions, whereas LF amplitude in the placebo group remained unchanged. A repeated-measures ANOVA indicated a significant group × time interaction for LF amplitude, $F(1.811, 47.081) = 4.273$, $p = .023$, $\eta^2_p = .141$, although no significant main effects of group or time were detected. Post hoc analysis revealed a significant difference in LF amplitude between T1 and T3 in the odor group, $t(26) = -3.996$, $p = .001$. In contrast, no significant main effects of group or time, or group × time interaction, were found for BRS.

Table 1 shows the time-domain indices of HRV, including R-R interval, SDNN, and RMSSD, from the T1 to T3 measurement sessions. A gradual increase in R-R interval, indicating decreased heart rate, was observed in the odor group across the measurement sessions. The ANOVA revealed significant effects of time and a significant group × time interaction, time on the R-R interval: $F(1.521, 39.551) = 17.141$, $p < .001$, $\eta^2_p = .397$; interaction: $F(1.521, 39.551) = 6.918$, $p = .005$, $\eta^2_p = .210$. Post hoc analysis indicated a

significant difference between T1 and T2 in the placebo group, T1–T2: $t(26) = -2.627$, $p = .043$. In the odor group, significant differences were observed between T1 and T2 and between T1 and T3, T1–T2: $t(26) = -6.595$, $p < .001$; T1–T3: $t(26) = -5.022$, $p < .001$. No significant main effects of group or time, or group × time interaction, were found for SDNN, although there were nonsignificant trends for time and the group × time interaction ($ps < .10$). Furthermore, the ANOVA showed a significant effect of time on RMSSD: $F(1.998, 51.949) = 4.846$, $p = .012$), whereas no significant effect of group was detected. There was also a nonsignificant trend for the group × time interaction for RMSSD ($p < .10$).

Table 1 HRV Time-Domain Indices (Mean ± SD)

Self-Report Scales

Table 2 shows the psychological scale scores, including relaxation, valence, and arousal, from the T1 to T3 measurement periods. The ANOVA revealed a significant effect of time on relaxation score, $F(1.343, 34.909) = 26.379$, $p < .001$, $\eta^2_p = .504$, but no significant effect of group or group × time interaction. There was also a significant effect of time on valence score, $F(1.679, 43.654) = 7.988$, $p = .002$, $\eta^2_p = .235$, whereas neither the effect of group nor the group × time interaction was significant. In contrast, no significant effects of group or time, or group × time interaction, were found for arousal score, although there was a nonsignificant trend for the group × time interaction ($p < .10$).

Table 2 Self-Report Scale Scores (Mean ± SD)

Scores on the adjective rating scale for the placebo and odor groups are presented in Table 3. A significant difference between the odor and placebo groups was observed for the “strong–weak” item ($p < .05$), indicating that participants in the placebo group, who were presented with purified water, perceived the odor as weaker than did those in the odor group, who were presented with geranium essential oil.

Table 3 Adjective Rating Scale Scores (Mean ± SD)

No significant differences between the odor and placebo groups were found for any MAIA subscale scores: Noticing, Not Distracting, Not Worrying, Attention Regulation, Emotional Awareness, Self-Regulation, Body Listening, or Trusting.

Discussion

We examined the effect of odor presentation on cardiac autonomic nervous activity in healthy young participants who performed paced breathing at RF. We found that LF HRV amplitude increased significantly in the odor group, whereas it remained unchanged in the placebo control group, although both groups reported comparable increases in subjective relaxation. BRS during paced breathing at RF did not change significantly in response to odor presentation. Moreover, the mean R-R interval increased significantly, indicating decreased heart rate, in the odor group compared with the placebo group. These

results appear to support the hypothesis that paced breathing at RF accompanied by a pleasant odor enhances cardiac parasympathetic activity. Paced breathing at RF is thought to produce the highest HRV amplitude and efficiently stimulate the autonomic nervous system (Lehrer et al., 2000). Therefore, olfactory stimulation from a pleasant odor may modulate the effects of paced breathing at RF on cardiac autonomic activity.

Previous studies have reported that presentation of geranium essential oil may enhance parasympathetic nervous activity. However, most of these studies evaluated HRV under spontaneous breathing conditions, and few have interpreted the experimental results while accounting for the interaction between respiratory frequency and heart rate. HRV amplitude is known to increase as respiratory rate decreases (Hirsch & Bishop, 1981), but such changes have been reported to be independent of parasympathetic nervous activity (Hayano et al., 1994). Therefore, when evaluating cardiac parasympathetic nervous activity using HRV analysis, respiration should be controlled experimentally, such as through paced breathing, or statistically, such as by controlling respiratory rate as a covariate (Ritz, 2024). In this study, we used paced breathing at RF as the evaluation basis and examined the effect of odor while maintaining paced breathing at RF. Thus, the increases in LF HRV amplitude and mean R-R interval observed in this study are likely attributable to enhanced cardiac parasympathetic activity.

This study did not clearly show any change in BRS. BRS plays a role in controlling heart rate and vascular tone in accordance with BP changes and is a homeostatic function that is mainly influenced by parasympathetic regulation (Duschek & Reyes del Paso, 2007; El Khadiri et al., 2025). BRS transiently increased during slower breathing compared with the resting period, as indicated in the Results section, and this finding is consistent with Sakakibara et al. (2020). However, the effects of pleasant odor presentation during paced breathing at RF may need to be evaluated over a longer time frame and under resting conditions. Lehrer et al. (2003) reported a gradual increase in basal BRS in patients with asthma undergoing HRV biofeedback training, suggesting that the influence of HRV biofeedback, that is, paced breathing at RF, on BRS may emerge progressively with continued intervention. Accordingly, further research is warranted to examine the sustained effects of paced breathing at RF accompanied by pleasant odor stimulation.

A growing body of evidence indicates that olfactory stimulation with pleasant odors increases HRV or respiratory sinus arrhythmia under resting conditions (Duan et al., 2007; Ghibaudo et al., 2025; Sakakibara et al., 2025; Watanabe et al., 2015; Yoshimoto et al., 2021). However, no studies to date have examined the effects of odor stimulation during paced breathing at RF, which is used in HRV biofeedback. Individuals often experience aversive side effects during the initial stages of HRV biofeedback training because maintaining slow-paced breathing can be challenging (Lehrer et al., 2003, 2007). In particular, because HRV biofeedback recommends performing a 20-min paced-breathing session twice a day, it is important to use adjunctive strategies that are as comfortable as possible to support continued practice. Inducing positive emotion during slow-paced breathing has been shown to reduce dyspnea (Allen & Friedman, 2011), suggesting that positive and relaxed emotional states may

facilitate cardiovascular resonance during slow-paced breathing in HRV biofeedback. Accordingly, pleasant odors, similar to positive imagery induction, may help mitigate breathing discomfort during the early phases of HRV biofeedback training. In this study, we examined the effects of geranium essential oil on HRV. Given the variability in individuals' olfactory preferences (Ghibaudo et al., 2025; Masaoka et al., 2012), future research may benefit from employing experimental conditions in which participants are exposed to odors they personally find pleasant.

In conclusion, this study demonstrated that presenting a pleasant odor enhanced HRV during paced breathing at RF in healthy young adults. These findings support the hypothesis that the relaxation response elicited by olfactory stimulation augments cardiac parasympathetic activity during slow-paced breathing. Moreover, the present findings may help clarify the beneficial influence of pleasant odors during paced breathing at RF and provide a rationale for the adjunctive use of odors in HRV biofeedback treatment.

Declarations

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Author contributions

M.S., E.T., and K.S. conceived the study and designed the experimental protocol. M.S. collected the data. N.N., and M.S. performed data preprocessing. Statistical analysis and interpretation were conducted by M.S., M.M., and M.K. M.S. drafted the manuscript. All authors reviewed and approved the final version of the manuscript.

Competing Interests

The authors declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: This study was funded by ACRO INC., E.T. and K.S. are affiliated with THREE Holistic Research Center of ACRO INC. M.S. served as a member of a joint research project between Aichi Gakuin University and ACRO INC., and received no personal remuneration. The funder had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Ethical approval

The study was approved by the Research Ethics Committee of Aichi Gakuin University (No. 25-10). Informed consent was obtained from all individual participants included in the study.

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Tables

Tables 1 to 3 are available in the Supplementary Files section.

Figures

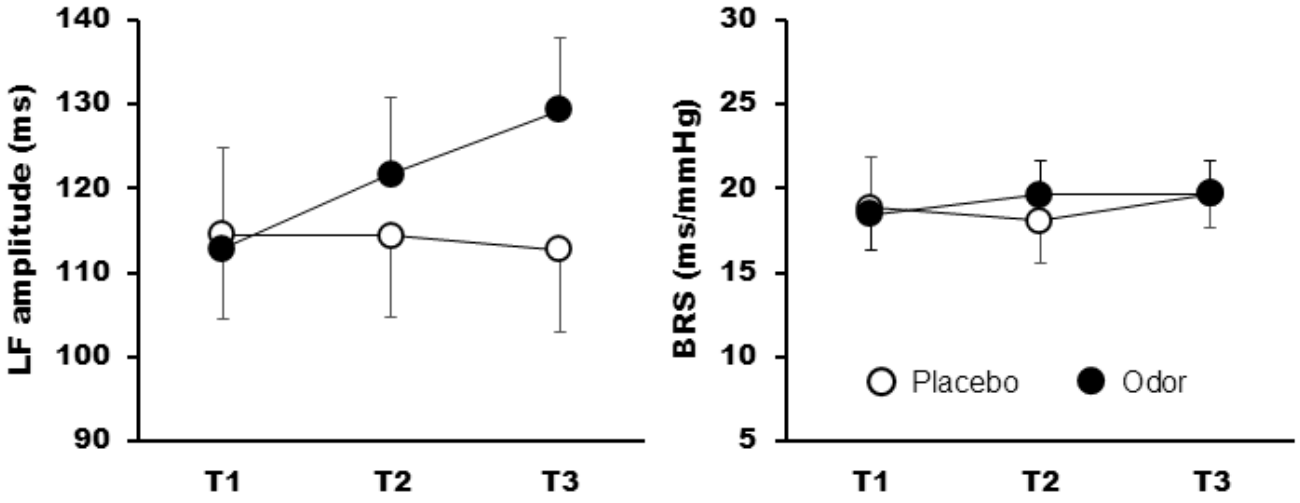

Figure 1

Changes in LF amplitude and BRS during paced-breathing measurement sessions (mean ± SE).

Supplementary Files

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