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"Harnessing the Power of Jasmine Sambac: Enhancing Skin Viscoelasticity through Olfactory Stimulation"

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1. Introduction

Cosmetics play a multifaceted role in people's lives, serving purposes such as cleansing the body, enhancing beauty, expressing identity, altering appearance, and maintaining healthy skin and hair. Skincare products, in particular, are designed to retain moisture and improve texture through various formulations like lotions, emulsions, and creams, each containing ingredients selected based on specific skin benefits. Traditionally, the effectiveness of skincare has relied on topical application. However, we propose a novel approach: "skincare through just inhaling scents without application". This innovative method embodies the concept of beauty wellness, pursuing health and beauty.

Research on the effects of scent on mind and body has been actively conducted, demonstrating its influence on the autonomic nervous system (1), brainwave activity (2–4), and endocrine indicators (5), as well as its potential to improve sleep quality (6). Despite these findings there has been limited research on the effects of scent on the skin, with some reports indicating sebum suppression (4) and enhanced recovery of barrier function (7). These findings suggest a close interconnection between mind, body, and skin (Figure 1). Extending the benefits of scent beyond mind and body well-being to include skin could pave the way for innovative beauty wellness solutions and new skincare paradigms. For instance, skincare functions can be integrated into scents traditionally focused on enjoyment and self-expression such that every moment can be an opportunity for skincare and thus create new market opportunities.

Jasmine sambac (hereafter referred to as JS) is known for its beneficial effects, such as improving sleep quality (8) and enhancing parasympathetic nervous activity (9), suggesting that JS has a relaxing effect. It is a distinct species from jasmine and is primarily recognized for its use in scenting jasmine tea. Furthermore, it has been reported that inhaling the scent of Jasmine sambac during deep breathing can reduce the increased respiratory rate caused by stress (10).

Previous studies have established that changes in the autonomic nervous system affect skin blood flow and skin temperature, with sympathetic nervous system suppression leading to increased peripheral blood flow and skin temperature (11). Furthermore, warming the skin and increasing skin blood flow have been shown to enhance skin viscoelasticity (12). Based on these findings, we hypothesized that by inhaling a scent with relaxation properties, it would be possible to suppress sympathetic nervous activity, thereby increasing skin temperature and blood flow, which in turn would improve skin viscoelasticity. Thus, we aimed to identify a scent that exerts beneficial effects on the mind, body, and skin.

To investigate the beauty wellness effects of JS scent, we conducted single-use and long-term tests. In the single-use tests, we examined the immediate effects of inhaling the JS scent on psychological factors, the autonomic nervous system, skin blood flow, skin temperature, and skin viscoelasticity. In the long-term test, we assessed the effects of prolonged use of the JS scent on psychological effects and skin viscoelasticity. In addition, because of the importance of oxidative stress on skin health and its connections with psychological factors (13) we measured the oxidation-reduction potential in saliva.

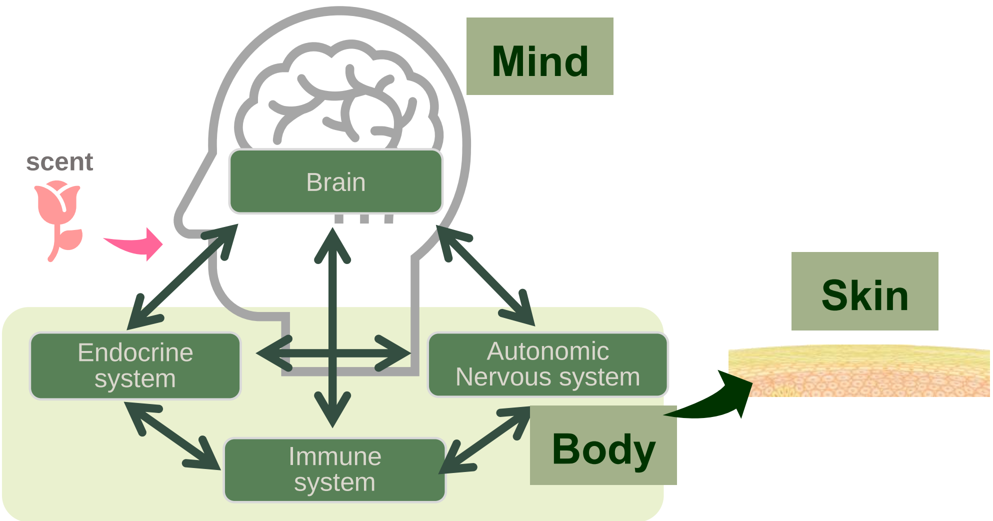

Figure 1. Mechanisms of effects of scent on mind, body and skin.

2. Materials and Methods

2.1 Human test

All subjects reported normal or corrected-to-normal vision and no history of psychiatric and neurological disorders, no disturbances in olfaction in the previous three weeks e.g., caused by hay fever. All procedures involving human subjects were approved by the company's ethics committee, and all subjects provided written informed consent.

2.2 Materials

As the scent samples, we used JS absolute (INCI NAME: Jasminum Sambac (Jasmine) Flower Extract, CAS No. 1034798-23-6, 91770-14-8), dissolved in EtOH or triethyl citrate (TEC, an odorless solvent). The no scent control samples used only solvent.

2.3 Single-use tests

Single-use tests were conducted to investigate the immediate effects of inhaling JS scent on the mind, body (autonomic nervous system) and skin.

2.3.1 Testing the psychological effects of Jasmine Sambac scent

The subjects were 42 healthy male and females aged between 20 and 49 (Test No. B10586). A sniffing strip was dipped in a solution of JS dissolved at a concentration of 0.5% (wt/wt) in EtOH. Subjects' psychological states were evaluated by the Affect Grid (14), designed as a quick means of assessing affect along the 2-dimensions of pleasant feelings–displeasant feelings and arousal–sleepiness. For each dimension, the subjects evaluated and answered on a 9-point scale both before and after smelling the scent.

2.3.2 Testing the effects of Jasmine Sambac scent on the autonomic nervous system

The subjects were 8 healthy females in their 20s (Test No. C00383). JS was dissolved at 0.25% (wt/wt) in TEC as the test sample. For stimulation, 5μl of the solution was applied to a piece of cotton (8 x 8 mm) and the cotton piece was fitted under subject's nose to sniff the scent during quiet breathing. Subjects were seated in a reclining seat in a temperature and humidity-controlled room (25°C, 50%) and kept in a resting state for 30 min before measurements began. The exposure sequence was: 3 min rest, 3 min control, 3 min rest, 3 min scent, 3 min rest, 3 min control, 3 min rest.

Average values from the control conditions were compared to those during the scent condition. Changes in arterial blood pressure were analyzed with an autonomic nerve activity analysis system (FLUCLET WT, Dainippon-sumitomo Pharmaceutical, Japan), which analyzes blood pressure fluctuations by using wavelet transform processing, and the low frequency amplitude (LF, range: 0.04-0.15 Hz) of systolic bloodpressure (SBP-LF amplitude) was calculated as an index of sympathetic activity (1). The effect of scent on autonomic nervous activity was assessed by comparing the middle 2 min scent average of the LF to those of control.

2.3.3 Testing the effects of Jasmine Sambac scent on the skin blood flow

The subjects were 7 healthy females in their 20s (Test No. C00383). The sequence and samples were the same as those described in 2.3.2. Skin blood flow was continuously measured while subject was sniffing the scent or control. To measure skin blood flow, a laser-Doppler skin blood flowmeter probe (ALF21, Advance, Japan) was fitted on the interior side of the left middle finger and continuously recorded at 1 sec intervals. The effect of test sample on skin blood flow was assessed by comparing the 3 min average of skin blood flow to that of control.

2.3.4 Testing the effects of Jasmine Sambac scent on the skin temperature

The subjects were 10 healthy females in their 20s (Test No. C00383). The sequence and samples were the same as those described in 2.3.2. Skin temperature was continuously measured while the subject smelled the scent or control. Skin thermometer sensors (NT Logger N542R, Nikkiso-Thermo, Japan) were fitted on the interior side of the middle finger and chest to measure skin surface temperatures continuously at 1 sec intervals. The skin temperature change of the finger was calculated based on chest skin temperature at 5 sec intervals, because chest skin temperature is fairly consistent over time. The effect of test sample on skin temperatures was assessed by comparing the 3 min average of the amount of change to that of the control.

2.3.5 Testing the effects of Jasmin sambac scent for skin viscoelasticity

The subjects in this experiment were 19 healthy females aged between 20 and 49 (Test No. C10406). The test sample was dissolved at 0.5% (wt/wt) in TEC. For stimulation, 5μl of the solution was applied to a piece of absorbent smelling strip (4 x 15 mm) and was set near subject's nose to sniff the scent during quiet breathing. After face cleansing, the subjects remained in a supine position in a temperature and humidity-controlled room (25°C, 50%). The testing began 30 min after cleansing. After 2 min of baseline, a scent sample was presented for 3 min, followed by cooling cheek with ice pack for 5 min. After removing the ice pack, the subjects remained at rest for 6 min.

The viscoelasticity of the left cheek was measured using a Cutometer (Cutometer dual MPA-580 Skin Elasticity Meter®, Courage & Khazaka Electronic GmbH, Köln, Germany) with a suction hole diameter of 2 mm and a suction pressure set at 400 mbar. For the Cutometer measurement, a constant load was applied for 2 sec, followed by a 2 sec release period. Skin viscoelasticity was defined using the recovery ratio of retraction (Ur) to maximal skin deformation at the end of the suction period (Uf), represented as Ur/Uf (R7). The percentage change in skin viscoelasticity relative to baseline was calculated for statistical testing.

2.4 Long-term test

The purpose of the long-term test was to investigate the sustained effects of continuous use and the impact on other parameters for which changes occur over a longer period of time.

2.4.1 Testing the long-term effects of Jasmin sambac scent for mind, body and skin

The subjects in this experiment were 31 healthy females aged between 20 and 49 (Test No. B10555). The subjects were provided with three types of products for continuous use: a room spray, aroma stickers (2 cm diameter, round stickers made with non-woven fabric and PET layers designed to absorb and release aromatic samples, Aglaia-medicalaroma, Osaka, Japan), and a night-time room fragrance.

All test samples contained a concentration of 0.5% JS. In the room spray, which can be used by pushing the spray 2-3 times as desired, JS was dilluted in ethanol. The aroma sticker was soaked with a mixture of DPG and ethanol (2:8) for daytime use. Similarly, cotton soaked in the aroma essence (in the same DPG and ethanol mixture), was placed at bedside during the night. The no scent sample consisted only of the solvent.

The subjects were instructed not to use any strong-scented products, such as fragrance products, for two weeks prior to the start of the study. Additionally, they were asked not to use any new cosmetics or toiletry products during the study period. The subjects were divided into two groups ensuring an equal number of participants from each age group. The first group used the samples in the order of scent and no scent, while the second group used them in the order of no scent and scent, to avoid any order effects (Figure 2).

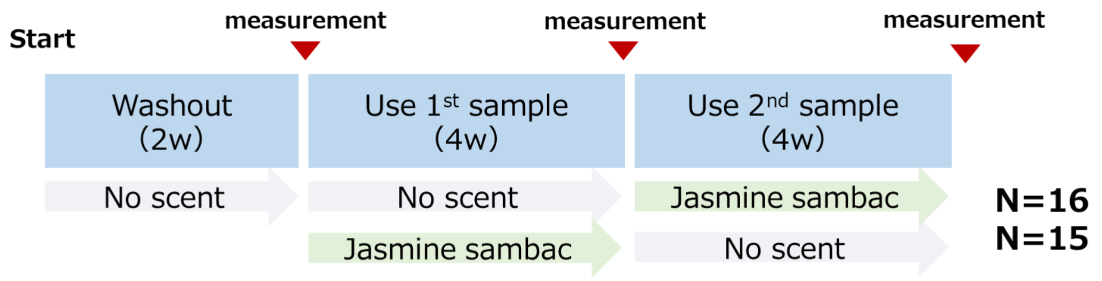

Figure 2. Sequence of associated experimental event for long-term test.

Measurements were taken after the washout period, as well as at 4 weeks and 8 weeks. The values obtained before a phase were used as the baseline for the measurements taken after that phase. The subjects washed their left inner forearms and then underwent a 20 min acclimatization period in a temperature and humidity-controlled room (20°C, 50%). During this period, salivary redox potential (Oxidation & Reduction device, ARAGENKI LL-001, Live and Love, Japan) was measured and the POMS2 (Profile of Mood States, 2nd Edition) short version questionnaire was completed (15). POMS2 includes a series of self-report items that evaluate different aspects of mood such as tension, depression, fatigue, confusion, and vigor. After this, measurements were taken for skin viscoelasticity (as per the single-test) on the inner forearm. The percentage change in ORP, POMS2 and skin viscoelasticity relative to before sample usage were calculated for statistical testing.

2.5 Statistical analysis

All data are expressed as the mean with standard deviation or percentage change relative to baseline or before use, and were analyzed using the following statistical tests as appropriate:

Paired *t*-test, Wilcoxon signed-rank test and one-sample Wilcoxon signed-rank test with JASP 0.19.3. $p < 0.05$ was considered significant.

3. Results

3.1. The scent of Jasmine Sambac had a psychologically relaxing effect

To examine the effect of JS scent on the mind, the psychological state before and after smelling the scent was assessed using the Affect Grid (Figure 3) and the change assessed by a paired *t*-test. The results showed that the scent of JS significantly increased Pleasant feelings score ($t(41) = 6.77$, $p < .001$) and significantly decreased Arousal score ($t(41) = 3.03$, $p = .004$), indicating that JS scent has a relaxing effect.

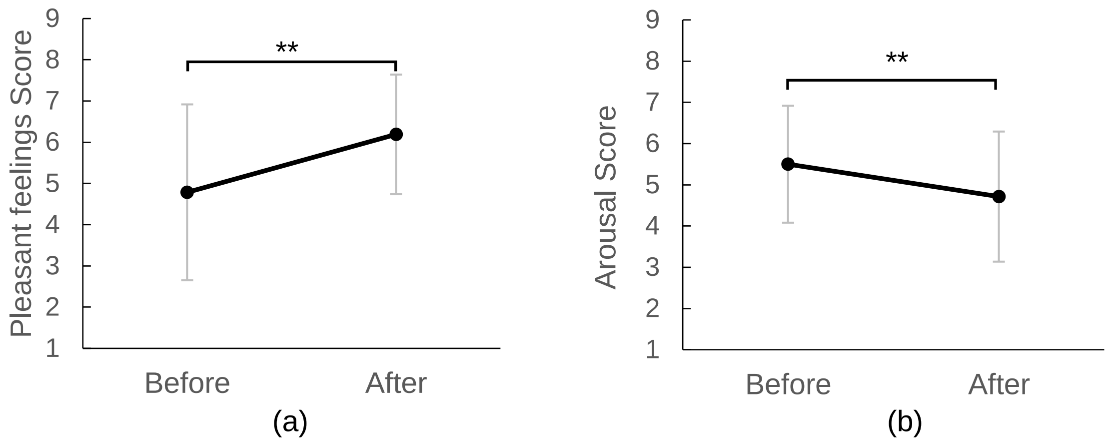

Figure 3. The Psychological Effects of JS scent from Affect Grid. (a) shows the Pleasant feelings scores before and after exposure to the JS scent, while (b) presents the Arousal scores for the same conditions. Data are mean ± S.D. A paired *t*-test was conducted, and $p < 0.05$ was considered significant (** indicates $p < 0.01$).

3.2. The scent of Jasmine Sambac has a suppressive effect on the sympathetic nervous system

Next, we examined changes in sympathetic nervous activity under conditions with and without the scent (Figure 4). Results from a paired *t*-test indicated that the JS scent significantly inhibited sympathetic nervous activity ($t(7) = 2.77$, $p = .028$).

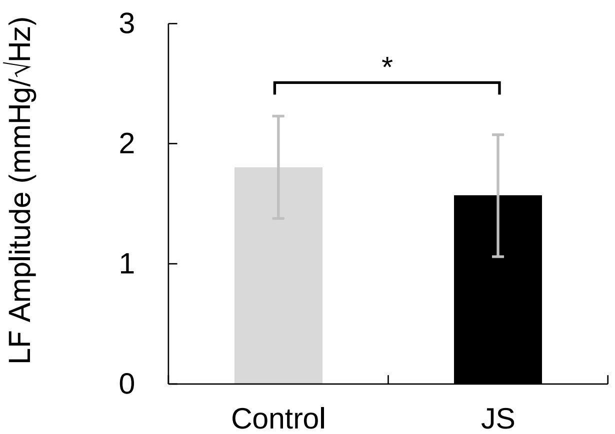

Figure 4. The sympathetic activity induced by JS scent. Data are mean ± S.D. A paired *t*-test was conducted, and $p < 0.05$ was considered significant (* indicates $p < 0.05$).

3.3 The scent of JS increased skin blood flow and skin temperature.

Next, the effect of the scent on skin blood flow and skin temperature were examined (Figure 5). Results from a paired *t*-test indicated that inhaling the scent of JS statistically significantly increased skin blood flow of finger compared to the control condition ($t(6) = 2.60$, $p = .041$). We also found that JS scent significantly increased skin temperature ($t(9) = 3.15$, $p = .012$).

The result indicates that JS scent has an effect on enhancing skin blood flow and skin temperature, which is consistent with the known relationship between these skin properties and the sympathe tic nervous system.

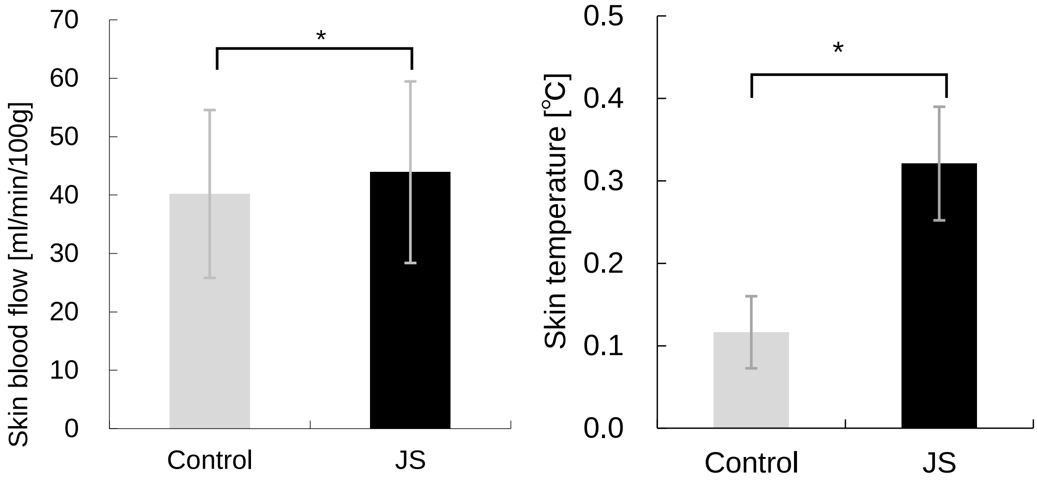

Figure 5. The mean effect of JS scent for skin blood flow and skin temperature of the finger. (a) shows the skin blood flow of Control and JS conditions, (b) shows the difference between the skin temperature of the fingers and the chest. Data are mean ± S.D. A paired *t*-test was conducted, and $p < 0.05$ was considered significant (* indicates $p < 0.05$).

3.5 The scent of Jasmine Sambac had an immediate effect on skin viscoelasticity

Having found that the scent of JS has an effect on the autonomic nervous system, skin blood flow, and skin temperature, we next examined the effects of the scent on the skin. Based on the hypothesis that increased skin blood flow enhances skin viscoelasticity, we investigated the improvement of skin viscoelasticity by JS scent. The effect on skin viscoelasticity was evaluated based on the recovery from a cooled state of the cheek.

The skin viscoelasticity index R7 indicated that the control did not significantly deviate from baseline, whereas the scent condition exhibited higher values (Figure 6). To verify whether the values during the resting phase differed significantly from the baseline, a one-sample Wilcoxon signed-rank test against the baseline (= 0) with Bonferroni correction was conducted. In the control group, no significant difference was observed immediately after cooling ($W = 66$, $p = .26$), and similarly, no significant difference was found during the rest period ($W = 78$, $p = .51$). Conversely, in the JS group, while no significant difference was observed immediately after cooling ($W = 116$, $p = .42$), a significant difference was noted during the rest period ($W = 159$, $p = .02$). This suggests that inhaling the scent of JS enhances cheek skin viscoelasticity after cooling.

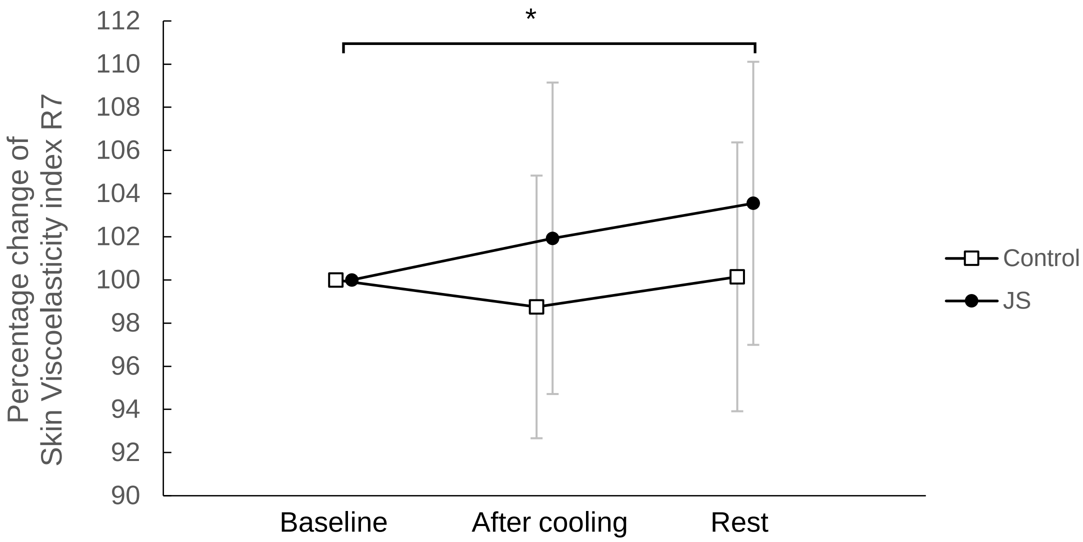

Figure 6. The effect of JS on skin viscoelasticity R7 during baseline, after cooling and rest. The percentage change relative to baseline for R7 is presented. Data are mean ± S.D. A one-sample Wilcoxon signed-rank test against the baseline (=0) with Bonferroni correction was conducted, and $p < 0.05$ was considered significant (* indicates $p < 0.05$).

3.6 The long-term use of Jasmine sambac scent improved balance redox potential and skin viscoelasticity

Given that the observed single-use effects of the JS scent on mind, body and skin conditions, we also investigated the effects due to long-term use. We anticipated potential benefits to the body, so in addition to measuring skin viscoelasticity, which showed effects in the single-use trial, we also assessed salivary oxidation reduction potential (ORP). Considering the effects of sun exposure, the long-term usage test was initiated during winter, and skin measurements were conducted on the inner forearm.

In the long-term test, no significant effects were observed in the POMS2 results.

The ORP results are shown in Figure 7. A Wilcoxon signed-rank test was conducted to compare the ORP values after the sample usage between the Control and JS conditions. The results indicated a significant difference ($Z = 2.16$, $p = .030$), suggesting that the ORP values in the Control condition were significantly higher than those in the JS condition after the usage of the sample. The skin viscoelasticity results are presented in Figure 8. A paired *t*-test was conducted to compare the R7 values after the sample usage between the Control and JS conditions. The results indicated a significant difference ($t(30) = 2.26$, $p = .032$), suggesting that the R7 in the JS condition were significantly higher than those in the Control after the usage of the sample.

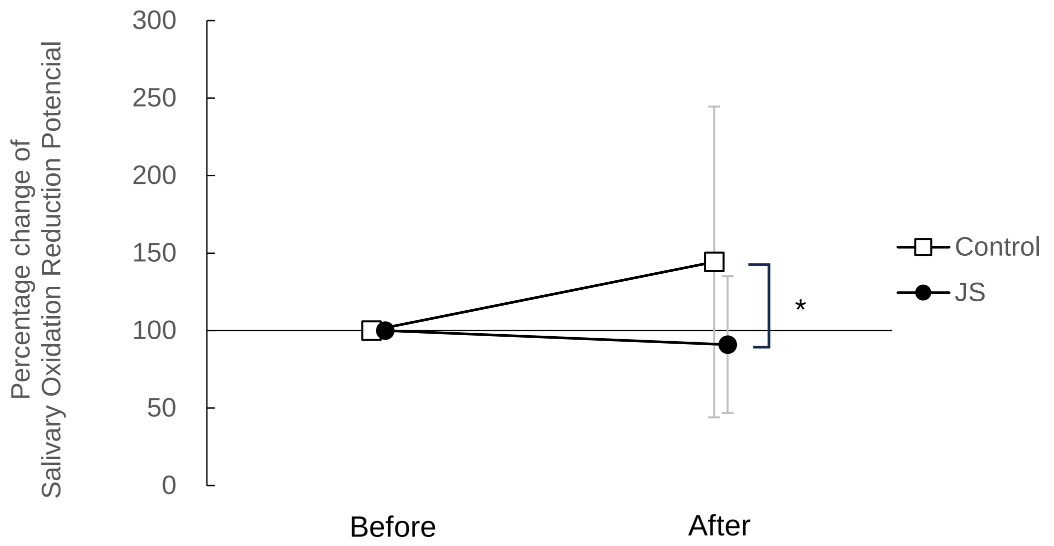

Figure 7. Salivary oxidation-reduction potential. Data are mean ± S.D. A Wilcoxon signed-rank test was conducted, and $p < 0.05$ was considered significant (* indicates $p < 0.05$). The data were normalized by calculating the percentage change.

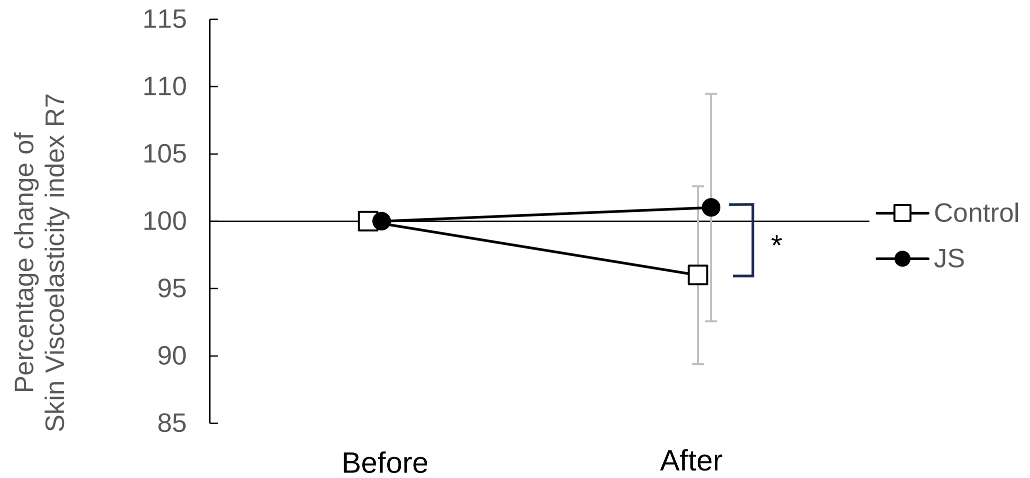

Figure 8. Skin viscoelasticity index R7. Data are mean ± S.D. A paired *t*-test was conducted, and $p < 0.05$ was considered significant (* indicates $p < 0.05$). The data were normalized by calculating the percentage change.

4. Discussion

This study investigated the effects of inhaling JS scent on the mind, body, and skin with both single-use and long-term use. The results from the single-use tests indicated that the JS scent promotes relaxation and suppresses sympathetic nervous activity. It increased skin blood flow and temperature and importantly increased skin viscoelasticity. Moreover, the long-term tests demonstrated that continuous inhalation of JS scent resulted in higher skin viscoelasticity and lower ORP values compared to the Control condition.

A single use of JS scent resulted in increased skin viscoelasticity, observed under cooling conditions. This is likely due to the observed increased skin blood flow and temperature (12) caused by vasodilation due to the decrease in sympathetic nervous activity (11). This decrease in sympathetic nervous activity may result from the observed psychological relaxation effect of JS (16).

In the long-term test, the change in skin viscoelasticity was found to be significantly higher in the JS condition compared to the Control. This suggests that JS scent may have at least a preventive effect against the decline in viscoelasticity often observed in the challenging environmental conditions of winter. Importantly, the measurement of skin viscoelasticity was made at a time when the participants were not smelling JS, indicating that a lasting effect has occurred. As sympathetic nervous system activation is associated with increased oxidative stress (17), the reduction in the latter we observed indicate that experience of the relaxing effects of JS over a prolonged period reduces sympathetic nervous activity which in turn may enhance blood flow. The skin viscoelasticity benefit we observed may be due to the cumulative impact of the scent's enhancement of blood flow. Moreover, oxidative stress is a key factor in skin aging and overall health (13,18) and its reduction by long term JS highlights benefits beyond relaxation and skin health.

Although we found a relaxing effect with a single use, no significant changes were observed following the long-term test. This may be because the effects of the scent were overshadowed by daily stressors, making them less noticeable to the subjects. If so, employing a more sensitive measure of emotional state and increasing the sample size may reveal a long-term psychological benefit. Although further research is needed to more deeply understand the mechanisms by which JS benefits the skin as well as how to optimize its usage, our research underscores the significant impact of JS scent on overall wellness.

Embracing the holistic benefits of scent opens doors to more unique wellness solutions, such as skincare through just inhaling scents without application. This approach not only promotes relaxation and enhances skin health but also celebrates the intricate connection between mind, body, and skin. Expanding the potential of scents allows individuals to wear them not only to express their true selves but also to benefit their skin and body. This innovative approach to beauty and wellness promises to redefine how we perceive and utilize scents, paving the way for a more holistic and personalized experience.

5. Conclusion

The study results indicate that the scent of JS offers immediate relaxation effects, influences the autonomic nervous system, enhances blood flow and temperature, and improves skin viscoelasticity. Prolonged use also resulted in ameliorations of skin viscoelasticity and oxidative stress. These findings suggest that inhaling JS scent holistically benefits the mind, body, and skin, presenting a novel approach to beauty wellness. This innovative wellness care through scent can create new market opportunities and engage consumers, while exploring other scents may address a wider range of mind, body and skin concerns.

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