



## **A Preliminary Investigation of How Lavender Essential Oil May Reduce Stress of High School Students during Class**

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### **Dear Editor-in-Chief**

Chronic stress is a critical risk factor in mental and physical health, in areas such as depression, high blood pressure, obesity, anxiety, and sleep (1). High school in Korea is very stressful because the system focuses on the importance of achieving high grades and entrance examinations (2). Having a system that could recognize students stress through gesture analysis could help early detection for educators and mental health practitioners to identify students that may need an intervention.

Various essential oils can affect psychological states, reducing stress and feelings of anxiety (3). Bergamot essential oil used in elementary school has been reported to positively effect the autonomic nervous system of teachers (4). Additionally, in university a mixture of lavender and rosemary is reported to reduce feelings of anxiety and improve cognitive performance of students (5).

Knowing that aromas alter mood, reduce stress and increase cognitive performance, the aim of this study was to investigate the behavior of high

school students participating in class with and without aroma.

After approval from the University's Institutional Review Board, the local high school principle and vice-principle agreed to participate. The study was conducted at high school, Seoul, Korea in 2018. Out of the class of 15 students, 4 students were recruited to participate in this pilot study, during social studies class. Four cameras recorded the two 90 minutes' classes (full HD at 100 Hz). On Day 1, their blood pressure and heart rate were recorded 10 min after the students' arrival, and after class. On Day 2, one week later, the same procedure was adopted (same subject and same teacher), however, with the addition of a lavender essential oil filled necklace. The students wore the lavender essential oil filled necklace (Table 1). All behavior was coded using NEUROGES ELAN Module I (Table 2) (5).

Data were analyzed by SPSS (Chicago, IL, USA) (version 23.0) and a general linear model with repeated measures ANOVA was performed with a focus on the Test of Within-Subjects Effects, with a significance level of <0.10.



**Table 1:** Groups blood pressure and heart rate before and after class with and without aroma

| <i>Groups</i> | <i>Systolic (mm/Hg)</i> |           | <i>Diastolic (mm/Hg)</i> |          | <i>Heart Rate (bpm)</i> |          |
|---------------|-------------------------|-----------|--------------------------|----------|-------------------------|----------|
|               | Before                  | After     | Before                   | After    | Before                  | After    |
| Control       | 116.5±6.6               | 107.2±5.9 | 71±2.2                   | 66.2±6.1 | 84.2±6.7                | 74.7±7.8 |
| Aroma         | 119.2±4.7               | 113.2±4.7 | 71±9.3                   | 71.5±9.1 | 87.7±14.4               | 75.2±6.7 |

Results of the statistical analysis for the systolic blood pressure ( $F(1, 6) = 10.01, P < 0.05$ ) and heart rate ( $F(1, 6) = 6.80, P < 0.05$ ) between the

aroma and control condition revealed statistically significant differences.

**Table 2:** Results of NEUORGES Module I

| <i>Variable</i>                 | <i>Control (Mean± S.D.)</i> | <i>Aroma (Mean± S.D.)</i> |
|---------------------------------|-----------------------------|---------------------------|
| Irregular on body               | 0.19±0.14                   | .23±0.14                  |
| Irregular on attached object    | .65±0.22                    | .53±0.22                  |
| Irregular on separate object    | .05±0.02                    | .00±0.02                  |
| Phasic within body              | .02±0.01                    | .01±0.01                  |
| Phasic on body                  | .43±0.18                    | .52±0.18                  |
| Phasic on attached object       | .80±0.19                    | .61±0.19                  |
| Phasic on separate object       | 1.19±0.32                   | 1.30±0.32                 |
| Phasic in space**               | .04±0.04                    | .15±0.04                  |
| Repetitive on body              | .29±0.08                    | .28±0.08                  |
| Repetitive on attached object** | .09±0.03                    | .25±0.03                  |
| Repetitive on separate object   | .13±0.03                    | .10±0.03                  |
| Repetitive in space             | .03±0.04                    | .07±0.04                  |

Between the aroma and control condition there were significant statistical differences shown for the phasic in space ( $F(1,6) = 4.31, P < 0.10$ ) and repetitive on attached object ( $F(1,6) = 15.19, P < 0.001$ )

The NEUROGES system provides an objective and reliable analysis of hand movement behavior independently of speech (6). This preliminary study highlighted a relatively low frequency of hand movements of the four test participants. The repetitive on attached object movement variable showed statistically significant results. The results showed an increase of hand movements, which can be linked to the participant using hand movements to self-regulate to reduce stress. Furthermore, the irregular on body (0.19 & 0.23) was larger than phasic in space (0.04 & 0.15), therefore the participant is assumed to be self-regulating to reduce stress. Physiological data

showed statistically significant decrease in the systolic blood pressure and the heart rate, similar to that recorded in other studies (4, 7).

In conclusion, high school students hand gesture data showed statistically significant increases in phasic space movement and repetition on attached object, which shows the possibility that aroma may have on helping students self-regulate and reducing stress. Statistical differences in the physiological data also indicated that exposure to Lavender essential oil positively affected the participant's parasympathetic system, which is shown to improve the cognitive performance because of stress reduction. Future studies should include more participants, different age groups, genders and class content.

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## Conflict of interest

The authors declare that there is no conflict of interest.

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