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File: ■ Bergamot (*Citrus bergamia*, Rutaceae)
■ Cortisol Levels
■ Stress and Anxiety

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RE: Bergamot Essential Oil Aromatherapy Calms the Autonomic Nervous System and Increases Vigor in Female College Students

Watanabe E, Kuchta K, Kimura M, Rauwald HW, Kamei T, Imanishi J. Effects of bergamot (*Citrus bergamia* (Risso) Wright & Arn.) [*sic*] essential oil aromatherapy on mood states, parasympathetic nervous system activity, and salivary cortisol levels in 41 healthy females. *Forsch Komplementmed*. 2015;22(1):43-49.

Bergamot (*Citrus bergamia*, Rutaceae) fruit essential oil aromatherapy is used to reduce stress and anxiety. Studies in animals demonstrate its efficacy; however, human trials are sparse. Cortisol levels and heart rate are reduced when stress is reduced. The purpose of this randomized, crossover study was to evaluate the effect of bergamot essential oil on cortisol levels, heart rate, and emotional state.

Healthy female undergraduate and graduate students (n = 41; aged 20-23 years, with an average age of 21.3 ± 1.02 years) participated in this study conducted in Japan. [Note: It is unclear what university the students attended.] Specific inclusion/exclusion criteria were not reported. There were 3 treatment conditions, and every subject received all 3 treatment conditions 1 time in a randomized order. The 3 treatment conditions were as follows: (1) 15 minutes rest upright in the test room (R); (2) 15 minutes rest + 400 mL water vapor diffused into the air for 15 minutes (RW); and (3) 15 minutes rest + 400 mL water vapor combined with 400 µL bergamot essential oil (Laboratoire Sanoflore; Renens, Switzerland) aromatherapy for 15 minutes (RWB). In an effort to eliminate sequence effects, subjects were divided into 6 groups so that every group could perform 1 of the 6 possible permutations of the 3 setups. The RWB, R, RW permutation had 1 less member (6 vs. 7). The study was conducted with 1 group per day at the same time and under identical measuring conditions for all parameters. Test subjects were advised not to eat anything from 1 hour before the start of the experiment.

Before testing began, each subject took a 15-minute rest. During each treatment session, heart rate spectral analysis was used to evaluate parasympathetic nervous system activity and sympathetic nervous system activity. Each treatment session was followed by 2 minutes used for collecting saliva samples, 10 minutes for rest and continued recording of heart rate, and 10 minutes for filling out questionnaires. The questionnaires were the Profile of Mood States (POMS), Total Mood Disturbance (TMD), State-Trait Anxiety Inventory (STAI), and Fatigue Self-Check List. The entire study lasted 3 hours for each subject.

In regard to salivary cortisol levels, regardless of the sequence of treatment conditions, salivary cortisol was highest during R, decreased following RW, and was lowest following RWB. There was a significant difference in salivary cortisol between R and RW ($P = 0.049$) and between R and RWB ($P = 0.004$). However, there was no significant difference in salivary cortisol between RW and RWB.

In regard to parasympathetic nervous system activity, there were no significant differences among groups during the treatment. However, during the 10 minutes of rest between the salivary collection and the questionnaire period, parasympathetic nervous system activity was significantly higher in the RWB group compared with the RW group ($P = 0.026$). In regard to sympathetic nervous system activity, there were no significant differences among groups during the treatment. However, during the 10 minutes of rest between the salivary collection and the questionnaire period, sympathetic nervous system activity was significantly lower in the RWB group compared with the R group ($P = 0.048$).

In regard to the POMS mood questionnaire, various subscales showed significant differences between R and RW or RWB; however, only the subscale of "vigor" showed a significant increase from RW to RWB ($P = 0.049$), as well as from R to RWB ($P \leq 0.001$), though it should be noted there was also a significant increase from R to RW ($P = 0.001$). In regard to STAI and Fatigue Self-Check, the average values were lower for RWB than for RW or R, but there were no significant differences between RW and RWB. No side effects were reported.

The authors conclude that bergamot essential oil had an influence on the whole autonomic nervous system and can be used to reduce stress. Also, they conclude that vigor could be significantly increased by the pharmacological action of the bergamot essential oil compared to water vapor alone. The authors hypothesize that the findings could be more robust if the analyses were conducted at different intervals and for longer durations. For example, they hypothesize that the effects on the nervous system happened during the rest phase instead of during the treatment phase because it took a longer time for physiological effects to occur than they projected. In particular, there could be a lag time for the oil components to be transported into the lung alveoli, then pass into the blood, and then be transported into the brain before producing a physiological effect. Also, individual differences in respiration could have affected the findings. Limitations of the study include an all-female, relatively young, student population, which could have different types of stress than other populations; lack of a placebo control with an odor; and lack of inclusion/exclusion criteria. A strength of the study was the well-designed statistics. Despite the numerous analyses, care was taken to prevent bias in data reporting. Nonetheless, these results should be viewed as preliminary until the study can be repeated with different treatment/analysis durations.

—Heather S. Oliff, PhD

Referenced article can be accessed at http://www.karger.com/Article/FullText/380989.