

Pseudoscience and Psychotherapy

**STRESS MANAGEMENT:
AROMATHERAPY AS AN ALTERNATIVE**

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Abstract. The consequences of a stressful lifestyle include myriad symptoms from depression to decreased function of the immune system. In the past, researchers have focused on the efficacy of traditional psychotherapy techniques in reducing the signs of stress. However, these techniques usually require trained individuals to facilitate the programs, participants must do a lot of work on their own, and it may take a long time to produce results. Because of the inconvenience and cost of these techniques, many have turned to alternative methods for stress reduction. The present study examined the efficacy of one of these alternatives, namely aromatherapy, in reducing psychological and physiological responses to an acute stress situation. Participants were randomly assigned to 1 of 4 conditions based on whether they were aware of the aromatherapy or whether they got the treatment. All groups were exposed to a short, 12-minute mental arithmetic task in which their performance was monitored. State anxiety and cardiovascular responses were recorded as well. No group differences in either perceived stress or the physiological responses to the task were recorded. Conversely, correlations displayed that one's knowledge of alternative medicine was highly related with one's physiological responses to stress. This study therefore suggests that although aromatherapy by

itself may not be the most effective treatment in reducing acute stress, one's knowledge of the procedure may relate to how one responds.

INTRODUCTION

ACUTE STRESSORS, SUCH AS DAILY HASSLES AND tasks, are commonplace. It has been theorized that individuals who are exposed to a large number of acute stressors on a daily basis are more at risk for the lasting detrimental outcomes associated with stress.¹ Thus, identifying methods that reduce the effects of stress has been the focus of much research. Traditional stress-management programs have included a wide variety of techniques including skills training, coping exercises, and behavioral modification.² These programs are generally expensive, take several sessions, and are not accessible to all individuals. Therefore, identifying methods that are easily applied, easily learned, convenient, and inexpensive may help to increase utilization of stress management.

Aromatherapy is the medical use of pure essential oils that are extracted from plants. A pure essential oil is the "soul" of the plant and is where the vital energy of the plant is stored. It has been shown that these oils help protect the plants from diseases and parasites. Different oils are believed to have different therapeutic properties because of their varying chemical compositions.³

In the past few years, so-called alternative medicines, including aromatherapy, have gained in popularity. The

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practice of aromatherapy has been applied in medical settings as an alternative to traditional drugs, used in combination with massage for its relaxation properties, and employed for its psychological benefits. The problem with these “alternative” methods is that there is very little empirical evidence to suggest the claims made about their effectiveness as therapies. Because of this, most insurance companies will not reimburse clients for their use and most physicians will not recommend these techniques.⁴

Very few studies have been done to test the efficacy of aromatic extracts as anti-stress agents. Of those studies, most have focused on medical recovery and are often paired with massage therapy. One such study monitored recovery rates in patients who had just undergone cardiac surgery. The patients were randomly assigned into groups based on the type of oils they received (placebo versus scented) and whether they received massage. Although no differences were found in recovery time, significant differences in the psychological state of the patients were observed. Those patients that received the aromatherapy treatment showed greater psychological improvements than individuals who did not receive aromatherapy.⁵ Similarly, another study that examined patients in the intensive care unit found that patients who received lavender essences had lower levels of anxiety and greater improvement in mood than those who did not receive the therapy.⁴

The oil chosen for this study is extract of lavender. Lavender is renowned for its diverse uses but particularly its psychological effects as an anti-stress remedy for moods of impatience, irritability, and panic.³ The goal of the present study is to empirically test the efficacy of lavender in reducing psychological and physiological responses to acute stress and to observe whether performance on a task is enhanced by the technique. In addition, the relationship between health behavior, beliefs, and responses to stress were studied.

METHODS

Participants

Eighty undergraduate students (20 in each group) at the University of San Diego over the age of 18 were selected to participate in the current study from a prescreened pool of 120 students. Participants were recruited via advertisements in the university paper and through class announcements. Incentives for participation included four \$50.00 prizes and extra credit or course credit in

some cases. Participants were randomly assigned to one of four groups:

- Group 1: told they would receive aromatherapy and received the therapy while doing the task; experimental group
- Group 2: told they would receive aromatherapy but did not receive it; the purpose of this group was to test for any placebo effect
- Group 3: not told anything about aromatherapy but received the treatment; the purpose of this group was to test whether aromatherapy works even if the person is unaware of receiving the therapy
- Group 4: not told anything about aromatherapy and did not receive treatment during task; control group

Because of technical errors, missed experimental sessions, and missing data 18 people were dropped from the final analysis leaving N=62 (51 females and 11 males). Group 1 contained 17 participants; group 2, 15; group 3, 18; and group 4, 12.

Materials

Background questionnaire. The purpose of this questionnaire was to gather background information about the participant and to help exclude anyone from participation. Exclusion criteria included those under 18; those reporting use of any sort of medication that may alter physiological states; those with heart problems or high blood pressure; and those who suffer from allergies, hay fever, and asthma.

Autonomic Perception Questionnaire (APQ). This 30-item questionnaire was developed by Mandler et al.⁶ to measure the frequency and intensity of autonomic self-perceptions. The questions ask participants to describe their states of feelings and reactions when (a) in a state of anxiety and apprehension and (b) in a state of pleasure. The scale is based on a 0 to 10 scale, with higher scores representing more awareness and preoccupation.

Perceived Stress Scale (PSS). This questionnaire was developed by Cohen, Kamarck, and Mermelstein⁷ to measure the degree to which situations in one's life are appraised as stressful. The measure allowed us to control for stress levels prior to the initiation of the task. A higher score represents more perceived stress.

Spielberger State Anxiety Questionnaire (Shorter version; Marteau and Bekker⁸). This questionnaire is a modification of the original 20-question state anxiety measure developed by Spielberger⁹ to measure the level of perceived anxiety a person is experiencing at a given point in time. This version contains 6 questions on a 1-to-4 scale; the higher the score, the higher the anxiety.

Math Anxiety Scale (MA). The 40-item questionnaire developed by Richardson and Woolfolk¹⁰ is a measure of mathematics anxiety. This questionnaire was used as a control measure to make sure the groups do not differ in their anxiety toward doing mathematics tasks. The scale for the measure was 1 to 5; a higher score represented more anxiety.

Alternative Medicine Knowledge and Attitude (AMKA). This questionnaire developed by the present investigators focuses on the knowledge of alternative medicine and its uses and effects as well as the beliefs in aromatherapy and other alternative techniques. The questionnaire was divided into three sections: (1) a 10-item list of herbs in which respondents were to describe what their medical uses were; (2) a checklist of various alternative medical practices in which respondents were to circle those that applied to them and explain what they used the technique for; and (3) 5 questions on their attitudes toward alternative medicine and practitioners, including a question specifically asking them their attitude toward aromatherapy (question #14).

Health Locus of Control (HLC). This 21-item questionnaire developed by Lau¹¹ has 4 subscales concerning self-control over health, provider control over health, chance health outcomes, and general threat.

Math Efficacy Scale (ME). This 34-item questionnaire measures an individual's belief in his or her abilities in mathematics and related topics. This measure was included to make sure the groups do not differ in their perceived abilities to complete the math task.

Task Rating Scale. The participants were asked to rate the task at the end of the session on three levels: R1: how well they did on the task (1=very well to 5=very poor); R2: how difficult the task was (1=very easy to 5=very difficult); R3: how physically aroused they felt during the task (1=not at all to 5=very aroused).

Automated Blood Pressure Monitor. All systolic and diastolic blood pressure readings as well as heart rate were collected using an automatically inflating sphygmomanometer cuff (Dinamap model 1846SX, Critikon) attached to the left arm of the participant.

Procedure

Prescreening. Approximately 250 questionnaire packets were distributed to interested individuals and returned to the faculty researcher directly within 3 weeks of distribution. This prescreening enabled the researcher to screen out individuals who were at risk for participation in the present study and included the background questionnaire, APQ, PSS, and MA. Consent forms were also included in the packets.

One hundred twenty packets were returned by the deadline date. Individuals who met the exclusion criteria on the background information questionnaire (N=80) were called back by the researcher for their individual experimental sessions and randomly assigned to their groups.

Experimental Session. During the experimental session, participants were given a brief description of the procedure and informed that only the top 4 performers on the math tasks would receive the \$50.00 cash reward. This deception was necessary to increase the desire to perform well on the tasks given and increase the level of competition (during the debriefing, the participants were told that a lottery would be held instead and that everyone had an equal chance of being selected for the money).

Each participant was given three separate sheets with different odors on each (one was water, one mint, and one lavender). The participants were asked to describe the smell of each verbally and the intensity of the smell from a scale of 1 to 5 (no smell to very potent). This test was included to make sure that all participants were capable of smelling the aromas that may have been presented. No one was excluded from the study for inability to identify the odors presented.

An automated blood pressure cuff was placed on the left arm for a 10-minute baseline in which heart rate and blood pressure readings were taken every 2 minutes. The experimenter, seated in an adjoining room, was not present while the participants were filling out the questionnaires or during the task. The participants were monitored on a television screen and an intercom system was used to give the instructions.

Aromatic oils were infused for groups 1 and 3 at this point. The aromatherapy was initiated using humidifiers with water and drops of lavender oil. Group 2 had regular water in the humidifier and group 4 had no humidifier. After each use, the humidifier and filter were cleaned according to the manufacturer's instructions to avoid carryover of the aroma. In addition, only one participant was scheduled in the lab per day to allow time

TABLE 1

Mean \pm Standard Error of Mean (SEM) for Demographic and Questionnaire Measures per Group

	Group 1 (N = 17)	Group 2 (N = 15)	Group 3 (N = 18)	Group 4 (N = 12)
Gender	13F/4 M	13F/2 M	15F/3M	9F/3M
Race	12C/4 Other	10 C/ 5 Other	11 C/7 Other	10 C/ 2 Other
MA	93.23 \pm 5.72	80.40 \pm 5.16	92.52 \pm 4.89	86.77 \pm 3.32
ME	5.47 \pm .33	6.22 \pm .33	5.61 \pm .33	5.78 \pm .33
MRS	5.20 \pm .41	6.15 \pm .39	5.49 \pm .45	5.62 \pm .45
MTS	5.73 \pm .33	6.30 \pm .31	5.70 \pm .28	5.93 \pm .34
APQ Happy	7.02 \pm .34	6.18 \pm .40	6.65 \pm .35	6.42 \pm .49
APQ Anxiety	4.98 \pm .43	4.64 \pm .31	4.40 \pm .24	4.36 \pm .24
PSS	23.53 \pm 2.41	23.73 \pm 2.31	28.29 \pm 1.48	23.08 \pm 1.29
PreSA*	9.70 \pm .64	8.87 \pm .50	11.41 \pm .69	9.0 \pm .90
PostSA	12.88 \pm .68	10.93 \pm .94	11.0 \pm .68	12.23 \pm .84
R1	3.0 \pm .21	2.80 \pm .28	2.62 \pm 0.18	2.84 \pm .27
R2	3.17 \pm .15	3.33 \pm .19	3.18 \pm .13	3.31 \pm .24
R3	2.88 \pm .27	2.87 \pm .27	2.65 \pm .29	3.23 \pm .30

F = Female

M = Male

C = Caucasian

* $p < 0.05$ using One-way ANOVA—Group 3 ahead highest score using Tukey HSD

for the odors to dissipate before the next participant was scheduled.

After the baseline, the pre-state anxiety (SA) questionnaire was given and the task was explained. The task consisted of a 12-minute mental arithmetic task in which the participants were given a number that they were to subtract from a three digit number (for example, subtract 7 from 394) or to add to it (for example, add 7 to 394). The participants were to respond aloud and to continue adding or subtracting until a new set of numbers was given, every 2 minutes. The task increased in difficulty with each set. The number of incorrect responses and total number of problems completed were recorded. Participants were corrected by the experimenter when they made a mistake and asked to continue. Heart rate and blood pressure were monitored every two minutes during each task. When completed, the participant was asked to rate the difficulty of the task and amount of arousal they felt as well as fill out the post-SA.

A 10-minute recovery period, in which readings were taken every 2 minutes, followed the last mental arithmetic task. Participants were asked to complete the following questionnaires during this time: AMKA, HLC, and ME.

At the end of the recovery period, participants were debriefed as to the purpose of the study and thanked for their participation. A drawing at the end of the study was held and the 4 \$50.00 prizes given to the winners.

RESULTS

Psychosocial variables

In general, our sample was made up of white females with average amounts of math anxiety, math self-efficacy, and perceived stress levels. All groups rated the math task as average difficulty and they perceived a fair to good performance on the task. Our sample also appeared to rate little arousal while performing the task. This suggests that the task may not have been as psychologically stressful as needed. Results from the APQ showed that the participants stated they were more aware of physiological changes during anxiety than compared with pleasurable times, further suggesting that the task was not stressful. Table 1 shows the average scores \pm standard errors of the mean for each questionnaire across groups.

Comparisons were made between groups in two stages: (1) comparing across all 4 groups using one-way analysis of variance and (2) combining data from aromatherapy groups (1 and 3) and groups that did not receive the therapy (2 and 4). No differences were found between the groups on any of the following characteristics: age, gender, race, level of physical activity, weight, height, physical symptoms, smoking, caffeine and alcohol consumption, life stressors, and year in school. Furthermore, no group differences were found between any of the questionnaires except the pre-state anxiety measure. As shown on table 1, group 3 had significantly higher levels of anxiety prior to the math task than compared with the other groups. Groups 1, 2, and 4 showed

TABLE 2

Mean \pm SEM for Cardiovascular Measures per Group

	Baseline	Change
Heart rate		
Group 1	70.90 \pm 2.61	+13.17 \pm 2.79
Group 2	71.37 \pm 2.66	+13.81 \pm 1.88
Group 3	73.71 \pm 2.65	+10.21 \pm 2.51
Group 4	73.08 \pm 3.89	+11.50 \pm 1.69
Systolic Blood Pressure		
Group 1	116.26 \pm 3.45	+12.98 \pm 1.98
Group 2	113.07 \pm 2.49	+15.89 \pm 1.71
Group 3	114.13 \pm 2.68	+11.91 \pm 2.54
Group 4	113.21 \pm 3.90	+14.01 \pm 2.51
Diastolic Blood Pressure		
Group 1	66.94 \pm 1.60	+9.30 \pm 1.29
Group 2	66.71 \pm 1.36	+8.22 \pm 1.05
Group 3	68.98 \pm 1.62	+7.27 \pm 1.36
Group 4	66.26 \pm 1.85	+10.25 \pm 1.13

a significant increase in state anxiety levels from pre- to post-measures. Group 3 actually went down. Finally, no group differences were seen for performance on the math tasks (calculated by the number of problems attempted and number of incorrect responses).

When groups 1 and 3 and 2 and 4 were combined, the same trends in the psychosocial data were observed.

Cardiovascular measures

No baseline differences were found on any of the variables across groups. The groups showed significant increases in cardiac levels from baseline to task across all measures, suggesting physiological arousal. Means are reported on table 2. Change scores were calculated by subtracting baseline scores from the average score during the task. Analysis showed no group or interaction effects.

As with the psychosocial variables, no differences in the data were observed when combining groups, suggesting no influence of aromatherapy on physiological responses.

Health measures

Since no differences were seen between the 4 groups, average scores were taken for the AMKA and HLC reported in table 3. Overall, students had little knowledge of use of alternative techniques, missing an average of 6 out of the 10 questions asked and reported using only 1 to 2 alternative techniques—mainly massage, aromatherapy, and chiropractors. Only 27.4% of the respondents correctly identified the use of lavender for stress reduction. Aloe was the number one recognized herbal treatment with 98.4% of the respondents getting

the correct answer. Additionally, 58.1% of the students stated that they believe “very much” that only naive people go to alternative practitioners. Question 14 on the AMKA responses showed that the students reported believing that aromatherapy is effective in reducing stress (average response was around 5 out of 7), although the technique seemed to have no effect on the participants’ stress responses. The scores for the HLC measure were all average except for the self-control scale. Therefore, our sample had a high level of belief in their own control of their health.

TABLE 3

Means \pm SEM of Alternative Medicine and Health Locus of Control Questionnaires for All Participants

Questionnaire	Mean \pm SEM
AMBADK	6.13 \pm 0.24
AMBAR	3.06 \pm 0.19
AMBAW	.80 \pm 0.12
CHHLC	19.67 \pm 0.57
GTHLC	20.10 \pm 0.47
PCHLC	29.33 \pm 0.55
SCHLC	33.77 \pm 0.55
AMBA	24.93 \pm 0.55
Q14	5.14 \pm 0.18
Number of Techniques	1.21 \pm 0.16

Correlations

Correlation coefficients were calculated to examine the relationship between the health measures and stress responses. Of those relationships, the most significant findings were between knowledge of alternative medicine and physiological responses. The number of blank responses [$r(60) = .33, p < .01$] and wrong responses [$r(60) = 0.36, p < .004$] was significantly correlated with heart rate changes to the task. In addition, change in SBP and DBP were also correlated with number of wrong responses [$r(61) = .26, p < .04$ and $r(61) = .25, p < .05$, respectively]. In summary, the less knowledge, the greater the physiological response.

Separately, baseline SBP was correlated with responses to question 14 on the AMKA [$r(60) = -.38, p < .003$] showing that the more they believed in aromatherapy, the lower the resting blood pressure.

CONCLUSIONS

Although aromatherapy has been reported to be effective in reducing anxiety and stress in some medical settings,^{4,5} data from the present study suggest that it may

not work during acute mental stress situations. Our results showed that neither psychological perceptions nor physiological responses were reduced by the presentation of aromatherapy during a 12-minute math task. Even with the addition of placebo and control groups (groups 3 and 4), lavender scent diffused through a humidifier did not affect stress reactions or performance.

This study was also interested in examining how health beliefs and practices in alternative therapies may be related to responses to the mental task. Although it appears that knowledge of alternative therapies was significantly correlated with changes in the cardiovascular measures during the task, it is difficult to explain why this may be. These data suggest that health beliefs may not influence reactions to stress but knowledge might.

IMPLICATIONS

The implications for these data are that aromatherapy may not be effective during short-term mental tasks but may require a longer regime of usage. Studies thus far have examined how aromatherapy may work to relieve anxiety in medical and work settings^{2,4,5} but have not focused on acute stress situations. Since it is clear that acute stress is also detrimental to health,¹ sources of stress reduction for these types of situations are also important to identify. Of course, caution must be taken when interpreting the results of the present study since our sample was primarily female and white. The influence of essential oils on other populations should be examined as well. Similarly, the task chosen may not have been as stress provoking as needed. Both physiological and state anxiety data showed significant increases during the task; however, because the ratings of arousal and difficulty were lower than expected, the task may have only produced a mild state of anxiety. Further studies will need to be completed varying the task difficulty to see if there are any significant changes in stress levels.

The implications of the correlation findings are more difficult to interpret since, to our knowledge, no other study has shown such relationships. It could be hypothesized that individuals who know more about alternative medicine take better care of their bodies and know more about their health in general. However, no significant correlations were seen between knowledge and health behaviors. In addition, belief in alternative medicine was

not correlated with health status (measured by baseline physiological levels) or health behaviors. Therefore, it appears that although knowledge of alternative medicine is related to stress responses, these relationships can not be attributed to health status or behavior.

In summary, stress management programs have initiated a variety of methods to help relieve tension and anxieties. The present study questions the efficacy of a popular method used known as aromatherapy. Although its use has been successful in other areas, management of acute stress may not be one of those areas.

REFERENCES

1. Cohen S, Williamson GM. Stress and infectious disease in humans. *Psychol Bull.* 1991;109(1):5–24.
2. Murphy LR. Stress management in work settings: a critical review of the health effects. *Am J Health Promotion.* 1996;11(2):112–135.
3. Damian P, Damian K. *Aromatherapy: Scent and Psyche.* Rochester, Vt: Healing Arts Press; 1995.
4. Dunn C, Sleep J, Collett D. Sensing an improvement: an experimental study to evaluate the use of aromatherapy, massage and periods of rest in an intensive care unit. *J Adv Nurs.* 1995;21:34–40.
5. Stevensen CJ. The psychophysiological effects of aromatherapy massage following cardiac surgery. *Complement Ther Med.* 1994;2:27–33.
6. Mandler G, Mandler JM, Uviller ET. Autonomic feedback: the perception of autonomic activity. *J Abnorm Soc Psychol.* 1958;58:367–373.
7. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav.* 1983;24:385–396.
8. Marteau TM, Bekker H. The development of the six-item short-form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI). *Br J Clin Psychol.* 1992;31:301–306
9. Spielberger CD, Gorsuch RL, Lushene RE. *Manual for the State-Trait Anxiety Inventory.* Palo Alto, Calif: Consulting Psychologists Press; 1970.
10. Richardson F, Woolfolk C. Mathematics anxiety. In: Sarason IG, ed. *Test Anxiety: Theory, Research, and Applications.* Hillsdale, NJ: Erlbaum; 1980:271–288.
11. Lau R. Origins of health locus of control beliefs. *J Pers Soc Psychol.* 1982;42:322–334.
12. Betz NE, Hackett G. *Mathematics Self-Efficacy Scale.* Palo Alto, Calif: Consulting Psychologists Press; 1993.