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Effects of aromatherapy massage with bergamot essential oil on vital sign, flexibility, stress level and stress hormone in healthy adults: a pilot study

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KEYWORDS
Aromatherapy massage;
Bergamot essential oil;
Vital sign;
Flexibility;
Stress.

ABSTRACT
Aromatherapy with essential oils has been shown to relieve stress and alleviate symptoms of musculoskeletal diseases. However, physiological changes generated by aromatherapy massage with bergamot oil are still limited. The objective of this study was to determine the effect of aromatherapy massage with bergamot essential oil in healthy subjects. Thirty-one healthy subjects received a 14-minute aromatherapy massage with bergamot oil at the back region three times a week for four weeks. Blood pressure, heart rate, respiratory rate, skin temperature, stress level, back flexibility, cortisol levels, and aldosterone levels were measured at baseline and the end of a 4-week aromatherapy massage with bergamot oil. The result showed that all parameters mentioned above except skin temperature, back flexibility, and diastolic blood pressure were significantly decreased after the intervention. Skin temperature and back flexibility were significantly increased after the intervention with aromatherapy massage with bergamot oil. Diastolic blood pressure was decreased after the intervention but did not reach statistical significance. In conclusion, a 4-week course of aromatherapy massage with bergamot oil at the back region could improve physiological parameters including autonomic, stress, back flexibility, and hormonal parameters.

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Introduction

Stress is a major mental health issue that affects people of all ages and genders[1]. Stressful life events and personal life changes, such as bereavement or job loss, have been identified as risk factors for mental disorders[2]. Stress refers to human reactions or responses to stressors, which can occur immediately or later after the incidence of stressors. It is partly due to the rapidly changing socio-economic conditions and social crises that lead to various sorts of problems such as unemployment, poverty, criminal activity, and economic crisis[3]. When the body is under stress, it reacts both physically and psychologically. The endocrine system emits more cortisol hormone, stimulating the autonomic system and leading to physical, mental, and behavioural abnormalities[4]. Moreover, the stress-induced elevation of aldosterone secretion was most significant. According to a previous study, aldosterone is an important hormone that regulates water and salt balance as well as blood circulation, resulting in better blood pressure regulation[5]. Physical abnormalities generated by stress include increased heart rate, blood pressure, respiratory rate, muscle tension, and muscle pain[6]. Chronic stress causes fatigue, muscle atrophy, and weakening by constantly mobilizing energy at the expense of energy storage. Worries, anxiety, muddled thinking, forgetfulness, poor concentration, annoyance, and other mental abnormalities are examples of mental abnormality[7].

Nowadays alternative medicine is taking more roles to treat and relax patients with stress. Aromatherapy is a complementary therapy that utilizes essential oils as the primary therapeutic agent to treat a variety of illnesses. It is one of these options that has attracted the public interest. The inhalation or absorption of essential oils through the skin stimulates physiological responses of the nervous and endocrine systems[8]. It has the effect of restoring mental and physical balance, and so relieving stress[9]. Patients with mental problems who got aromatherapy had lower cortisol levels and were more relaxed as a result. Previous studies have shown that essential oils including lavender, sandalwood, ylang-ylang, and sweet orange oil have effects on the body and autonomic system, including lowering blood pressure, heart rate, respiratory rate, pain, and inflammation[10]. Furthermore, it has been revealed that these essential oils reduce cortisol, a stress hormone. Bergamot essential oil aromatherapy can be a helpful supplement to other treatments for improving mental health and well-being. It promotes happiness and proper brain function. Moreover, it has been demonstrated that bergamot essential oil reduces cortisol levels. In addition, aromatherapy with bergamot essential oil has been shown to reduce heart rate, blood pressure, anxiety, stress responses, and improve mood[11].

It is well known that massage therapy promotes relaxation and reduces stress[12]. Swedish massage is a well-known treatment that has been practiced in a bunch of countries. This massage technique relaxes the muscles while simultaneously increasing blood flow back to the heart. Furthermore, it has been demonstrated to improve blood pressure, heart rate, respiration rate, reduced anxiety, and reduced stress levels[13]. Being considered the advantages of bergamot oil aromatherapy and Swedish massage, combining aromatherapy and massage with bergamot oil may bring extra health benefits. A previous study reported that the massage with blended lavender and bergamot essential oils reduced autonomic arousal by decreasing heart rate, blood pressure and promote relaxation[14]. There is currently insufficient research on aromatherapy with bergamot essential oil and massage as a combined therapy. Thus, the goal of this research is to see how this combination affects physiological markers.

Materials and methods

Participants

The one group pretest-posttest study was conducted on 31 healthy subjects. The inclusion criteria were aged between 18 and 25 years, not sensitive to aroma, and not having irritation or allergy to essential oils. If subjects had coronary heart disease, asthma, cancer, a fractured or inflamed bone, diabetes, autonomic dysfunction,

hypertension, fever, or obesity, they were excluded from the study because these conditions may influence the measured parameters. In addition, if subjects did not complete the aromatherapy massage course, they were also excluded from this study. To avoid the impacts on physiological parameters, the participants were requested not to consume caffeinated drinks such as tea or coffee for a period of 12 hours and not to exercise vigorously for 24 hours before participating in the study. The study protocol was approved by the Ethics Committee in Human Research (ID. 5202040013). Before signing the consent form for participation, subjects were informed about the experimental protocol and possible risks. All subjects signed informed consent before study enrolment.

Preparation of the essential oil

Bergamot oil was mixed with a sweet almond oil for body massage (approximately 10-15 drops of bergamot oil per 30 ml base oil, or one ml of essential oil per 30 ml of base oil. The dose of bergamot oil was modified from a previous study[15]. The mixture was then poured in a foam cup at each bed for massage.

Preparation of the participants

Before participating in the study, the volunteers were asked to come in for a blood test to evaluate their cortisol and aldosterone levels. This was done between 1:00 and 3:00 p.m. Cortisol levels range from 2.3 to 11.9 ug/dl, while aldosterone levels range from 1.4 to 16 ng/dl. Hormones have a half-life of about 1-3 hours. The subjects were then asked to change their clothes into a back-opening gown and complete a stress questionnaire. They took a 15-minute rest before the outcome's measurement and massage. The subjects' blood pressure, heart rate, respiration rate, temperature, and back flexibility were all measured by the researchers before and immediately after the last aromatherapy massage. Throughout the trial, all volunteers were requested to maintain their usual activities of daily life and degree of exercise. All experiments were conducted in a bright and separate room free from noise and stimulation. The ambient temperature was 27 °C.

Blood pressure and heart rate measurement

Blood pressure and heart rate were measured two times at one-minute intervals by using OMRON (HEM 7203, USA). The average data were used for statistical analysis. The stress level was measured by using a Thai self-reported stress questionnaire. The questionnaire consists of 20 questions with four alternative answers about current events (never, sometimes, often, and always). A total score of 60 represents a typical stress level, whereas a score of less than 17 indicates normal stress level. The questionnaire was developed by the Department of Mental Health.

Measurement of flexibility

Flexibility was evaluated by the sit-and-reach test using a trunk flexometer. Subjects performed long sitting with straight knees, feet together to the wall of flexometer. The subjects moved their arms forward, both hands above the flexometer, and their trunk in a forward bending position until they reached their limit motion, which they maintained for two seconds. The investigator measured from the zero scale to the tip of the middle finger. Each subject performed two times and the highest score in centimeter (cm) was chosen.

Measurement of cortisol levels, and aldosterone levels

The blood sample was collected from the median cubital vein by a medical technologist immediately after the last aromatherapy massage. The determinations of cortisol and aldosterone levels were performed by a lab technician at Chiangmai R.I.A Lab, Mueang Chiang Mai District, Chiang Mai Province, Thailand.

Procedure of massaging

The volunteers received aromatherapy massage with bergamot oil at the back region three times per week for four weeks[16]. The massage was started by asking the volunteer to lie prone and turn their heads to any side they felt comfortable with. Two little pillows were placed under their ankles and a small pillow was placed under their abdomen. A blanket sheet was placed over their legs, kept open only at the

massaged areas. The massage was performed from the 7th cervical spinous process and the most protruding part of the shoulder bone adjacent to the shoulder (acromion process), and the line on their side from the mid axillary line and the iliac crest, (L4-5). Seven massage steps made up the whole therapeutic time of 14 minutes (Figure 1). Each step took two minutes to complete. Before rubbing the volunteer, the massage therapist rubbed bergamot oil all over the volunteer's back.

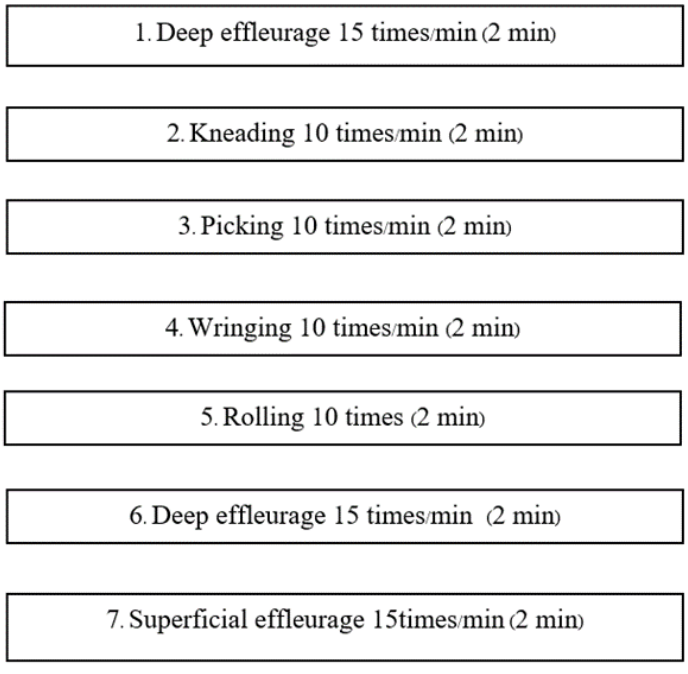

Figure 1 Seven steps of massaging with a total massage time of 14 minutes

Statistical analysis

The data were analyzed using SPSS version 17. All data were shown in means and standard deviations (SD). Normality was tested using the Shapiro-Wilk test. In each participant, all continuous variables were normally distributed and compared using the paired t-test. Significance was defined as a *p*-value of less than 0.05.

Results

There were 40 subjects who were enrolled at the beginning of the study. Nine subjects were excluded due to an incompletion of the study protocol. Therefore, a total of 31 subjects completed the study. There were no adverse events during the assessments and massage. The average age of the participants was 23.08 years. There were 11 males (35.5%) and 20 females (64.5%) among the participants. Table 1 lists the characteristics of the subjects. A 4-week aromatherapy massage with bergamot oil increased body temperature and back flexibility (p-value < 0.001 and p-value = 0.014, respectively), but decreased heart rate, respiratory rate, systolic blood pressure, and stress score (all p-value < 0.001) (Table 2). The diastolic blood pressure was observed to be reduced from 75.9 to 74 mmHg (p-value = 0.208) (Table 2). Furthermore, after completing the aromatherapy course, cortisol and aldosterone levels reduced significantly (p-value = 0.009 and p-value < 0.001, respectively) (Table 3).

Table 1 Subject characteristics

Characteristic	Value (n=31)
Age (years)	23.08 ± 0.8
Gender, male (%)	11 (35.5%)
Gender, female (%)	20 (64.5%)
Body weight (kg)	56.64 ± 5.27
Height (cm)	159.70 ± 4.12

Note: All data were shown in means and standard deviations (SD).

Table 2 Measured parameters before and after the 4-week intervention

Variables	Before (n = 31)	After (n = 31)	95%CI	*p*-value
SBP (mmHg)	114.4 ± 8.8	107.1 ± 9.5	(4.79) - (10.21)	< 0.001
DBP (mmHg)	75.9 ± 8.6	74.0 ± 7.2	(-1.30) - (4.86)	0.208
HR (beats/minute)	72.7 ± 7.6	67.8 ± 8.5	(3.08) - (6.70)	< 0.001
RR (times/minute)	17.9 ± 3.1	16.4 ± 2.7	(0.90) - (2.26)	< 0.001
Temperature (°C)	35.9 ± 0.4	36.5 ± 0.3	(-0.58) - (-0.40)	< 0.001
Back flexibility (cm)	6.6 ± 8.0	8.3 ± 7.3	(-3.10) - (-0.98)	0.014
Stress score	20.0 ± 7.9	16.5 ± 8.2	(-3.32) - (-2.29)	< 0.001

Note: SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; RR, respiratory rate; (°C), Degree Celsius; kg, kilogram; cm, centimeter; mmHg, millimeter mercury; 95% confidence interval.

Table 3 Cortisol and aldosterone levels of subjects before and after the intervention

Data	Before (n = 31)	After (n = 31)	95%CI	*p*-value
Cortisol (ug/dl)	10.3 ± 4.4	7.7 ± 3.0	(2.36) - (7.58)	0.009
Aldosterone (ng/dl)	4.8 ± 2.8	0.3 ± 0.1	(1.04) - (0.23)	< 0.001

Note: ug, microgram; ng, nanogram; dl, deciliter; 95% confidence interval.

Discussion

The results of this study showed that a 4-week aromatherapy massage with bergamot oil improved autonomic, stress, back flexibility, and hormonal parameters. This suggests that the combination of aromatherapy and massage may have a beneficial effect. After the intervention, autonomic measures such as heart rate, respiratory rate, and systolic blood pressure all improved significantly. In addition, there is a downward tendency in diastolic blood pressure. Massage has been shown to accelerate the pace of venous return to the heart[17]. Furthermore, prone lying promotes relaxation, which lowers heart rate and systolic blood pressure[18]. It is well recognized that cortisol activates the sympathetic nervous system (SBP). We found that aromatherapy massage with bergamot oil significantly lowered cortisol levels in the current study. As a result, the sympathetic nervous system function was reduced, resulting in lower SBP, heart rate, and respiratory rate; all of which are indicators of sympathetic function[19]. Aromatherapy massage with bergamot oil lowered the secretion of aldosterone, a hormone that

regulates water and mineral balance, as well as cortisol levels, resulting in improved blood pressure regulation. Low levels of aldosterone have been linked to lower blood pressure[20]. We observed a trend of reduced diastolic blood pressure in this study, although the change was not significant. As a result, we suggest that aromatherapy massage with bergamot oil had some effect on diastolic blood pressure, due to lower levels of aldosterone.

The results of a 4-week aromatherapy massage with bergamot oil showed a considerable increase in skin temperature, which is consistent with earlier research. Heavy pressing and squeezing of the muscles have been shown to improve blood circulation, body metabolism, and skin friction, as heat is liberated from the muscles and transmitted to the vessels, the temperature rises[21]. Following an aromatherapy massage with bergamot oil, back flexibility increased significantly, indicating improved muscle relaxation. Massage improved relaxation by reducing adrenocorticotropic hormone (ACTH)[22]. In addition, the generation of ATCH by the adrenal glands was suppressed, resulting in lower levels of adrenalin. Blood pressure and heart rate are also reduced when adrenalin levels are low[23]. Aromatherapy with bergamot essential oil was found to increase relaxation and emotional status in a previous study[11]. It can be a useful supplement to other treatments for improving mental health and well-being. Our results confirmed this hypothesis by the evidence that both cortisol (adrenalin-like) and aldosterone hormone from the adrenal gland were significantly reduced after the intervention. The massage itself also increased blood circulation at the massaging spot and thus relaxed muscles and promoted more flexibility.

We found that following a 4-week aromatherapy massage using bergamot oil, stress levels decrease. These findings support prior research that showed slow stroke back massage decreased psychological stress as measured by a subjective visual analog score[24]. The lowering of cortisol hormone after massage therapy was linked to stress levels in various situations[25]. Another study found that a 12-week aromatherapy massage combined with music reduced stress and anxiety over the summer and winter months[26]. Furthermore, previous studies found that a 10-minute back massage helped reduce vital signs and anxiety levels. Fifteen-minute back massage to enhance anxiety levels, cortisol levels, blood pressure, heart rate, and sleep quality[27]. Aromatherapy using bergamot essential oil vaporized for 15 minutes reduced saliva cortisol levels significantly[28]. Therefore, we suggest that the stress score was decreased possibly related to the reduction of cortisol levels.

Massage benefits include reducing muscle tension, increasing joint range of motion, and reducing stiffness, as well as improving and maintaining normal flexibility. The length of the back muscles partly influences body flexibility. Back muscle spasms or shortening can obstruct back motion, resulting in reduced flexibility[29]. As a result, we chose to massage the back region using the seven-step procedure. The duration of the back massage employed in this study was modified based on previous research that revealed that 10 minutes of massage significantly improved physiological measures[30]. We found an increase in flexibility after an aromatherapy massage using bergamot oil in this study. Therefore, the increased flexibility that occurs after receiving an aromatherapy massage with bergamot oil could be attributed to both the aromatherapy and the massage. Nevertheless, we also aware that the resting alone (without either massage or aromatherapy) in the same position and environment could provide these effects. The lack of a control group for comparison was one of the study limitations. However, in the one-group pre-test and post-test experimental design, the results of this intervention regimen were good, given the intervention being a combination of massage and bergamot aromatherapy. Thus, the authors are unable to indicate whether the benefit of the intervention generated by both massage and bergamot oil, or by each of them. Therefore, further studies with different experimental designs are still required.

Conclusion

In conclusion, a 4-week course of aromatherapy massage with bergamot oil could improve physiological parameters including vital sign, stress, back flexibility, and hormonal parameters.

Take home messages

A 4-week course of aromatherapy massage with bergamot oil at the back may reduce blood pressure, heart rate, respiratory rate, stress, cortisol, and aldosterone levels while increasing skin temperature and back flexibility. This intervention could help people improve their mental health and well-being.

Conflicts of interest

The authors declare no conflict of interest.

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