



Research Paper: Effect of Aromatherapy with Lavender 10% Essential Oil on Motor Function, Speech and Delirium in Patients with Acute Thrombotic Cerebral Ischemia



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ABSTRACT

Background: Stroke is one of the most disabling diseases worldwide. Herbal medicines, especially lavender, have been used to treat ischemic diseases today.

Objectives: The aim of our study was to investigate the effect of aromatherapy with lavender 10% essential oil on motor function, speech and delirium in acute thrombotic cerebral ischemia patients.

Materials & Methods: In this double blind clinical trial, 70 patients with acute thrombotic cerebral ischemia were enrolled. Patients were randomly assigned into two equal groups; the first group received lavender essential oil (10%) as aromatherapy, and the second group received placebo. Motor function, speech and delirium scores were calculated using standard questionnaire before and one week after treatment. The level of antioxidants and melancholically was also measured in post-treatment patients. Data were analyzed in SPSS V. 18 using descriptive statistics and paired t-test and independent t-test with a significance level of $P < 0.05$

Results: There was no significant difference between the two groups in terms of demographic information, motor function, speech and delirium scores ($P > 0.05$). After treatment, the mean scores of motor function, speech and delirium were changed significantly in both groups, and the mean of these scores in the intervention group was significantly less than placebo, and in the intervention group the level of antioxidants was significantly higher and level of malondialdehyde was significantly less than placebo group ($P < 0.05$).

Conclusion: Using lavender 10% essential oil in our study improved the symptoms of patients such as motor function, speech and delirium after ischemic thrombolytic stroke. This is associated with decrease in malondialdehyde level and an increase in the level of antioxidants.

Keywords: Lavandula; Stroke; Motor Neurons Speech; Delirium

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Highlights

- Lavender essential oil can improve the symptoms of stroke including motor function, speech and delirium.
- Using Lavender essential oil is associated with decrease in malondialdehyde level and an increase in the level of antioxidants.

Introduction

Stroke is an acute brain injury caused by impairment in blood supply to one part of the brain tissue due to cerebrovascular blockage by a blood clot or rupture of arteries supplying that part [1]. Stroke is the third leading cause of mortality and morbidity in industrial countries, and a surviving patient will suffer complications such as paralysis, memory, thinking, speech, and psychological problems. Delirium, another complication of stroke, is a common impairment in consciousness and cognition that occurs acutely with characteristics such as altered consciousness, reduced focus and memory, impaired orientation, with rapid onset in a few hours or a few days and acute and notable fluctuations in inpatients [2]. Post-stroke delirium can increase mortality and morbidity, hospital costs, time consumed, and ultimately many problems for the family and community [3].

Following the above problems and subsequent disorders in swallowing, bladder and bowel control, respiratory muscle functioning, muscle movement, blood pressure changes, and many other complications, these measures are taken for the patients: inserting NG tube, physiotherapy, frequent draining of secretions from lungs and airways, tracheal intubation, urinary catheterization, using air mattresses, and even medication-therapy with antibiotics, anticoagulants, and antibiotic [4-8].

In conjunction with the routine care and treatment techniques, other methods have been suggested to provide care for patients with inflammation, wounds, neurological disorders, and muscular problems [9]. One of these methods is aromatherapy, in which aromatic oils are used in a controlled manner to maintain and promote physical and mental health. These oils are the essences extracted from aromatic plants with anti-inflammatory, antimicrobial, and stress-reducing and pain reducing properties [9,10].

Lavandula angustifolia, commonly known in Iran as *Ostokhodoos* (Lavender), is widely available as an aromatic plant. The flower and essence of lavender are used in the cosmetic and perfume industries [11]. Many compounds have been identified in this plant, including geraniol, linalool, linalyl acetate, cineol, borneol, α -pinene, and camphor, which produce sedative and analgesic effects probably by affecting different regions of the CNS [12]. Of all different plants, aromatherapy with lavender is of much interest to researchers because it is safe and has no known contraindications [13]. Given the progress made in diagnosis of stroke; therefore, the improvement and development of effective treatments, which include post-event recovery stage are vitally important in medical, social and economic terms [14].

To prevent the incidence of delirium or minimize the complications resulting from treatment in the acute phase, lavender is added to the main treatment of patients with stroke (anticoagulant and antiplatelet medications), and its effects are assessed on rehabilitation of motor function, speech and delirium in these patients. Hence, the present study was conducted to investigate the effect of aromatherapy with lavender 10% essential oil on motor function, speech, and delirium in a group of patients with thrombotic ischemic stroke receiving treatment with lavender compared to the control group.

Materials and Methods

The present randomized clinical trial was enrolled patients attending emergency department of Kashani Hospital in the city of in Iran from 2016 to 2018. Convenience non-randomized sampling was used to select the participants. The study inclusion criteria were age over 50 years, sudden onset of symptoms, diagnosis of thrombotic stroke, evidence of stroke in the patients' CT scan, sufficient consciousness for cooperation in examinations, attending hospital immediately after the onset of symptoms (12 hours at the latest), no history of cognitive

or use of psychiatric medications, no alcohol dependence, no history of lengthy surgeries, and willingness to take part.

The study exclusion criteria were blood glucose <50mg/dl, unwillingness to take part, not completing questionnaires, and failure to follow-up. A total of 70 patients with ischemic stroke were enrolled based on the study inclusion and exclusion criteria, and were randomly and equally divided into two groups of 35 after obtaining written consents. Randomization was carried out by random allocation software.

The control and intervention groups were matched in terms of age (50-90 year-old), gender, severity of symptoms, and the ischemia site in CT scan. Data relating to the patients' neurological disorders were collected using the National Institutes of Health Stroke Scale (NIHSS), which was completed by the relevant intern and a physician after assessment of the patients in two stages: 1. On the first day; and 2. After the first post-stroke week. Delirium was assessed using Delirium Rating Scale-Revised-98 (DRS-R-98) in two stages: 1. On the first day; and 2. A week after stroke to diagnose the symptoms of delirium. Data relating to each questionnaire were completed by the intern. NIHSS is a quantitative questionnaire used for measuring neurological abnormalities of stroke. This questionnaire is used in nearly all studies on acute strokes in America as the initial and final criterion for the measurement of neurological abnormalities. Validity and reliability of this scale have been confirmed for prospective studies [15].

In the present study, only motor and parts of NIHSS were used, with two questions about the limb muscle strength, with maximum score of 4 (the lowest strength) and minimum of 0 (the highest strength), and two questions about speech, with maximum score of 3 (the lowest strength and minimum of 0 (the highest strength), and finally, the scores were summed up and analyzed. In DRS-R-98 scale, each variable is scored from 0, 1, 2, to 3 points, and the patient's score for each variable is separately calculated and then summed up. Patients' scoring higher than 15 points in total suffer from delirium.

The highest score in this questionnaire is 39, which indicates the severity of this disorder. Validity of DRS-R-98 has been demonstrated in previous studies [16]. The control group received the routine treatment such as aspirin, enoxaparin, atorvastatin and antihypertension medications and placebo instead of lavender essential oil. The intervention group received aromatherapy with lavender essential oil 10% (produced by Barij Pharma-

ceuticals) in addition to the routine medications. Therapy began 12 hours after the onset of symptoms and continued for a week.

Identical capped bottles were used for placebo and lavender essential oil. A researcher who had PhD in pharmacognosy, prepared the identical capped bottles and filled half of them with cotton balls smeared with sunflower oil and marked them with 1. The other half of the bottles were filled with cotton balls smeared with 0.1 ml of lavender essential oil and marked with 2 [17].

Other members of the research team were blinded to the content of the bottles. Each time the patients received routine therapy, they inhaled the content of the bottles 5 minutes. When two patients with stroke were in one room, only one of them was selected. Blood samples were taken from the patients and sent to the laboratory to determine total serum antioxidant capacity and serum level of malondialdehyde. The two groups were compared before therapy and one week after.

Analysis of data

Data collected were analyzed in SPSS V. 18 using descriptive statistics (mean and standard deviation for quantitative data and frequency or percentage for qualitative ones) and analytical statistics (Chi-square test to compare the qualitative data in two groups, paired t-test to compare the quantitative data before and after therapy, and independent t-test to compare the quantitative data in two groups) at a significance level of $P < 0.05$.

Results

A total of 70 patients (33 men and 37 women) participated in the present study, and were randomly divided into two equal groups (35 patients each). The gender distribution was as follows: 19(54.3%) men in the intervention group and 21(60%) women in the control, and Chi-square test showed no significant difference between the two groups in terms of gender distribution ($P=0.23$). The patients' mean age was 71.87 ± 9.82 years in total, 71.45 ± 9.44 years in the intervention group, and 72.28 ± 10.31 years in the control. Independent t-test showed no significant difference between the two groups in terms of mean age ($P=0.77$). The muscle strength and speech parts of NIHSS were completed on the first day, with no significant difference between the two groups in mean muscle strength ($P=0.34$).

Mean score of muscle strength after the first week was significantly less in the intervention group than that in

Table 1. Changes in speech score in intervention and control groups before and after therapy

Variable		Intervention Group	Control Group	P
Speech	Before therapy	4.40±1.33	4.57±1.33	0.59
	After therapy	2.11±1.11	3.43±1.07	<0.001
P		<0.001	<0.001	
Changes before and after therapy		2.29±0.22	1.14±0.26	<0.001


Table 2. Changes in the delirium score in intervention and control groups before and after therapy

Variable		Intervention Group	Control Group	P
Delirium	Before therapy	26.14±6.95	27.57±4.63	0.31
	After therapy	14.65±6.04	20.46±4.53	<0.001
P		<0.001	<0.001	
Changes before and after therapy		11.49±0.91	7.11±0.10	<0.001



the control group ($P<0.001$). Moreover, mean score of muscle strength in each group before therapy was significantly higher compared to after therapy ($P<0.001$) (Table 1-3). Mean changes before and after therapy were significantly greater in the intervention group compared to the control ($P<0.001$) (Table 4). No significant difference was found between the two groups in mean score of speech on the first day of admission ($P=0.39$). A week after therapy, mean score of speech was signifi-

cantly lower in the intervention group than that in the control group ($P<0.001$). Mean score of speech in each group was significantly higher before therapy compared to after ($P<0.001$) (Table 3), and mean changes before and after therapy was significantly higher in the intervention group compared to the control ($P<0.001$) (Table 2). DRS-R-98 was used to assess the patients' delirium. No significant difference was observed between the two groups in the delirium score on the first day of admis-

Table 3. The body antioxidant and malondialdehyde levels in the study groups a week after therapy

A Week After Therapy	Intervention Group	Control Group	Total	P
	Mean±SD	Mean±SD	Mean±SD	
Antioxidant level mmol/l	635.11±196.80	382.14±135.75	508.62±210.64	0.04
Malondialdehyde nmol/l	2.98±0.96	4.26±1.34	3.62±1.32	0.04


Table 4. Changes in muscle strength score in the intervention and control groups before and after therapy

Variable		Intervention group	Control Group	P
Muscle strength	Before therapy	5.74±1.60	6.09±1.42	0.34
	After therapy	2.63±1.21	4.51±1.29	<0.001
P		<0.001	<0.001	
Changes before and after therapy		3.11±1.05	1.57±0.13	<0.001



sion ($P=0.38$). A week after therapy, mean score of delirium was significantly lower in the intervention group compared to the placebo group ($P=0.001$). Furthermore, mean score of delirium in each group was significantly greater before therapy compared to after ($P<0.001$) (Table 4), and mean changes before and after therapy were significantly higher in the intervention group compared to the control ($P<0.001$) (Table 3).

A week after therapy, the patients' serum antioxidants and plasma malondialdehyde levels were measured. The level of antioxidants was significantly lower in the intervention group compared to the control ($P=0.04$), and plasma malondialdehyde was also significantly lower in the intervention group compared to the control ($P=0.04$) (Table 4).

Discussion

According to the results, mean scores of muscle strength and speech were higher in the lavender group compared to the placebo group, which means that muscle strength and speech were better in the intervention group compared to the placebo group. Furthermore, the score of delirium was significantly lower after therapy in the lavender group compared to the placebo group, which means that lavender group had less delirium compared to the placebo group.

Other results obtained related to the measurement of serum antioxidants and plasma malondialdehyde a week after therapy. The serum antioxidant level was significantly higher in the lavender group compared to the placebo group. The level of plasma malondialdehyde (a marker that increases in ischemia) was significantly lower in lavender group compared to the placebo group. According to the results, lavender improved the patients' muscle strength, speech, and alertness, and increased antioxidants and reduced malondialdehyde. Some studies have mentioned the effect of lavender in preventing ischemia, which will be discussed in the present study.

A study by Wang et al. to assess the effect of lavender oil on cerebral ischemia in rats showed that lavender oil therapy significantly reduced the score of neurological disturbance, the size of infarction area, malondialdehyde level and catalase level in these rats, and it was concluded that lavender oil has neuro-protecting properties against cerebral ischemia, which may be due to its antioxidant property [12].

Rabiei et al. investigated the protective effect of lavender on the size of stroke and its potential mechanisms

in stroke model in 42 rats that had been divided into six groups. They reported using 200 mg/kg of lavender for 20 days significantly reduced the size of tissue damage caused by stroke in the cortical and focal regions of the brain compared to the control. This dose of medication significantly increases nitric oxide in the blood. Finally, it was stated that lavender extract has protective effects on the brain against cerebral ischemia, and reduces the size of stroke in rats exposed to ischemia. Its mechanism may be explained by lavender effect on increasing the level of antioxidants. It was also argued that lavender reduces the size of stroke by increasing the endothelial nitric oxide level by inhibition of reduced cerebral blood flow [18].

The results of a study by Vakili et al. to assess the effect of lavender oil in reducing cerebral edema in in-vitro stroke models showed that intravenous administration of 200 and 400 mg/kg doses at the onset of ischemia significantly reduced the size of infarction, cerebral edema, and corrected functional outcomes following cerebral ischemia. It was argued that using 200 mg/kg dose significantly reduced malondialdehyde and increased superoxidase dismutase activity, glutathione peroxide, and total antioxidants.

The authors argued that lavender oil has neuro-protective activity against cerebral ischemia, because of anti-oxidant effect. However, their results showed that lavender oil cannot suppress the process of apoptosis in these models [19]. Other similar studies have shown that lavender has an effective role in the treatment of cognitive disorders, especially Alzheimer's [20]. In addition, some evidence indicates that lavender essence significantly reduces tumor necrosis factor in mast cells isolated from rats [21].

To the best of our knowledge, no study has yet been conducted on the effect of lavender on stroke in humans. The effect of lavender in treating anxiety and postoperative pain was assessed in a study by Mesri et al. whose results showed that aromatherapy with lavender before surgery is effective in reducing anxiety and postoperative pain [22].

In another study by Wang et al. to assess the effect of lavender flower in treating ischemia and cardiac damage, it was concluded that lavender reduces the heart tissue damage following ischemia by reducing malondialdehyde and increasing antioxidants [23]. Also, some studies have mentioned that lavender has a role in certain diseases such as hyperactivity and attention deficit in children [24].

The present study limitations included small sample size, short follow-up period, the lack of control and consideration of other factors that can be effective in improving stroke symptoms and creating delirium, and the lack of similar studies. Therefore, given all the above and the effect of this plant in treating neurological and ischemic diseases, and also the fact that no similar study has been conducted on the effect of lavender in the treatment of stroke, it is recommended that further studies on the subject be conducted in the future.

Conclusion

Using lavender 10% essential oil improved the patients' symptoms such as muscle strength, speech, and delirium following ischemic stroke, and this was accompanied by reduced malondialdehyde and increased antioxidants levels.

Ethical Considerations

Compliance with ethical guidelines

The study protocol was approved by the ethics committee of Shahrekord University of Medical Sciences (No. IR.SKUMS.REC.1396.210). All the study procedures were in compliance with the ethical guidelines of the Declaration of Helsinki 1957.

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Authors contributions

Conception, Collection, Critical revision of the article for important intellectual content: Shiva Seyed Salehi; Final approval of the study; Interpretation of data, assembly, Critical revision of the article for important intellectual content, final approval of the study: Zahra lorigooini; Design of the study, collection, critical revision of the article for important intellectual content, final approval of the study: Nahid Jivad; Analysis, statistical expertise, critical revision of the article for important intellectual content, Final approval of the study: Keyvan Ghadimi.

Conflict of interest

The authors declare no conflict of interest.

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