

Original Article

Effect of Aromatherapy with Rosemary Essential Oil on Occupational Fatigue and Depression Experienced by Ambulance Technicians

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Abstract

Background and Aim: A considerable number of pre-hospital emergency technicians have been negatively impacted by occupational fatigue and depression. This research was conducted to examine the effect of rosemary essential oil on the pre-hospital emergency technicians' occupational fatigue and depression.

Materials and Methods: Eight pre-hospital emergency stations were randomly chosen in this community trial study. Subsequently, four stations were randomly assigned to the intervention, and four stations were allocated to the placebo groups. 8 to 10 technicians were chosen from each station. In the intervention group, badges with 25% rosemary essential oil and badges impregnated with refined almond oil in the placebo group were used for two hours in 3 shifts per week. The participants completed the fatigue severity scale and the DASS-42 depression subscale before and one hour after the intervention. In this study, chi-square, paired t-test, and independent t-test were used.

Results: The statistical analysis indicated no remarkable distinction between the mean occupational fatigue ($p=0.17$) and depression ($p=0.15$) scores in the two groups before the intervention. After the intervention, there were no significant differences with regard to the mean and mean changes in occupational fatigue scores between the intervention group and the placebo group ($p=0.65$). However, in contrast with the placebo group, significant decreases were observed in the mean and mean changes in depression scores in the intervention group one hour after the intervention ($p<0.001$).

Conclusion: Although inhaling a composition of 25% rosemary essential oil does not have any effect on the reduction of occupational fatigue, it can be useful in reducing depression in pre-hospital emergency technicians.

Keywords: Aromatherapy, Rosmarinus officinalis, Depressive symptoms, Fatigue

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Introduction

Human resource plays a pivotal role in the

achievements of organizations (1). Paying attention to employees' needs and problems increases the efficiency of the organization and motivates employees (2).

Occupational fatigue and employee depression are factors that negatively influence the employee's effectiveness (3, 4). Today, occupational health experts pay more attention to the concept of fatigue (5). Occupational fatigue is considered a lack of physical and mental energy or burnout in a person to continue work (6). This problem is not specific to industry employees. Health care providers such as nurses and pre-hospital emergency technicians also experience occupational fatigue (7). Patterson *et al.* (2012) reported the prevalence of occupational fatigue among emergency medical services providers to be 55% (8). This phenomenon is also common in Iran's pre-hospital emergency technicians (9).

Occupational fatigue causes drowsiness, digestive problems, impaired judgment, forgetfulness, decreased alertness, increased occupational injury, and depression (10). It also affects the employee's safety and performance, and the patient's safety. Moreover, it increases the likelihood of damage to patients (11). Improving the physical and mental problems of employees is challenging. Reducing the number of working days, increasing financial and spiritual support, and psychological interventions by employers may minimize occupational fatigue (12).

Depression is another problem that can affect the productivity and efficiency of employees. It can lead to absenteeism, impaired personal communication, decreased safety and increased physical complaints of employees (13). In various studies, the prevalence of depression in pre-hospital emergency technicians has been reported to be 17% to 25% (14). In Iran, Kalantari *et al.* (2017) reported that the prevalence of depression in pre-hospital emergency technicians is more than 75% (15). In Iran, due to a lack of financial resources and equipment and a shortage of human resources in the pre-hospital emergency organization (14), there is little chance of intervention to improve the employee's occupational fatigue and depression. Moreover, encouraging people to use antidepressants and substances that cause unpleasant side effects imposes a high financial cost on the individual and the health care system (16).

Hence, the use of economic, inexpensive, and effective methods is required. Complementary and alternative medicine is an easy-to-perform, non-invasive, cost-effective, and low-risk intervention

with limited side effects compared to conventional treatments (17). In recent years, aromatherapy, as one of the complementary and alternative therapies, has attracted much attention (18). Aromatherapy refers to the use of essential oils extracted from aromatic plants for therapeutic purposes. Aromatherapy is the placebo use of aromatic plants essential oils to maintain and enhance physical and mental health (19).

The results of studies conducted on the impact of aromatherapy with rosemary on the reduction of occupational fatigue are contradictory. Mehrabi *et al.* (2015), for example, stated that the herbal tea of rosemary reduces the burnout of employees in the chemical industries (20). Research by Bicer *et al.* (2017) showed that the use of an aromatic combination of rosemary and lavender reduces the fatigue of hemodialysis patients (21). However, Lindheimer *et al.* (2013) stated that the oral form of rosemary does not affect the rise of energy and alleviation of fatigue in healthy young people (22).

In investigating the effect of rosemary on depression, Kim *et al.* (2005) stated that the use of compounds containing rosemary essential oil reduces the depression of patients with chronic arthritis (23). Nematollahi *et al.* (2017) also showed that the oral form of rosemary reduces depression in college students (24).

Several studies have examined the impacts of rosemary on occupational fatigue and depression in different populations. It is essential to note that occupational fatigue, depression and their causes are intrinsically distinct different for pre-hospital emergency technicians compared to other professions, which can affect the results of aromatherapy with rosemary. Psychiatric drugs such as benzodiazepines and antidepressant drugs have beneficial effects in treating psychological disorders. However, most people refuse to take them because of drugs' adverse effects (mental and physical dependence) and high costs (25). Thus, identifying a psychologically enhancing natural component that can be used without harmful effects on healthy individuals has gained the interest of research groups. There is no clinical research, to our best knowledge, on the effect of rosemary aromatherapy in occupational fatigue and depression among pre-hospital emergency technicians. It can be said that there is a lack of evidence for aromatherapy with rosemary

and the mechanism of action on occupational fatigue and depression. Finally, such studies will result in a more developed set of knowledge relating to aromatherapy. Hence, the present study was carried out to determine the impact of aromatherapy with rosemary essential oil on occupational fatigue and depression experienced by ambulance technicians.

Materials and Methods

Design and Participants

This study is a community trial conducted in 2019. The research proposal has been registered in the Iranian Registry of Clinical Trial Center with the code IRCT20190515043601N1. The research community included all pre-hospital emergency technicians in Birjand. The sample size was determined according to the study conducted by Hongratanaworakit *et al.* (2009) using the following formula to include 39 participants in each group (26):

At first, 8 pre-hospital emergency stations affiliated to Birjand University of Medical Sciences were selected in Birjand. Subsequently, 4 stations were assigned to the intervention group and 4 stations were assigned to the placebo group, using random number software. In the next step, 8 to 10 participants from each station were chosen based on the inclusion criteria. Inclusion criteria included the informed and written consent, non-use of antidepressants, no history of allergies to aromatic compounds, migraines and asthma, no drug addiction, no history of liver or kidney disease, and a healthy sense of smell.

The health state of the olfactory system was approved using the Iranian version (IRAN-SIT) of the Pennsylvania Smell Identification Test. The IRAN-SIT tool has both a short form and a long form. The short form has six aromas of banana, rose water, cinnamon, garlic, mint toothpaste, and cantaloupe as a nano-capsule. This tool can detect olfactory dysfunction within 3 minutes. After each participant smelled each of the scents, 5 to 6 correct answers indicated that the olfactory system was functioning properly. The validity and reliability of this tool have been confirmed in the study by Taherkhani *et al.* (2015)(27). Exclusion criteria included common cold and other illnesses that affected the sense of smell, and unwillingness to continue the intervention.

During the sampling process, 90 potential participants

were evaluated for eligibility to enter the study. Of these, 12 did not have the opportunity to participate in the study due to their reluctance to participate in the research or lack of inclusion criteria. After obtaining the written consent, all the participants completed the characteristic demographic form, the depression subscale of the 42-item Depression, Anxiety, Stress Scale (DASS-42), and the 15-item Occupational Fatigue Exhaustion Recovery (OFER-15) scale.

To measure the participants' depression, the DASS-42 depression subscale was used. This scale was developed by Lovibond & Lovibond (1995) and had two short and long forms. Its main form has 42 questions that examine each of the psychological structures of stress, anxiety, and depression. Depression scales include terms 42, 38, 37, 34, 31, 26, 24, 21, 17, 16, 13, 10, 5, and 3. Answering the items is performed on a 4-point Likert scale. The range of answers varies from "never" to "always". Scoring is from "zero" to "three", and a score of zero is considered for the "never" choice, a score of one for the "few" choice, a score of two for the "occasionally" choice, and a score of three for the "always" choice. The minimum score for depression is 0, and the maximum score is 28. Rising scores means increasing depression. Studies have shown that the reliability of the depression subscale is 0.71 (28). In the present study, the reliability of the depression subscale was calculated using Cronbach's alpha to be 0.79.

The OFER-15 questionnaire was used to measure occupational fatigue. This tool was designed by Winwood *et al.* (2005). The questionnaire has 15 items that measure the three subscales of acute occupational fatigue, chronic occupational fatigue, and inter-shift recovery. Answering the items is performed on a 7-point Likert scale: totally disagree (1), strongly disagree (2), disagree (3), abstained (4), agree (5), strongly agree (6), totally agree (7). In this questionnaire, questions 9, 10, 12, and 14 are scored in reverse. Rising scores means increasing occupational fatigue. The minimum score for occupational fatigue is 0, and the maximum score is 100. In various studies, the Cronbach's alpha coefficient of the OFER-15 questionnaire was reported to be more than 0.80 (29). In this research, the reliability of this questionnaire was calculated to be 0.83 using Cronbach's alpha.

Intervention

Pure rosemary essential oil was prepared from Tabib Daru Pharmaceutical Company located in Kashan, Iran. To produce a 25% composition of rosemary essential oil, under the control of a pharmacist, pure rosemary essential oil was mixed with purified and odorless sweet almond oil in 1 to 4 ratios, respectively. The mixture was then placed in uniform and unicolor 20 cc bottles for the intervention group participants. Badges were made using linen. The size of the badges was 5 x 3 cm. The badges were attached to the participants' uniforms at a distance of 30 cm from the nose. Subsequently, the participants were then asked to spray two puffs (1 cc) of the mixture on their badges each morning at the beginning of each work shift. The compound was used at 8 to 10 in the morning (2 hours) in 3 shifts per week for one month. In the placebo group, the size and material of the badges, the frequency and duration of the intervention, the amount of spray on the badges, and the distance of the badges from the nose were the same as the intervention group. Nevertheless, in this group, the sprays contained refined and odorless sweet almond oil. The researcher reminded the participants of the interventions by making phone calls and text messages using Auto Reminder software. Finally, one hour after the last intervention, the participants in both groups re-completed the DASS-42 (Depression subscale) and OFER-15 questionnaires. The data collector and data analyzer were blinded to the data.

Ethical Considerations

This research was carried out with the approval of the Ethics Committee of Birjand University of Medical Sciences (IR.BUMS.REC.1397.353). The researcher explained the purpose of the study and the intervention method for the research units. After knowingly signing the consent form, they were told that at any stage of the research, it would be possible to withdraw from continuing the study without paying any fee. They were assured of the confidentiality of the collected data.

Statistical Analysis

SPSS 16.0 software was used to analyze the data. To compare the demographic characteristics of the two groups, the Chi-square and Fisher statistical tests were used. The Kolmogorov-Smirnov test showed that occupational fatigue and depression scores were normally distributed. Hence, the comparison of the

mean scores of occupational fatigue and depression between the two groups was carried out using an independent t-test. Moreover, the paired t-test was used for intra-group comparison in the pre-phase and one hour after the end of the intervention. The significance level was considered for all analyzes at $p < 0.05$.

Results and Discussion

Out of 87 participants, nine from each group (18 in total) were excluded. Five from the intervention and seven from the placebo groups did not want to continue participating in the research. Four in the intervention and two in the placebo group dropped out of research due to a catch a cold. Finally, the data of 30 individuals in the intervention and 30 in the placebo groups were analyzed.

No statistically remarkable distinction was observed between the intervention and placebo groups in terms of demographic variables ($p > 0.05$). As the independent t-test indicated, there was no statistically significant difference concerning the mean scores of occupational fatigue between the intervention (52.47 ± 14.06) and the placebo (47.93 ± 11.09) groups before the intervention ($p > 0.05$). The independent t-test revealed that one hour after the intervention, there was no remarkable statistical distinction between the mean and mean changes scores of occupational fatigue in the two groups ($p > 0.05$; Table 2).

The independent t-test indicated that before the intervention, the mean depression scores were 21.5 ± 5.46 for the intervention group and 22.1 ± 4.52 for the placebo group, which did not show a statistically significant difference ($P > 0.05$). The independent t-test showed that after the intervention, there was a statistically significant decrease in the mean and mean changes in depression scores in the intervention group compared to the placebo group ($P < 0.001$; Table 2).

As mentioned, occupational fatigue and depression are common in pre-hospital emergency technicians. This study was conducted to investigate the impact of aromatherapy with rosemary essential oil on occupational fatigue and depression experienced by ambulance technicians. The results did not indicate any significant statistical difference between the two groups in terms of demographic variables. Since the participants in the two groups reported that they did not have a history of taking antidepressants and anti-fatigue

Table 1: Comparison of frequency of demographic characteristics in two groups of intervention and placebo.

		Groups		Results
		Intervention	Placebo	
Age	20-25	3(10.0%)	5(16.7%)	X ² =1.94 P=0.63
	26-30	9(30.0%)	10(33.3%)	
	31-35	10(33.3%)	11(36.7%)	
	More than 35	8(26.7%)	4(13.3%)	
Marital status	Married	26(86.7%)	24(80.0%)	X ² =0.48
	Single	4(13.3%)	6(20.0%)	P=0.73
Job experience	1-5	4(13.3%)	7(23.3%)	X ² =1.58 P=0.71
	6-10	12(40.0%)	13(43.3%)	
	11-15	10(33.3%)	7(23.3%)	
	16-20	4(13.3%)	3(10.0%)	
Type of employment	Contract-based	17(56.7%)	23(76.7%)	X ² =4.37
	Officially	13(43.3%)	7(23.3%)	P=0.23
Educational level	Diploma	11(36.7%)	11(36.7%)	X ² =1.10 P=0.77
	Bachelor	16(53.3%)	18(60.0%)	
	Master's degree and more	3(10.0%)	1(3.33%)	

Table 2: The mean values of the MBC and MIC concentrations (µg/ml) of the essential oil of *E. cinerea*.

		Groups		P value ^a
		Intervention	Placebo	
Occupational fatigue	Before	52.47 ± 14.06	47.93 ± 11.09	t=1.39 p=0.17
	After	47.83± 13.09	42.03 ± 16.33	t=0.45 p=0.65
	P value ^b	t=1.47 p=0.24	t=2.25 p=0.11	
Depression	Before	21.57 ± 5.46	22.16 ± 4.52	t=1.79 p=0.15
	After	12.61 ± 7.59	23.94 ± 6.71	t=3.61 p<0.001
	P value ^b	t=3.48 p<0.001	T=1.02 p=0.89	

^a Independent samples t-test, ^b paired sample t-test

drugs and herbs, the results of the present study can be attributed mainly to the intervention. According to the findings, aromatherapy with 25%

rosemary essential oil did not reduce the occupational fatigue of pre-hospital emergency technicians. The result of the research carried out by Lindheimer *et al.*

Table 3: Comparison of mean changes scores of occupational fatigue and depression before with one hour after the end of the intervention.

	Intervention	Placebo	P value ^a
Occupational fatigue	-4.46 ± 12.38	-5.90 ± 14.75	t=1.62 p=0.71
Depression	-8.96 ± 7.25	1.78 ± 5.72	t=4.47 p=0.001

^aIndependent sample t-test

(2013) is consistent with the present study. Lindheimer concluded that rosemary did not reduce fatigue and increase energy in healthy young people (22).

In explaining the results of the present study, it can be said that there is a shortage of human-resources in Iran's pre-hospital emergency system (14). These employees are required to perform their duties during shifts and at any time of the day or night (30). Occupational fatigue can be related mainly to job instability. More than 65% of the present study participants had a contracted-based (temporary) employment status. Studies have shown that the type of employment affects employees' occupational and emotional fatigue, such that permanent employees experience less fatigue (31). Therefore, it seems that improving and reducing occupational fatigue in pre-hospital emergency technicians require a comprehensive approach by the country's emergency organization. Of course, in addition to management strategies (increasing human resources, increasing salaries, and improving facilities), complementary medicine interventions such as aromatherapy can also be used. Furthermore, researchers believe that one of the leading causes of fatigue in pre-hospital emergency technicians is poor sleep (8). Inhaling the rosemary essential oil increases the Alpha and beta-1 power in EEG and ultimately reduces sleep duration and increases alertness (32).

The results of some studies are inconsistent with the results of the present research. Bicer et al. (2017) stated that the use of rosemary and lavender aromatic compounds has highly favorable effects on improving the fatigue of hemodialysis patients (21). In this regard, Jo et al. (2010) also reported that inhaling the combination of Lavender, Zeranium, and Mazoram fragrances reduces nurses' fatigue (33). One of the reasons for the difference in the results is the

distinction in the nature of fatigue in pre-hospital emergency technicians. Pre-hospital emergency technicians are confronted continuously with critically ill patients with complex and specific needs which leads to increased stress and chronic mental and physical fatigue (34). Moreover, the methods and components of aromatherapy in the present research are different from the studies conducted by Bicer et al. and Jo et al. In the mentioned studies, a combination of rosemary essential oil and other essential oils such as lavender has been used. Lavender has disrable effects on increasing the quality of sleep. Improving sleep quality reduces fatigue (35).

The findings of the present indicate that in the intervention group, the mean and the mean changes in depression scores were significantly lower than the placebo group after the intervention. Hence, aromatherapy with 25% rosemary essential oil is effective in reducing the depression of pre-hospital emergency technicians. Hongratanaworakit et al. (2009) stated that aromatherapy massage using rosemary oil reduces depression in healthy individuals (26). A study by Kim et al. (2005) also showed that aromatherapy massage reduces depression in the elderly with chronic arthritis (23).It has been shown that using rosemary, lavender, zeranium, and mazoram scents improve nurses' depression (33). Natalya et al. (2015) concluded that inhaling a combination of rosemary and lavender essential oils improves depression (36). Sayorwan et al. (2013) also believe that inhaling rosemary scent improves mood (37). The results of the studies mentioned above are consistent with the findings of the present research.

Rosemary improves depression with several different mechanisms. Researchers believe that inflammatory processes in the central nervous system have a significant effect on the incidence of depression. Rosemary has anti-inflammatory properties.

Absorption of carnosol, betulinic acid, ursolic acid, and polyphenols available in rosemary through the olfactory system affects the monoaminergic system. Rosemary increases dopaminergic, serotonergic, noradrenergic, and cholinergic activities (38). In fact, polyphenols of rosemary regulate thyroxin-hydroxylase and pyruvate-Carboxylase (genes involved in the gabaergic system, serotonergic and dopaminergic). Polyphenols of rosemary protect neurons against the toxicity of corticosteroids (39). Cognitive disorders and depression are inversely related. As cognitive power increases, depression decreases. The ingredients in rosemary enhance cognitive abilities (40). Another mechanism that can be expressed is related to the regulation of cortisol secretion. In depression disorders, cortisol levels in the blood increase (41). The compounds in rosemary reduce the amount of cortisol in the central nervous system and blood, and reduce stress and ultimately improve depression (42, 43).

One of the limitations of the present study was the relatively small sample size. The selection of research samples from one center was another limitation of the present study. It is suggested that in future studies, researchers compare rosemary essential oil with other aromatic compounds. It is also recommended to compare the effect of aromatherapy with other complementary medicine methods in different job groups.

Conclusion

Aromatherapy with 25% rosemary essential oil did not reduce the occupational fatigue. However, it can have positive effects in reducing depression in pre-hospital emergency technicians.

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Conflict of Interest

The authors declare that they have no conflict of

interest.

References

1. Farid H, Izadi Z, Ismail IA, Alipour F. Relationship between quality of work life and organizational commitment among lecturers in a Malaysian public research university. *The Social Science Journal*. 2015;52(1):54-61.
2. Nwaeke LI, Obiekwe O. Impact of manpower training and development on organizational productivity and performance: A theoretical review. *European Journal of Business and Management*. 2017;9(4):153-9.
3. Brown R, Wey H, Foland K. The relationship among change fatigue, resilience, and job satisfaction of hospital staff nurses. *Journal of Nursing Scholarship*. 2018;50(3):306-13.
4. Rasool SF, Maqbool R, Samma M, Zhao Y, Anjum A. Positioning Depression as a Critical Factor in Creating a Toxic Workplace Environment for Diminishing Worker Productivity. *Sustainability*. 2019;11(9):2589.
5. Lerman SE, Eskin E, Flower DJ, George EC, Gerson B, Hartenbaum N, et al. Fatigue risk management in the workplace. *Journal of Occupational and Environmental Medicine*. 2012;54(2):231-58.
6. Bowen J, Hinze A, Griffiths C. Investigating real-time monitoring of fatigue indicators of New Zealand forestry workers. *Accident Analysis & Prevention*. 2019;126:122-41.
7. Lewis G, Wessely S. The epidemiology of fatigue: more questions than answers. *Journal of epidemiology and community health*. 1992;46(2):92.
8. Patterson PD, Weaver MD, Frank RC, Warner CW, Martin-Gill C, Guyette FX, et al. Association between poor sleep, fatigue, and safety outcomes in emergency medical services providers. *Prehospital Emergency Care*. 2012;16(1):86-97.
9. Tahanian M, Jouybari L, Vakil MA, Sanagoo A, Haghdst Z. The Effect of Progressive Muscle Relaxation on Sleep Quality and Fatigue among Pre-Hospital Emergency Staff in the Center of Management of Accident and Medical Emergency in Golestan Province. *Iran Occupational Health Journal*. 2018;15(2):101-10.
10. Asadi P, Ziabari SMZ, Vatani J, Ghotbi J, Safaee F. Assessing the knowledge of Guilan Pre-Hospital emergency personnel (EMS) from safety principles. *Journal of Advanced Pharmacy Education & Research* | Apr-Jun. 2019;9(S2):99.
11. Ulrich B. Nurse fatigue: Dangerous for nurses and patients. *Nephrology Nursing Journal*. 2018;45(3):239-40.
12. Patterson PD, Buysse DJ, Weaver MD, Callaway CW, Yealy DM. Recovery between work shifts among Emergency Medical Services clinicians. *Prehospital Emergency Care*. 2015;19(3):365-75.
13. Tabatabaei S, Maleki A, Mataji M, Nurian R, Karimi M. Investigation of depression, anxiety, and

- musculoskeletal disorders in emergency staff of hospitals supervised by Shahid Beheshti University of Medical Sciences. *Iran Occupational Health*. 2015;12(1).
14. Bayrami R, Ebrahimpour H, Rezazadeh A. Challenges in Pre hospital emergency medical service in Mashhad: A qualitative study. *Hospital*. 2017;16(2):82-90.
15. Kalantari S, Hosseinzadeh M. An assessment of general health of operational staff of pre-hospital emergency in Golestan province. *Journal of Health and Care*. 2017;18(4):359-67.
16. Moncrieff J. Challenging the new hype about antidepressants. *Critical Psychiatry*. 2018;24:1-5.
17. Lewith GT, Jonas WB, Walach H. *Clinical research in complementary therapies e-book: Principles, problems and solutions*: Elsevier Health Sciences; 2010.
18. Muzzarelli L, Force M, Sebold M. Aromatherapy and reducing preprocedural anxiety: A controlled prospective study. *Gastroenterology Nursing*. 2006;29(6):466-71.
19. Edge J. A pilot study addressing the effect of aromatherapy massage on mood, anxiety and relaxation in adult mental health. *Complementary Therapies in Nursing and Midwifery*. 2003;9(2):90-7.
20. Mehrabi T, Gorji S, Zolfaghari B, Razmjoo R. The effect of Rosmarinus herbal tea on occupational burnout in Iran Chemical Industry Investment company employees. *Iranian journal of nursing and midwifery research*. 2015;20(4):460.
21. Bicer S, Demir G. The effect of aromatherapy inhalation on fatigue level in individuals undergoing hemodialysis therapy. *International Journal of Caring Sciences*. 2017;10(1):161.
22. Lindheimer JB, Loy BD, O'Connor PJ. Short-term effects of black pepper (*Piper nigrum*) and rosemary (*Rosmarinus officinalis* and *Rosmarinus eriocalyx*) on sustained attention and on energy and fatigue mood states in young adults with low energy. *Journal of Medicinal Food*. 2013;16(8):765-71.
23. Kim MJ, Nam ES, Paik SI. The effects of aromatherapy on pain, depression, and life satisfaction of arthritis patients. *Journal of Korean Academy of Nursing*. 2005;35(1):186-94.
24. Nematollahi P, Mehrabani M, Karami-Mohajeri S, Dabaghzadeh F. Effects of *Rosmarinus officinalis* L. on memory performance, anxiety, depression, and sleep quality in university students: a randomized clinical trial. *Complementary Therapies in Clinical Practice*. 2018;30:24-8.
25. De Oliveira JR, Camargo SEA, De Oliveira LD. *Rosmarinus officinalis* L. (rosemary) as therapeutic and prophylactic agent. *Journal of Biomedical Science*. 2019;26(1):5.
26. Hongratanaworakit T. Simultaneous aromatherapy massage with rosemary oil on humans. *Scientia Pharmaceutica*. 2009;77(2):375-88.
27. Taherkhani S, Moztafzadeh F, Seraj JM, Nazari SSH, Taherkhani F, Gharehdaghi J, et al. Iran smell identification test (Iran-SIT): A modified version of the university of Pennsylvania smell identification test (UPSIT) for Iranian population. *Chemosensory perception*. 2015;8(4):183-91.
28. Dehghan A, Memarian R. Abundance of stress, anxiety and depression in multiple sclerosis patients. *Alborz University Medical Journal*. 2013;2(2):82-8.
29. Javadpour F, Keshavarzi S, Choobineh A, Aghabaigi M. Validity and reliability of Occupational Fatigue/Exhaustion Recovery scale (OFER-15) among Iranian working population. *Iran Occupational Health*. 2014;11(6).
30. Patterson PD, Suffoletto BP, Kupas DF, Weaver MD, Hostler D. Sleep quality and fatigue among prehospital providers. *Prehospital Emergency Care*. 2010;14(2):187-93.
31. Payami Bousari M. Occupational burnout and some related factors in female nurses working at Zanjan educational hospitals in 2001. *Journal of Advances in Medical and Biomedical Research*. 2002;10(40).
32. Diego MA, Jones NA, Field T, Hernandez-Reif M, Schanberg S, Kuhn C, et al. Aromatherapy positively affects mood, EEG patterns of alertness and math computations. *International Journal of Neuroscience*. 1998;96(3-4):217-24.
33. Jo M-J. The effects of aroma inhalation on stress, fatigue, mood, and vital signs of the nurses in the operating rooms. *Korean Journal of Adult Nursing*. 2010;22(2):153-60.
34. Snooks HA, Khanom A, Cole R, Edwards A, Edwards BM, Evans BA, et al. What are emergency ambulance services doing to meet the needs of people who call frequently? A national survey of current practice in the United Kingdom. *BMC Emergency Medicine*. 2019;19(1):1-8.
35. Lytle J, Mwatha C, Davis KK. Effect of lavender aromatherapy on vital signs and perceived quality of sleep in the intermediate care unit: a pilot study. *American Journal of Critical Care*. 2014;23(1):24-9.
36. Natalya T, Tatyana S, Elina T, Olga L. Aromatherapy with essential oils treating chronic fatigue syndrome. *Сборник научных трудов Государственного Никитского ботанического сада*. 2015(141).
37. Sayorwan W, Ruangrunsi N, Piriyanunporn T, Hongratanaworakit T, Kotchabhakdi N, Siripornpanich V. Effects of inhaled rosemary oil on subjective feelings and activities of the nervous system. *Scientia Pharmaceutica*. 2013;81(2):531-42.
38. Rabiei Z, Rabiei S, Lorigooini Z. A review on antidepressant effects medicinal plants with emphasis on their mechanisms of action. *Journal of Medicinal Plants*. 2016;15(60).
39. Sasaki K, El Omri A, Kondo S, Han J, Isoda H. *Rosmarinus officinalis* polyphenols produce antidepressant-like effect through monoaminergic and cholinergic functions modulation. *Behavioural Brain Research*. 2013;238:86-94.

40. Filiptsova O, Gazzavi-Rogozina L, Timoshyna I, Naboka O, Dyomina YV, Ochkur A. The essential oil of rosemary and its effect on the human image and numerical short-term memory. *Egyptian Journal of Basic and Applied Sciences*. 2017;4(2):107-11.
41. Kumari M, Badrick E, Chandola T, Adam EK, Stafford M, Marmot MG, et al. Cortisol secretion and fatigue: associations in a community based cohort. *Psychoneuroendocrinology*. 2009;34(10):1476-85.
42. Hamidpour R, Hamidpour S, Elias G. *Rosmarinus officinalis* (Rosemary): a novel therapeutic agent for antioxidant, antimicrobial, anticancer, antidiabetic, antidepressant, neuroprotective, anti-inflammatory, and anti-obesity treatment. *Biomed J Sci Tech Res*. 2017;1(4):1-6.
43. Rahimi H, Nakhaei M, Mehrpooya N, Hatami SM, Vagharseyyedin SA. The Effect of Inhaling the Aroma of Rosemary Essential Oil on the Pre-Hospital Emergency Personnel Stress and Anxiety: A Quasi-Experimental Study. *Modern Care Journal*. 2019;16(3).

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