

Phytochemical and Anti-oxidant Activity of *Lavandula Angustifolia* Mill. Essential oil on Preoperative Anxiety in Patients undergoing Diagnostic Curettage

Foozieh Bakhsha^{1*}, Masoumeh Mazandarani², Mohammad Aryaei¹, Seid Yaghub Jafari¹, Human Bayate³

Abstract

Objective: The objective of present work was mainly to phytochemical, antioxidant properties and examine the effect of *Lavandula angustifolia* Mill. Essential oil on Preoperative Anxiety in Patients undergoing Diagnostic Curettage (Gorgan, Iran).

Materials and Methods: Essential oil of plant in blooming was obtained by hydro distillation method (clavenger) and analysed by (GC/MS). Antioxidant activity determined by 1,1-diphenyl-1-picrylhydrazyl (DPPH) assay, anti anxiety effects were studied using Spielbergers state anxiety inventory questionnaire method and analyzed by using SPSS 18 statistical Software and t-test (0.05%).

Results: Carvacrol (26.2%), limonene (19.6%), 1,8-cineole (11.8%), terpinen-4-ol (7.6%), spathulenol (4.9%), α -pinene (4.2%), p-cymene (4.2%), caryophyllene oxide (2.7%), and terpinolene (2.6%) were the prominent components of essential oil and showed good antioxidant property via radical scavenging activity (DPPH) assay with IC₅₀ values of 4.3±0.12% to compare with BHT standard (2.18±0.3%). Clinical results showed that among 100 patients with average anxiety scores for the case group and the control was recorded 53.37±9.8 and 49.19±12.96, respectively and the difference was not significant (P<0.08), but after intervention, this difference was found to be statistically significant (P<0.0001) with regard to the results 40.28±6.66 and 47.87±12.96 for cases and controls, respectively.

Conclusion: There is a positive relationship between essential oil components, its antioxidant activity in reducing anxiety in patients undergoing curettage (D & C), especially in the night before the surgery.

Keywords: Antioxidant Activity, Diagnostic Curettage, *Lavandula Angustifolia* Oil, Preoperative Anxiety

Introduction

Free radicals and oxidative stress are involved in variety of disorders including atherosclerosis, chronic renal failure, diabetes mellitus, cancer, immune dysfunction, anxiety and aging (1). So in recent years there is an increasing interest in attraction of natural antioxidant derived from aromatic medicinal plants, which could be relevant in relation to their role in health disease and their nutritional value (2). For many patients, preoperative stage is critical and anxieties in which mental status can be adversely affected by increased tension, headache, confusion and lack of memory (3).

Lavender (*Lavandula angustifolia* Mill.) is a perennial aromatic plant, belonging to the Lamiaceae family with regard as natural antioxidants (4). It has been used in the treatment of depression, amenorrhoea, insomnia and analgesia (5). Lavender oil contains linalool alcohol, ketone, and sterzoaldehyde ketone to reduces pain, inflammation and helps for sleeping. Lavender extract

stimulates the olfactory bulb, it can release encephalin, endorphin and serotonin, which cause feelings of calm and reduce anxiety (6). In another study, Celal Bayar considered the effect of lavender extract on anxiety level of students in two control and study groups, and concluded that the study group (42.76±12.48) compared with control (51.51±12.21) had significantly lower anxiety (P=0.002) (7). Da Porto et al., also concluded that the lavender extract increases brain concentration among young men and can lower anxiety in clinical situations (8), so its extract, as a delightful fragrance, is extensively used to improve a wide range of states such as stress, depression, enhancing employees productivity, increasing attention and learning level, enhancing writing, motional, cognitive and memory skills (9).

The present study was carried out in order to evaluate of essential oil composition, antioxidant properties and examine the effect of *Lavandula angustifolia* Mill. oil on preoperative anxiety in patient in Sayyad Shirazi

Received 26 February 2014, Revised 16 March 2014, Accepted 1 April 2014, Available online 14 April 2014

¹Golestan University of Medical Sciences, Golestan, Iran

²Department of Botany, Gorgan branch, Islamic Azad University, Gorgan, Iran

³Niak Pharmaceutical Company, Gorgan, Iran

*Corresponding Author: Foozieh Bakhsha, Golestan University of Medical Sciences, Golestan, Iran. Tel: +989111775765, Email: bakhshaf@gmail.com

curettage center, Gorgan.

Materials and Methods

Plant materials

Aerial parts of *Lavandula angustifolia* Mill., at flowering stage, were collected from Botanical Garden of Niak pharmaceutical factory (Gorgan) in September 2012. Plant material was air-dried and stored at room temperature without exposure to direct sunlight. The sample was identified and the voucher specimens were deposited at the Herbarium of botany faculty of Islamic Azad University, Gorgan branch, Gorgan, Iran.

Essential oil and antioxidant activity

Essential oil was obtained by hydro distillation method (clavenger), and analyzed by gas chromatography-mass spectrometry (GC/MS). Antioxidant activity of essential oil was conducted using DPPH (2,2-diphenyl-1-picrylhydrazyl) free-radical scavenging assay (5). Different concentrations of essential oil were added, at an equal volume, to methanolic solution of DPPH (100 M). After 15 min at room temperature, the absorbance was recorded at 517 nm. The experiment was repeated for three times. BHT and quercetin were used as standard controls. IC50 values denote the concentration of sample, which is required to scavenge 50% of DPPH free radicals.

Anxiety properties

In this clinical trial, 100 D & C patients were divided into two groups randomly including the study group (n=50) and the control (n=50). Spielberger's state anxiety inventory with 20 items and the VAS questionnaire (visual analogue scale) were filled out by the two groups before and after aromatherapy. Lavender patients inhaled essential oil for 60 seconds and to be stable, the patient's nose was shortly massaged with the extract and the control group was treated with A little lemon juice with density 0.1% using the same procedure. The data were analyzed by using SPSS 18 statistical software, and using t-test to compare between the two groups and paired t-test to compare the before and after intervention, with a significant level of 0.05%.

Results

Essential oil of *Lavandula angustifolia* Mill. was obtained (1.2%) in yield and in a total of 28 compounds (97.3%) were identified, in which the major compounds were: carvacrol (26.2%), limonene (19.6%), 1,8-cineole (11.8%), terpinen-4-ol (7.6%), spathulenol (4.9%), a-pinene (4.2%), p-cymene (4.2%), caryophyllene oxide (2.7%), and terpinolene (2.6%). Antioxidant activity determined by 1,1-diphenyl-1-picrylhydrazyl (DPPH) assay and had good DPPH radical-scavenging activity, with IC50 values of $4.3 \pm 0.12\%$.

Level of anxiety of patient was evaluated according to Spielberger's questionnaire with the minimum and maximum scores of 20 and 80, and this range was divided into 5 sub-range including low level (20-31), moderate

to low (32-42), moderate to high (43-53), relatively severe (54-64) and highly severe (65-75). The results showed that there was statistically significant difference between relatively and highly severe anxiety levels in the intervention group (Figure 1).

Before intervention, the mean anxiety score for study group was 53.37 ± 9.8 and after the intervention it found to be 40.28 ± 6.66 , and this difference was statistically significant ($p < 0.0001$). For the control group, the mean anxiety scores before and after intervention was 49.19 ± 12.96 and 47.87 ± 12.96 , respectively which was not statistically significant ($p < 0.172$).

The mean anxiety score for the therapeutic curettage group before intervention was 53.6 ± 13.7 and for diagnostic curettage group was shown to be 49.95 ± 10.58 which the difference was not statistically significant ($p < 0.137$). By contrast, it was observed a significant difference between the two groups after intervention with the mean anxiety scores 47.47 ± 12.42 and 41.43 ± 8.49 for therapeutic and diagnostic curettage groups, respectively ($p < 0.005$), the level of anxiety after intervention was also shown by the box plot based on the type of curettage (Figure 1).

Discussion

The present study revealed that the apparent anxiety level in patients who inhaled lavender extract was noticeably lower than before intervention results and also compared with control group, especially at the levels of the severe and highly severe anxiety, so these results were in agreement with the results reported by Ita, Burns, Zare, Seraj, Vakilian, Lherner, and Kanaani, due to exposure of the cases with medicine more than 30 minutes (10-12). Although, Kicolit believes that undiluted essential oils should not be used more than 20 minutes due to reduced sensitivity of olfactory receptors in clinical situations (13). However, this study was not compatible with Muzarelli and Graham researches where in Muzarelli survey no significant difference was observed in apparent anxiety

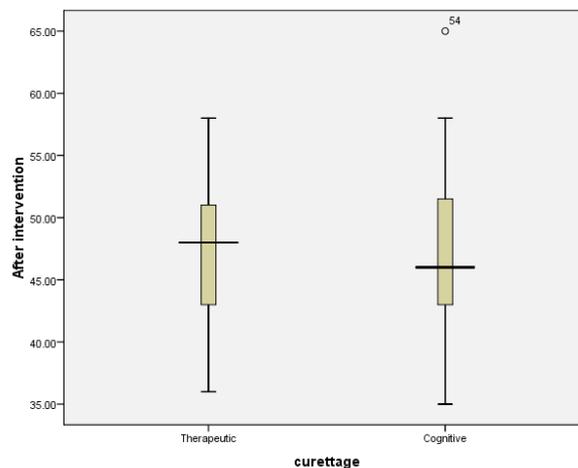


Figure 1. The level of anxiety after intervention was also shown by the box plot based on the type of curettage.

levels of patients undergoing endoscopy after inhaling lavender extract and the placebo (14), and this may be because of ineffectiveness of short inhalation. Lavender extract stimulates olfactory receptors and transfers the olfactory message to the limbic system. Limbic system, the feeling center in the brain, can release encephalin, endorphin and serotonin in response to the stresses which can bring calmness to the body and reduce anxiety.

Essential oils are absorbed through respiration. They can affect the enzymes, channels and ion receptors leading to brain stimulation, relief anxiety, and anti-depression effects and improve blood flow to the brain. They are also able to cross the blood-brain barrier through respiration and interact with receptors present in the central nerve system. Lavender is used for restlessness, insomnia, nervousness, and depression, loss of appetite, nausea, migraine headaches, sprains, nerve pain, sores, and joint pain (15). The mechanism of the plant effects has not been completely specified at the cell level, but according to various studies its psychological effects by affecting limbic system, especially amygdala and hippocampus the plant may have performance similar to benzodiazepines and gamma amino butyric Acid (GABA) in amygdala (16). According to RE et al., Linalool present plant essential oil, inhibits acetylcholine release and changes the function of ion channels at neuromuscular joints. Linalyl acetate has narcotic function and acts as a sedative (17). Mirzaei et al. studied 121 pre-imperious pregnant women inhaling lavender fragrance before the operation, and resulted that the anxiety level and the secretion of cortisol from the adrenal gland reduced during childbirth and the secretion of serotonin from the gastrointestinal tract increased but has no effect on blood pressure and pulse rate (18). In addition, in a survey conducted by Burn on 8058 mother at delivery showed that the use of lavender reduced fear and anxiety, and also decreased the need for epidural anesthesia and also reduced the usage of narcotics by 2%, and as a result, it can lead to a reduced care costs (19).

According to some authors, essential oil composition of Lavender with major components: carvacrol (66.2%), spathulenol (4.9%), p-cymene-8-ol (4.2%), caryophyllene oxide (2.7%) and terpinolene (2.6%) have a good Antioxidant, antifungal and antimicrobial activity against gram positive and negative bacteria (4).

Yang et al. suggested that the linalyl acetate (28.2%) was the most constituents of Lavender essential oil which has the highest DPPH radical-scavenging activity (5).

Thai Danh et al (20) suggested that linalool, linalyl acetate, camphor and borneol making up approximately 80% of essential oil, significantly higher antioxidant and anti microbial activity.

Therapeutic properties were reported from some authors showed that the monoterpenes and poly phenols of lavender oil as antiseptic, analgesic, anti-depressant, anti-rheumatic, anti-spasmodic, anti-inflammatory, antiviral, bactericide, carminative, deodorant, diuretic, hypotensive, nervine, rubefacient and sedative (21).

Conclusion

With regard to the findings of this study, there is a positive relationship between essential oil components and their antioxidant in reducing anxiety in patients undergoing curettage (D & C) thus, it would be important to use the essence in mental health care systems and patient's supportive therapies. So lavender aromatherapy may be effective in controlling and reducing anxiety, also be evaluated in the night before the surgery.

Ethical issues

The local ethics committee approved the study.

Conflict of interest

Authors declare that there is no any conflict of interest.

Acknowledgments

The article was part of research project under the code of 9005040147, and the moral code of 1599112944. The research team thanks all people helping the project to be carried out, especially Assistance Research of Medical University of Golestan and Research Center of medicinal plant (RCMP in Islamic Azad University of Gorgan branch).

References

1. Mazandarani M, Sineh Sepehr K, Baradaran B, Zarghami Moghaddam P, Khuri V. Autecology, phytochemical and antioxidant activity of *Peganum harmala* L. seed extract in North of Iran (Tash Mountains). *Journal of Medicinal Plants and By-products* 2012; 2: 85-90.
2. Rubiolo P, Sgorbini B, Liberto E, Cordero C, Bicchi C. Essential oils and volatiles, sample preparation and analysis. *Flavour Fragr J* 2010; 25:282-90.
3. Kamatou GPP, Viljoen AM. A review of the application and pharmacological properties of α -bisabolol and α -bisabolol-rich oils. *J Am Oil Chem Soc* 2010; 87:1-7.
4. Salleem K, Ramchoun M, Alem C, Khallouki F, El Moulaj B, El Rhaffari L. Chemical composition, antioxidant and antimicrobial activities of essential oil of *Lavandula* spp from oases of Morocco. In: Salih B (editor). *Gas Chromatography – Biochemicals, Narcotics and Essential Oils*. Intech Open; 2012. p. 213-220.
5. Yang SA, Jeon SK, Lee EJ, Shim CH, Lee IS. Comparative study of the chemical composition and antioxidant activity of six essential oils and their components. *Nat Prod Res* 2010; 24:140-51.
6. Sakamoto R, Minoura K, Usui A, Ishizuka Y, Kanba S. Effectiveness of aroma on work efficiency: lavender aroma during recesses prevents deterioration of work performance. *Chem Senses* 2005; 30:683.
7. Ceccarelli I, Lariviere WR, Fiorenzani P, Sacerdote P, Aloisi AM. Effects of long-term exposure of lemon essential oil odor on behavioral, hormonal and neuronal parameters in male and female rats. *Brain Res* 2004; 1001:78-86.
8. Da Porto C, Decorti D. Analysis of the Volatile Compounds of Flowers and Essential Oils from *Lavandula angustifolia* Cultivated in Northeastern Italy by Headspace Solid-Phase Microextraction Coupled to Gas Chromatography-Mass Spectrometry. *Planta Med* 2008; 74:182-7.

9. Gibbs RS, Danforth DN, Karlan BY, Haney AF. Danforth's Obstetrics and Gynecology. 10th ed. Philadelphia: Lippincott Williams & Wilkins; 2008.
10. Itai T, Amayasu H, Kuribayashi M, Kawamura N, Okada M, Momose A, et al. Psychological effects of aromatherapy on chronic hemodialysis patients. *Psychiatry Clin Neurosci* 2000; 54: 393-7.
11. Tafazoli M, Zaremobini F, Mokhber Naghmeh EA. The effects of lavender oil inhalation on level of anxiety during first stage of labor in primigravida women. *The Quarterly Journal of Fundamentals of Mental Health* 2011; 4:702-9.
12. Kanany M, Mazloom R, Emami A, Mokhber N. Lavender essential oil fragrance therapeutic effect on anxiety of patients undergoing hemodialysis. *Journal of Mashhad School of Nursing & Midwifery* 2011; 10:63-71.
13. Kiecolt-Glaser JK, Graham JE, Malarkey WB, Porter K, Lemeshow S, Glaser R. Olfactory influences on mood and autonomic, endocrine, and immune function. *Psycho neuroendocrinology* 2008; 33(3):328-39.
14. Muzzarelli L, Force M, Sebold M. Aromatherapy and reducing pre procedural anxiety: A controlled prospective study. *Gastro enterol Nurs* 2006; 29:466-71.
15. Lehrner J, Marwinski G, Lehr S, Jöhren P, Deecke L. Ambient odors of orange and lavender reduce anxiety and improve mood in a dental office. *Physiol Behav* 2005; 86: 92-5.
16. Cavanagh HM, Wilkinson JM. Biological activities of lavender essential oil. *Phytother Res* 2002; 16:301-8.
17. Re L, Barocci S, Sonnino S, Mencarelli A, Vivani C, Paolucci G, et al. Linalool modifies the nicotinic receptor channel kinetics at the mouse neuromuscular junction. *Pharmacol Res* 2000; 42:177-82.
18. Mirzaei F, Keshtgar S, Kaviani M, Rajaeifard AR. The effect of lavender essence smelling during labor on cortisol and serotonin plasma levels and anxiety reduction in nulliparous women. *Journal of Kerman University of Medical Sciences* 2009; 16:245-54.
19. Burns EE, Blamey C, Ersler SJ, Barnetson L, Lloyd AJ. An investigation into the use of aromatherapy in intrapartum midwifery practice. *J Altern Complement Med* 2000; 6:141-7.
20. Thai Danh L, Han LN, Anh Triet ND, Zhao J, Ammucari R. Comparison of Chemical Composition, Antioxidant and Antimicrobial Activity of Lavender (*Lavandula angustifolia* L.) Essential Oils Extracted by Supercritical CO₂, Hexane and Hydro distillation. *Neil Foster. Food and Bioprocess Technology* 2013; 6:3481-89.
21. Robu SV, aprosoaie AC, Miron A, Cioanc O, Stănescu U, Hăncianu M. In vitro antioxidant activity of ethanolic extracts from some *Lavandula* species cultivated in Romania. *Farmacia* 2012;60:394-401.

Copyright © 2014 The Author(s); This is an open-access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.