Aromatherapy

The effect of lavender on anxiety and sleep quality in patients treated with chemotherapy

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BACKGROUND: A cancer diagnosis is a serious stressor that is associated with anxiety, depression, sleep disorders, and inability to fulfill daily routines. Many pharmacologic and nonpharmacologic options are available to help patients with cancer manage anxiety.

OBJECTIVES: This randomized, controlled trial examined the effects of lavender oil aromatherapy on anxiety and sleep quality in patients undergoing chemotherapy.

METHODS: 70 patients were randomly assigned to a lavender oil group, a tea tree oil group, and a control group with no oil. A patient identification form, the State-Trait Anxiety Inventory, and the Pittsburgh Quality Sleep Index (PSQI) were used to measure anxiety and sleep quality before and after chemotherapy.

FINDINGS: State anxiety before and after chemotherapy did not vary among groups. The authors compared trait anxiety values before and after chemotherapy and found a significant difference in the lavender group. In addition, a significant change in PSQI measurements before and after chemotherapy was observed.

ESSENTIAL OILS ARE CHEMICALS EXTRACTED FROM PARTS OF PLANTS that have a unique aroma and complex chemical properties (National Cancer Institute [NCI], 2018; Worwood, 2016). Essential oils can be inhaled, digested, or applied topically, and they are eliminated from the body through urine and by respiration (Maddocks-Jennings & Wilkinson, 2004; NCI, 2018). They were introduced to nursing care by Florence Nightingale, and their use grows daily by nurses with certification in the use of essential oils (Gnatta, Kurebayashi, Turrini, & Silva, 2016; Smith & Kyle, 2008).

Lavender is a member of the mint family and contains linalyl acetate, linalool, and caryophyllene. *Lavandula angustifolia* increases the effect of gamma-Aminobutyric acid on the amygdala and has narcotic and sedative effects similar to those of benzodiazepines (Conrad & Adams, 2012; Fismer & Pilkington, 2012; Maddocks-Jennings & Wilkinson, 2004). In addition, *Lavandula hybrida* has relaxing and sedative properties (Price & Price, 2011). In addition to its antibacterial, antifungal, and carminative characteristics, which increase wound healing and the detoxification of enzymes associated with insect bites, lavender has no known contraindications and is safe to use (Braden, Reichow, & Halm, 2009; Howard & Hughes, 2008; Kritsidima, Newton, & Asimakopoulou, 2010; Muzzarelli, Force, & Sebold, 2006). Inhaling lavender has been reported to have an immediate effect, and topical administration takes effect in 10–90 minutes and lasts a few days (Worwood, 2016).

Lavender is used for spiritual relaxation, for therapeutic purposes (to build physical and emotional well-being), and for regulation of sleep disorders (Koulivand, Khaleghi Ghadiri, & Gorji, 2013; Kritsidima et al., 2010). In a study conducted by Franco et al. (2016), 2% lavender oil was administered to one group of women and odor-free aromatic oil was given to another group for 10 minutes through an oxygen mask before all underwent a breast biopsy. Women who inhaled lavender oil reported decreased negative feelings, and the aromatherapy was shown to be effective in the management of preoperative anxiety (Franco et al., 2016). Another study showed that smelling four drops of 10% lavender oil for four weeks improved sleep quality in postpartum women (Keshavarz Afshar et al., 2015). Kritsidima at al. (2010) observed the diagnosis and treatment procedures carried out on a group of patients who visited an outpatient clinic for dental treatment in a room where a 10-cc cup of water with 5 drops of lavender oil was located. They observed the procedures conducted on another group in an odor-free room. At the end of the study,

they found that the anxiety levels of the patients undergoing procedures in the room with the lavender aromatherapy were lower (Kritsidima et al., 2010). Although lavender oil is used for the management of anxiety and sleep disorders in varied populations, no studies to date have reported on the efficacy of lavender oil to better manage anxiety and sleep disorders in patients undergoing chemotherapy.

Patients with cancer experience symptoms from their disease and treatment, including fear of death, poor quality of life, and damaged relationships, which can cause a feeling of a loss of control, anxiety, and sleep disorders (Chandwani et al., 2012; Chang & Lin, 2017; Delsigne, 2013; Graci, 2005; NCI, 2016; Palesh et al., 2010; Yaranoğlu, 2015). Oncology nurses play an important role in the pharmacologic and nonpharmacologic management of anxiety and sleep disorders. Many pharmacologic treatments are used to manage anxiety and sleep disorders, but they can lead to adverse effects and economic loss (NCI, 2016). Nonpharmacologic treatments that are effective in treating anxiety and sleep disorders include participating in relaxation exercises, listening to music, shifting attention, practicing sleep hygiene, and using aromatherapy (Cramer, Lauche, Langhorst, Dobos, & Paul, 2013; Dóro, Neto, Cunha, & Dóro, 2017; Emberly, 2008; Firmeza et al., 2017; Gallagher, Lagman, & Rybicki, 2017; Ovayolu, Seviğ, Ovayolu, & Sevinç, 2014; Zupanec et al., 2017). The current study was designed to evaluate the effects of lavender oil on anxiety and sleep quality in patients receiving chemotherapy.

Methods

Participants

The study sample consisted of patients with cancer who were receiving chemotherapy in outpatient units. Inclusion criteria were as follows: patients with cancer aged 18 years or older who had the ability to smell, were receiving paclitaxel weekly, agreed not to use scented products, and volunteered to participate in the study. The exclusion criteria included having a chronic disease (cardiovascular disease, asthma), being diagnosed with a psychiatric disease (anxiety, panic attacks, depression), having a known history of allergies, and using anxiolytic drugs.

Outcome Measures

For the collection of data, the researchers used a patient identification form created for the study, The State-Trait Anxiety Inventory (STAI), and the Pittsburgh Sleep Quality Index (PSQI).

The patient identification form included questions about patients' socio-demographic characteristics (age, sex, educational status, marital status, information about caregivers), sleep characteristics (room temperature, sound, light, day and night sleep durations), and disease characteristics (diagnosis, treatment, and duration of disease).

The STAI is a self-evaluation questionnaire that uses short statements to evaluate how participants feel in a certain time

"The use of lavender oil significantly increased the sleep quality of patients with cancer."

or under a certain condition. It was adapted to Turkish by Öner and Le Compte (1985) and was used in this study. It has two subscales, the State Anxiety Scale (S-Anxiety) and the Trait Anxiety Scale (T-Anxiety), which are measured by a four-point Likert-type scale ranging from 1 (never) to 4 (always). According to reliability analysis, the Cronbach alpha internal consistency coefficients are from 0.94–0.96 for the S-Anxiety and from 0.83–0.87 for the T-Anxiety, respectively (Kara & Acet, 2012; Şirin, Kavlak, & Ertem, 2003). The STAI clearly differentiates between the temporary condition of state anxiety and the more general and long-standing quality of trait anxiety, helping professionals distinguish between feelings of anxiety and depression.

The PSQI was developed by Buysse, Reynolds, Monk, Berman, and Kupfer (1989), and Ağargün, Kara, and Anlar (1996) performed its validity and reliability analyses in Turkey. The Turkish version was used in this study. Although the PSQI consists of 24 items, it is scored using 19 items. It includes open-ended questions, such as "During the past month, when have you usually gone to bed at night?" as well as multiple-choice questions, such as "During the past month, how would you rate your sleep quality overall?" with answers ranging from 0 (very good) to 3 (very bad) or 0 (not during the past month) to 3 (three or more times a week). It has 7 components, each scored from 0–3. Total scores range from 0–21 points. Scores lower than five points indicate good sleep quality, and scores higher than five points indicate poor sleep quality (Ağargün et al., 1996).

Data Collection

Before initiating this study, the researchers obtained written permission from the ethical committee and administration of the Private Ümit Hospital in Eskişehir, Turkey. After the researchers recruited patients who met the criteria, they obtained written consent. Using the random-number method on a computer, the authors randomized participants to one of three groups (lavender oil group, tea tree oil group, or control group). The patients were homogeneously distributed across groups, and the data were collected by a nurse who was independent of the research team. The patients' records and group numbers were delivered to the

administering nurse in a closed envelope. Numbered labels were affixed to the bottles of aromatic oils to blind the contents of the bottles to patients and the administering nurse.

The researchers bought the lavender essential oil (*Lavandula hybrida*) from an herbal product firm with quality certifications, consisting of business registration G06-3231 from the Ministry of Food, Agriculture, and Livestock, and ISO 9001:2008 from the International Organization for Standardization. The tea tree oil used in the current study was bought from the same herbal product firm. In their study, Howard and Hughes (2008) used tea tree oil, which does not have a sedative or relaxing effect, to create a placebo effect, as it was used in the current study.

In the first and second stages of the study, lavender oil and tea tree oil were administered to the respective intervention groups, and no aromatherapy was administered to the control group. Three drops of lavender or tea tree oil were put onto a piece of cotton that was placed on each patient's neck and shoulders, about 10 inches below the nose.

FIRST ASSESSMENT: The authors used a patient identification form, the STAI (T-Anxiety and S-Anxiety), and the PSQI for the first evaluation of all groups just before the first cycle of chemotherapy. During chemotherapy, the nurse administered lavender and tea tree oil to the respective intervention groups. No aromatherapy was administered to the patients in the control group. When the patients completed chemotherapy, the S-Anxiety was readministered to all patients.

SECOND ASSESSMENT: The nurse gave written and verbal information about the use of lavender or tea tree oil at home to patients in the respective intervention groups when they were discharged after chemotherapy. For one month, the lavender group patients and tea tree oil patients smelled the oil every night at 9 pm for five minutes at home. After chemotherapy, the T-Anxiety and PSQI were readministered, and a second evaluation was performed.

Statistical Methods and Data Analysis

Descriptive statistics for quantitative variables were calculated and presented as a mean and standard deviation. Frequencies and percentages were given for qualitative variables, and the Shapiro-Wilk test was used to evaluate the normality of quantitative variables. Scores from the scales were assessed with two-way mixed analysis of variance (ANOVA) using general linear models for repeated measures procedure from IBM SPSS Statistics, version 21.0. The model included group and time as main effects and a group * time interaction effect term. Post hoc testing was carried out only for significant interactions and was performed using a simple effect analysis with Bonferroni adjustment. The relationship between categorical variables was evaluated using Pearson chi-square analysis. A probability value of less than 0.05 was considered significant, unless otherwise noted.

Findings

Sample Characteristics

Of the participants, 30 were in the lavender group, 20 were in the tea tree oil group, and 20 were in the control group. The mean age of the participants was 58.22 years. Most were women and were married, and about half were graduates of primary school. The distribution of patients by age, sex, educational status, marital status, and income level was homogeneous ($p < 0.05$) (see Table 1). In addition, 10 expressed that their income met their expenses, most had breast cancer, 22 were undergoing paclitaxel-carboplatin treatment, and 7 had not experienced any symptoms in the past week.

State-Trait Anxiety Inventory Scores

According to the S-Anxiety and T-Anxiety scores from the first assessment before chemotherapy, all patients had moderate state and trait anxiety. In the second assessment, S-Anxiety and T-Anxiety mean scores decreased in all groups.

Table 2 shows descriptive statistics. In terms of S-Anxiety values, no difference was found among groups ($F_{[2.67]} = 1.16$, $p = 0.32$). The authors did not find a significant change in S-Anxiety values from the first to second assessment ($F_{[1.67]} = 1.981$, $p = 0.164$). The change that occurred between S-Anxiety values from the first to second assessment did not vary by group ($F_{[2.67]} = 0.826$, $p = 0.442$). The authors did not perform power analysis because no significant difference existed in group, time, or group * time interaction.

The model established for T-Anxiety showed that no difference existed among all groups ($F_{[2.67]} = 1.246$, $p = 0.294$); however, considering all participants, a significant change in T-Anxiety values was observed from the first to second assessment ($F_{[1.67]} = 9.595$, $p = 0.003$), which also differed among groups ($F_{[2.67]} = 11.002$, $p < 0.001$). The researchers examined reasons for this difference and determined that, when the groups were compared at the first and second assessments, there was a difference only between the lavender and tea tree oil groups at the second assessment ($p = 0.046$). However, when comparing group measurements at the first and second assessments, a significant difference was found only between measurements for the lavender group ($p < 0.001$). The posterior power of these comparisons performed in terms of the group * time interaction was 98%.

Pittsburgh Sleep Quality Index Scores

In the first assessment performed before chemotherapy, the PSQI mean score for each group was higher than five points; in the second assessment after chemotherapy, the PSQI mean score decreased only in the lavender and tea tree oil groups (PSQI: L = 3.86 [SE = 0.58], T = 5.9 [SE = 0.722], C = 7.15 [SE = 0.722]).

Given all measurements obtained in this study, no difference existed among groups in terms of PSQI ($F_{[2.67]} = 1.721$, $p = 0.187$); however, the researchers found a significant change

TABLE 1.
SAMPLE CHARACTERISTICS

CHARACTERISTIC	LAVENDER GROUP (N = 30)		TEA TREE GROUP (N = 20)		CONTROL (N = 20)		TOTAL (N = 70)		p
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	
Age (years)	57.73	12.81	57.55	12.87	59.65	13.37	58.22	12.83	> 0.05
CHARACTERISTIC	n		n		n		n		
Sex (χ^2 = 0.917)									0.653
Female		24		17		18		59	
Male		6		3		2		11	
Educational status (χ^2 = 0.633)									0.386
Primary school		15		7		11		33	
Secondary school		7		9		5		21	
High school		4		2		4		10	
Literate		4		2		–		6	
Marital status (χ^2 = 0.243)									0.877
Married		24		15		15		54	
Single		6		5		5		16	
Income level (χ^2 = 3.118)									0.596
Income meets expenditure		23		15		17		55	
Income exceeds expenditure		6		3		1		10	
Income does not meet expenditure		1		2		2		5	
Cancer type									–
Breast		18		12		16		46	
Lung		6		3		2		11	
Urothelial		1		–		1		2	
Ovarian		3		2		1		6	
Gastrointestinal		2		–		–		2	
Unknown origin		–		2		–		2	
Renal		–		1		–		1	
Chemotherapy									–
Paclitaxel and carboplatin		11		7		4		22	
Paclitaxel and trastuzumab		10		7		7		24	

Continued on the next page

TABLE 1. *(CONTINUED)*
SAMPLE CHARACTERISTICS

CHARACTERISTIC	LAVENDER GROUP (N = 30)		TEA TREE GROUP (N = 20)		CONTROL (N = 20)		TOTAL (N = 70)		
	n		n		n		n		p
Chemotherapy *(continued)*									–
Paclitaxel	3		5		4		12		
Paclitaxel, trastuzumab, and carboplatin	5		–		5		10		
Paclitaxel and gemcitabine	1		1		–		2		
Symptoms experienced in the past week									–
Fatigue and weakness	11		15		8		34		
Anorexia, fatigue, and pain	15		2		4		21		
Numbness in hands and feet	1		1		5		7		
None	3		2		3		8		
SE—standard error									

between the first and second measurement values ($F[1.67]$ = 33.162, $p < 0.001$), which also differed among groups ($F[2.67]$ = 8.991, $p < 0.001$). In terms of measurement time, this study revealed a significant difference in measurements between the lavender and control groups only at the second assessment. The group comparisons showed a significant difference between measurements at the first and second assessments for the lavender and tea tree oil groups ($p < 0.001$). The posterior power of these comparisons in terms of the group * time interaction was 95%.

Discussion

The use of lavender oil in different therapeutic activities has been explored by various studies (Kianpour, Mansouri, Mehrabi, & Asghari, 2016; Koca Kutlu, Yılmaz, & Çeçen, 2008; Maddocks-Jennings & Wilkinson, 2004; Ovayolu et al., 2014; Smith & Kyle, 2008; Takeda, Watanuki, & Koyama, 2017). Several studies support the ongoing use of lavender oil as part of an integrated approach to invasive interference (Karadag, Samancioglu, Ozden, & Bakir, 2017; Trambert, Kowalski, Wu, Mehta, & Friedman, 2017). Aromatherapy massage with lavender oil has had positive effects on patients with cancer (Ovayolu et al., 2014). In the current study, trait anxiety was reduced and sleep quality improved with the use of lavender oil.

The first assessment revealed that the sleep quality of each group was poor prior to the use of the oils and that participants experienced a moderate level of state and trait anxiety.

The present study evaluated the immediate anxiety levels of the patients and revealed that the medium level of state anxiety observed in the control group before chemotherapy did not change, along with the state anxiety levels of the two groups that smelled lavender oil and tea tree oil during chemotherapy. No difference was found the state anxiety levels among groups. A study examining the effects of one drop of *Lavandula hybrida* oil before surgical operations by Braden et al. (2009) revealed that it reduced patients' state anxiety. Other studies have also found that the inhalation of lavender oil reduces state anxiety (Koca Kutlu et al., 2008; Kritsidima et al., 2010). However, the current study revealed no effect of *Lavandula hybrida* oil (three drops) on participants' state anxiety, which was largely in agreement with the findings of other studies (Howard & Hughes, 2008; Perry, Terry, Watson, & Ernst, 2012).

A study by Bikmoradi et al. (2015) revealed that smelling lavender for 20 minutes two days per week did not reduce participants' anxiety, and these researchers suggested increasing the duration of aromatherapy to determine the effect of lavender. In the current study, results did not indicate a significant difference in state anxiety levels because the S-Anxiety was administered to patients before and after chemotherapy, the time between these two administrations was short according to chemotherapy protocols (a minimum of one hour and a maximum of four hours), and the patients may have given the same responses at the first and second assessments because they remembered their prior answers. The time invariance of scales defines the relationship

among datasets obtained by measuring anything in different time periods under similar conditions (Karasar, 2005). In the current study, the time invariance criterion of the S-Anxiety was not met.

The current study also showed no difference in trait anxiety levels among patients in the tea tree oil and control groups at the first and second assessments, whereas the trait anxiety levels of patients in the lavender group decreased by the second assessment. Published studies have reported that, because of its anxiolytic and sedative effects (Conrad & Adams, 2012; Fismer & Pilkington, 2012; Kianpour et al., 2016; Maddocks-Jennings & Wilkinson, 2004; Woelk & Schläfke, 2010), lavender provides spiritual comfort and physical and emotional well-being (Franco et al., 2016; Hur, Song, Lee, & Lee, 2014; Koulivand et al., 2013; Redstone, 2015). Ovayolu et al. (2014) found that aromatherapy massage and aromatherapy with lavender oil maintain physical comfort in the short term and that lavender oil can be used to manage psychological problems in the long term. Essential compounds, such as linalool and linalyl acetate in lavender oil, are linked to receptors in the olfactory bulb by smelling, and a therapeutic effect arises in the area where actions and moods, such as fear and anger, are controlled and motivated in the limbic system (Huang & Capdevila, 2017; Koulivand et al., 2013; Lis-Balchin & Hart, 1999; Maddocks-Jennings & Wilkinson, 2004; NCI, 2018). The current study determined that lavender oil is effective in managing anxiety if it is regularly used every day for a month. Patients expressed satisfaction with the pleasant aroma of lavender in the room when administered during chemotherapy.

The current study revealed that the use of lavender significantly increased the sleep quality of patients with cancer based on the assessment time compared to the other two groups. The sleep quality of patients in the tea tree oil group increased in the second assessment compared to the first assessment; however, no statistical difference was found between the lavender and control groups. As with other studies (Karadag et al., 2017; Keshavarz Afshar et al., 2015), the current study revealed that the use of lavender oil improved sleep quality.

Otaghi, Qavam, Norozi, Borji, and Moradi (2017) found that essential lavender oil was not effective in improving sleep quality. However, Otaghi et al. (2017) did not report on the anxiety level of patients. There is a negative relationship between sleep quality and anxiety. In the current study, patients began to relax, revealed by a decrease in trait anxiety, and their sleep quality improved. Tea tree oil had no effect on state and trait anxiety levels but did increase sleep quality. The current authors hypothesized that tea tree oil had a placebo effect; statistical analyses confirmed the superiority of lavender oil in improving sleep quality.

Limitations

The study is limited to patients who were treated with weekly paclitaxel and who completed the STAI and PSQI. The effects

TABLE 2.

DESCRIPTIVE STATISTICS OF STAI AND PSQI SCORES BY GROUP AND TIME

| GROUP AND TIME | LAVENDER GROUP | | TEA TREE GROUP | | CONTROL | | P | | |
	X̄	SE	X̄	SE	X̄	SE	TIME	GROUP	GROUP * TIME
S-Anxiety							0.164	0.320	0.442
First assessment	41.4	1.49	45.3	1.82	42	1.82			
Second assessment	42.36	1.53	45.3	1.88	42.4	1.88			
T-Anxiety							0.003	0.294	< 0.001
First assessment	44.8	1.27	45.4	1.556	45.4	1.556			
Second assessment	40.833	1.123	45.25	1.376	45.25	1.376			
PSQI							< 0.001	0.187	< 0.001
First assessment	7.63	0.82	9.15	1.009	7.05	1.009			
Second assessment	3.86	0.58	5.9	0.722	7.15	0.722			

PSQI—Pittsburgh Sleep Quality Index; S-Anxiety—State Anxiety Scale; SE—standard error; STAI—State-Trait Anxiety Inventory; T-Anxiety—Trait Anxiety Scale

of lavender oil inhalation on anxiety and sleep quality should be evaluated in a larger population who receive other chemotherapy protocols. Although the authors tried to blind the nurse and patients to the aromatic oils used in the study, blinding failed because participants were familiar with the scent of lavender.

Implications for Nursing and Conclusion

The current study showed that the patients treated with chemotherapy had a medium level of state and trait anxiety and a low level of sleep quality. The patients treated with tea tree and lavender oil had no complaints associated with the application of oils in the study. This study determined that three drops of lavender oil inhaled nightly before sleep reduced patients' trait anxiety levels and improved sleep quality.

As a result, oncology nurses should regularly assess patients' anxiety and sleep status, learn about complementary treatment methods for the management of anxiety and sleep disorders, and include lavender oil during care. Lavender oil has no adverse effects, and it is more cost effective than other complementary methods.

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