

## Research Article

# The Effect of Aromatherapy with Lavender Oil on the Health-Related Quality of Life in Patients with Fibromyalgia

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The aim of this study was to evaluate the effect of lavender oil, which has been used in complementary medicine as an aromatherapeutic, on the health-related quality of life in patients diagnosed with fibromyalgia and to determine the main volatile compounds of lavender oil with healing effects. Forty-two patients aged 18 years and over who were diagnosed with fibromyalgia according to the American College of Rheumatology 2010 diagnostic criteria and used lavender oil as an aromatherapeutic by applying it on the wrist or via inhalation for four weeks were included in this study. The Short-Form (SF)-36 Quality of Life Scale was administered to the patients at baseline and after four weeks of lavender oil treatment to determine whether there was any change in their quality of life. The averages and correlation levels between the scores were calculated with the paired-sample *t*-test taking  $p < 0.05$  as the statistical significance limit. In addition, the chromatographic analysis of lavender oil was performed with the combined headspace solid-phase microextraction and gas chromatography-mass spectrometry methods. When the quality of life scores were evaluated at baseline and after four weeks of lavender oil treatment, improvements were detected in all the subscales of SF-36 at the end of the study. It was found that all the subscale scores, except for general health, were statistically significantly higher compared to the baseline scores ( $p < 0.05$ ). The major volatile compounds detected in lavender oil were linalool (29.33%) and linalyl acetate (27.69%). The remaining main compounds were terpinolene, cis-ocimene, eucalyptol, and lavandulol in the order of frequency, which is consistent with the literature. To our knowledge, this is the first study investigating the effect of lavender oil aromatherapy on patients diagnosed with fibromyalgia, and our results support that lavender oil aromatherapy significantly improves the quality of life in these patients. However, further comprehensive studies are needed to confirm our findings.

## 1. Introduction

Fibromyalgia is a chronic pain syndrome that is more common in adults between the ages of 20 and 55 years and especially in women, with the prevalence ranging from 2 to 8% in the general population. Common musculoskeletal pain, sleep disorders, and fatigue are often found together [1]. Despite various complaints of patients, no significant impairment is found in physical examination and laboratory tests, suggesting that these symptoms may be psychological [2]. Psychological factors are an important component of all types of pain, especially chronic pain, and they create an interaction in a vicious circle [3].

It is known that the quality of life of individuals with fibromyalgia syndrome is affected negatively [4]. Widespread pain, fatigue, sleep disorders, and psychiatric symptoms are effective in deteriorating the quality of life, cause loss of labor force, and result in high health-related expenses. The main goal in the treatment of the disease is to increase the quality of life by reducing pain [5]. Quality of life is a general parameter that shows the comfort levels of individuals, and health-related quality of life scales are widely used in evaluating the effects of many chronic diseases, including fibromyalgia, on individuals [6–8]. The Short-Form Quality of Life Scale (SF-36), adapted into Turkish by Koçyiğit et al., has been proven to be reliable and

valid and is one of the frequently used quality of life scales in the assessment of health-related quality of life. It consists of 36 items structured under eight subscales. The distribution of the items according to the subscales is as follows: physical functionality (10 items), social functionality (two items), role limitations due to physical functionality (four items), mental role (emotional problems) (three items), mental health (five items), vitality (four items), body pain (two items), and general health (six items). Separate scores are obtained from each subscale, with a high score indicating good health in the corresponding subscale. Each subscale is evaluated separately, and it is not possible to calculate the total score for the whole scale [9, 10].

Analgesics, muscle relaxants, and anxiolytics are generally used to reduce the complaints caused by fibromyalgia [11]. However, studies have also reported that these drugs may cause side effects in some individuals [12]. Due to these side effects, patients sometimes refer to complementary medicine approaches, such as nonpharmacological exercise, mind and body therapy, acupuncture, massage therapy, and aromatherapy [13]. Lavender oil, an aromatherapeutic agent, is also increasingly used for this purpose due to its analgesic, anti-inflammatory, and anxiolytic effects [14]. Lavender oil is considered to physically and psychologically calm the individual and relieve anger and fatigue [15]. The flowers' leaves and oil of lavender (*Lavandula angustifolia*) contain linalyl acetate, linalool, perillyl alcohol, 1,8-cineole (eucalyptol), and at least 100 other known compounds. It is recognized as "generally safe" to be consumed as food by the US Food and Drug Administration [16].

This study aimed to evaluate the effect of lavender oil, which has been used in complementary medicine (aromatherapy) for many years and recently become more popular, on the health-related quality of life in patients diagnosed with fibromyalgia and to determine the volatile compounds of lavender oil with healing effects.

## 2. Materials and Methods

Male and female patients aged 18 years and over who presented to the physical therapy and rehabilitation outpatient clinic of Adana City Hospital in the second half of 2019 due to widespread pain and were diagnosed with fibromyalgia based on the American College of Rheumatology 2010 fibromyalgia diagnostic criteria (FMS ACR) [17] were included in this study. Patients with any chronic disease, pregnant and breastfeeding women, patients with a history of medical treatment for fibromyalgia, those that used medical treatment together with aromatherapy, and those that used drugs for sleeping disorders during and/or before applying lavender oil were excluded from the study. Forty-two patients who used aromatherapeutic lavender oil (product license/permit approval code: E-97834074-399-2344860—Istanbul Provincial Directorate of Agriculture) by applying it on the wrist and via inhalation for four weeks were evaluated. The mixture, prepared by dropping 1 ml of essential lavender oil in 10 ml of fixed oil, was applied (three drops) on the wrist and inhaled for 10 minutes, keeping it about 10 cm away from the nose. This

intervention was recommended for each patient once a day before going to bed in the evening, and all subjects noted that they received the intervention as recommended. The SF-36 Quality of Life Scale was administered to the patients to determine their experiences before and after four weeks of using lavender oil via face-to-face (during follow-up visits) or phone interviews. The SF-36 scores were calculated by scoring the items in eight subscales from 0 to 100, and the obtained data were statistically analyzed using SPSS (version 21). The averages and correlation levels between the scores were calculated with the paired-sample *t*-test taking  $p < 0.05$  as the statistically significant limit. This study was approved by the Adana City Hospital Clinical Ethic Board.

In Cukurova University, Department of Horticulture, the chromatographic analysis of lavender oil was performed with the combined headspace solid-phase microextraction (HS/SPME) and gas chromatography-mass spectrometry (GC/MS) methods for the determination of the volatile compounds of lavender oil. The extraction of essential oils from lavender oil was performed by treating the oil with 5 M  $\text{CaCl}_2$  on a magnetic stirrer at 3°C for 20 minutes in a standard headspace glass bottle (Supelco, 75 mm × 23 mm). Analyses were undertaken with three replications. The volatiles were absorbed by polydimethylsiloxane (PDMS) using an SPME needle (Supelco, Bellefonte, PA). PerkinElmer GC (Clarus 600) equipped with HP-5 MS (30 m × 0.25 mm × 0.25 μm) and a fused-silica capillary column were used for the separation of volatiles. The carrier gas was helium (0.6 ml/min). The injection temperature was set as 280°C. The initial column heating was 40°C for two minutes, followed by an increase of temperature to 250°C at a rate of 5°C/minute, at which the sample was kept for 20 minutes. Compounds were determined by obtaining their mass spectra and using the NIST, Wiley, and flavor libraries according to their retention time.

## 3. Results and Discussion

**3.1. Results.** Thirty-six of the individuals participating in the study were female (85.7%), and six were male (14.3%). The mean age of women was 44.6, and that of men was 48.3. When the quality of life scores were evaluated at baseline and after four weeks of lavender oil treatment, improvements (higher scores) were detected in all subscales of SF-36. It was found that all the subscale scores, except for general health, were statistically significantly higher compared to the baseline ( $p < 0.05$ ) (Table 1).

As shown in Table 2, a total of 33 volatile compounds were detected, including two ketones, 10 alcohols, nine esters, and 12 terpenes. Alcohols (40.60%) formed the largest part of volatiles in lavender oil followed by esters (32.29%), terpenes (25.53%), and ketones (1.58%). The major volatile compounds detected in lavender oil were linalool (29.33%) and linalyl acetate (27.69%). The remaining main compounds were terpinolene, cis-ocimene, eucalyptol, and lavandulol in the order of frequency. These compounds are consistent with those previously reported in the literature [18].

TABLE 1: Comparison of the quality of life scores at baseline and after four weeks of lavender oil treatment.

Subscales	Baseline	Min–max	After four weeks	Min–max	<i>p</i>
General health	36.10 ± 20.90	0–75	39.27 ± 14.60	15–95	>0.05
Physical functioning	53.41 ± 27.44	0–100	75.85 ± 23.1	30–100	<0.001
Physical role	26.83 ± 38.89	0–100	68.29 ± 35.81	0–100	<0.001
Mental role	24.39 ± 40.16	0–100	76.42 ± 30.95	0–100	<0.001
Social functioning	40.24 ± 24.13	0–87.5	64.94 ± 15.62	37.5–100	<0.001
Body pain	35.91 ± 27.03	0–100	66.71 ± 18.49	35–100	<0.001
Mental health	37.56 ± 22.00	0–80	70.73 ± 13.87	32–100	<0.001
Vitality	32.20 ± 21.65	0–80	67.48 ± 15.00	40–100	<0.001

TABLE 2: Volatile compounds of lavender oil.

RT	Compound name	%
Ketones		
2.337	2-Propanone (CAS)	0.92
18.259	Camphor (CAS)	0.66
	Total ketones	1.58
Alcohols		
13.789	1-Hexanol (CAS)	0.25
14.958	3-Octanol (CAS)	0.62
16.535	1-Octen-3-ol	1.25
17.052	<i>cis</i> -Linalool oxide	0.40
19.446	Linalool	29.33
22.453	Lavandulol	2.91
22.93	Alpha-Terpineol	1.92
25.301	Nerol (CAS)	0.23
26.357	<i>trans</i> -Geraniol	0.47
9.731	Eucalyptol	3.22
	Total alcohols	40.60
Esters		
6.221	Acetic acid, butyl ester (CAS)	0.19
10.146	Butanoic acid, butyl ester (CAS)	0.66
11.761	Acetic acid, hexyl ester (CAS)	0.53
13.473	3-Octanyl acetate	0.68
13.62	Propanoic acid, 2-methyl-, hexyl ester (CAS)	0.29
14.74	Oct-1-en-3-yl acetate	1.00
15.756	Butanoic acid, hexyl ester (CAS)	0.94
19.968	Linalyl acetate	27.69
24.401	Geranyl acetate	0.31
	Total esters	32.29
Terpenes		
5.002	Alpha-Pinene	0.93
5.13	l-Phellandrene	0.56
5.879	Camphene (CAS)	0.61
8.114	Delta-3-carene	0.41
8.679	Beta-Myrcene	0.58
9.575	Bicyclo[2.2.1]hept-2-ene, 1,7,7-trimethyl	2.50
10.82	<i>cis</i> -Ocimene	3.86
10.993	Gamma-Terpinene	0.45
11.991	Alpha-Terpinolene	0.45
14.533	2,6-Dimethyl-2,4,6-octatriene	0.38
20.918	Terpinolene	13.59
20.234	Santalene	1.21
	Total terpenes	25.53

RT: retention time.

3.2. Discussion. Fibromyalgia is a common chronic pain syndrome characterized by sleep disturbance, fatigue, and anxiety, and although its cause is not exactly known, it has been suggested in a study that it is caused by a disorder in

pain physiology. Fibromyalgia symptoms significantly affect the overall quality of life. Although a complete cure cannot be achieved, the treatment aims to reduce the symptoms and increase the quality of life of patients [19]. Studies have also shown that the aromatherapeutic application of lavender oil is used as a complementary medicine approach to relieve chronic pain, anxiety, and sleep disorders, which are the basic symptoms of fibromyalgia [15, 20–22]. While there is insufficient evidence for the curative effects of lavender oil aromatherapy on acute pain [23–25], there are studies showing that it has curative effects, especially in the case of chronic pain [26, 27].

Although the symptoms, causes, and mechanisms of pain differ, they can be evaluated under three main headings: acute pain, inflammatory pain, and neuropathic pain. Neuropathic pain and inflammatory pain can cause chronic pain syndromes [22, 28]. The analgesic and anti-inflammatory effects of lavender oil have been demonstrated, and it has been stated that it exerts an opioid-like effect, and its mechanism of action may be related to the activation of ion channels via protein G [22]. It has also been shown that linalool, a monoterpene alcohol found in lavender volatile compounds, activates hypothalamic orexin neurons, which play an important role in pain physiology, significantly increasing the pain threshold and reducing pain behavior [29].

Anxiety is one of the common symptoms of fibromyalgia, and studies have reported that lavender essential oil, especially administered by inhalation, is effective in reducing anxiety levels and can be used in the treatment of chronic anxiety as complementary therapy. It is considered that aromatherapy shows its therapeutic effect both psychologically and through the physiological effects of the volatile compounds it contains, and it is particularly effective in the limbic system. It has also been stated that lavender oil can increase the effect of gamma-aminobutyric acid in the amygdala, with an effect similar to benzodiazepines [15, 20, 27]. In addition, a clinical study investigating the effects of lavender aromatherapy on sleep disorders reported that lavender had a lasting effect on sleep quality and a rebalancing effect on the sleep cycle [21].

In the current study, the SF-36 Scale was preferred because its subscales include components such as general body pain, anxiety, and sleep disturbance. We did not find any clinical study in the literature that used SF-36 to assess these complaints after lavender oil aromatherapy in patients

TABLE 3: Average values of the SF-36 subscale scores previously reported for the Turkish society [30].

Subscales	Female	Male
General health	69.1 ± 16.9	73.6 ± 14.9
Physical functioning	80.6 ± 21.7	89.8 ± 19.3
Physical role	82.9 ± 28.6	89.8 ± 19.3
Mental role	89.0 ± 22.5	92.8 ± 15.1
Social functioning	90.1 ± 12.9	91.7 ± 12.8
Body pain	81.0 ± 20.2	85.1 ± 16.4
Mental health	70.1 ± 11.4	71.0 ± 10.6
Vitality	63.4 ± 13.7	65.7 ± 11.9

with fibromyalgia, and therefore, our study can be considered a pioneer in this and similar therapies.

When the subscales of SF-36 were evaluated, it was observed that the scores of the general health subscale after aromatherapy did not statistically significantly differ compared to the baseline, and they were also below the average scores (female-male) of the Turkish population identified by Demiral and colleagues as shown in Table 3 [30]. Although there was a statistically significant improvement in the scores of physical functioning, physical role, mental role, social functioning, and body pain subscales, even the post-aromatherapy scores in these subscales were below the average scores of the Turkish population for both genders. When the scores of the mental health and vitality subscales were evaluated, there was a statistically significant increase in these scores, and they were similar to the average scores of the Turkish population. It is considered that this improvement may be related to the analgesic, anti-inflammatory, sleep-regulating, and anxiety-reducing effects of linalool and linalyl acetate, which are the major volatiles contained in lavender oil. We found no statistically significant increase in the general health subscale scores between the two evaluation times, which can be attributed to the limited number of patients enrolled in the study and the duration of treatment being too short to make a general health assessment.

#### 4. Conclusions

After lavender oil aromatherapy, there was a statistically significant increase in the perception of well-being in all subscales, except for the general health subscale, and this increase in the scoring of the mental health and vitality subscales was similar to the average values of the healthy Turkish population. In line with these data, it can be stated that lavender oil aromatherapy can improve the health-related quality of life of patients with fibromyalgia. However, further comprehensive studies are needed to confirm our findings.

#### Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

#### Conflicts of Interest

The authors declare that they have no conflicts of interest regarding the publication of this paper.

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