Breathe in Lavender, Breathe Out Stress: Essential Oils for Stress, Burnout, and Compassion Fatigue

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Abbreviations

EO	**Essential oil**
5-HT1A	**5-hydroxytryptamine 1A**
LEO	**Lavender essential oil**
SLO	**Standardized lavender oil**

Abstract

Stress, burnout, and compassion fatigue have been recognized as common concerns in veterinary medicine. The objectives of this article are to describe how essential oils (EOs) help the veterinary team cope with stress, counter burnout, and prevent compassion fatigue and to present practical ideas for incorporating EOs into a stress management plan. Animal model studies, clinical trials, and meta-analyses on the topic of EOs and well-being are reviewed. Physiological and pharmacological mechanisms of calming and anxiolytic EOs are examined. Some of the successful interventions that use EOs in human medicine, including Code Lavender®, are described. Finally, steps for safely and effectively incorporating EOs into a veterinary stress management plan are presented.

Introduction

Stress, burnout, and compassion fatigue among health care personnel are common, serious entities with devastating personal and professional consequences (1). Half of all nurses report being emotionally exhausted, two-thirds have difficulty sleeping, and one-fourth are clinically depressed (2). Estimates of physician burnout approach 50% (2, 3).

Statistics for veterinarians are even worse than for their human counterparts. Veterinarian burnout scores are nearly 40% higher than physician burnout scores, despite veterinarians working fewer hours per week (4). According to the recent Merck Animal Health Veterinarian Wellbeing Study II, stress in veterinarians was considered the most important issue facing the profession (4).

Chronic stress causes physiological breakdown: blood sugar dysregulation, hormone imbalances, adrenal and thyroid dysfunction, reduced digestion, and impaired liver function (5). Chronic stress also causes emotional breakdown: loss of enthusiasm for work and feeling helpless, trapped, and defeated (1).

In addition, chronic stress adversely affects sleep quality (6). Insufficient sleep can lead to difficulty focusing, lethargy, irritability, and increased risk of workplace injury (3). Sleep deprivation is also associated with increased sensitivity to stressful events and increased negative emotional reactivity, and poor sleep quality has been correlated with burnout (6).

Although essential oils (EOs) cannot eliminate a stressful work environment, they can help generate a positive response to daily stressors and facilitate restorative sleep (7-12). This article describes how EOs can help the veterinary team cope with stress, counter burnout, and prevent compassion fatigue and presents practical ideas for incorporating EOs into a stress management plan.

Physiology

The olfactory system has an intimate connection with emotion. Unique among the senses, olfactory neuroanatomy

is intertwined with primary emotion areas of the brain, including the amygdala, hippocampus, and orbitofrontal cortex (13). Consequently, smell can trigger memories and emotions such as anxiety, fear, and joy.

Upon inhalation, EOs travel up the nose and bind to receptor sites in the olfactory epithelium. These receptors send signals to the olfactory bulb, which then transmits them to the gustatory cortex (taste center) and limbic system. Physiologic responses to EOs include altered heart rate, respiratory rate, blood pressure, and detoxification pathways; antioxidant activation; and hormone and immunoglobulin release (7, 14-17). For example, patients undergoing dental surgery who were exposed to inhaled bitter orange EO (*Citrus aurantium*, also known as sour orange and Seville orange) experienced reduced anxiety and a significantly lower mean blood pressure, pulse rate, and respiratory rate than patients in the control group (14).

EOs are complex molecules. Analysis of lavender (*Lavandula angustifolia*) essential oil (LEO) with a gas chromatograph-mass spectrometer equipped with 3 capillary columns of different polarities identified 40 compounds, accounting for 92.03% of the total EO. Each vertical peak in the 3 chromatograms represents one of these unique compounds (**Figures 1A-C**) (18).

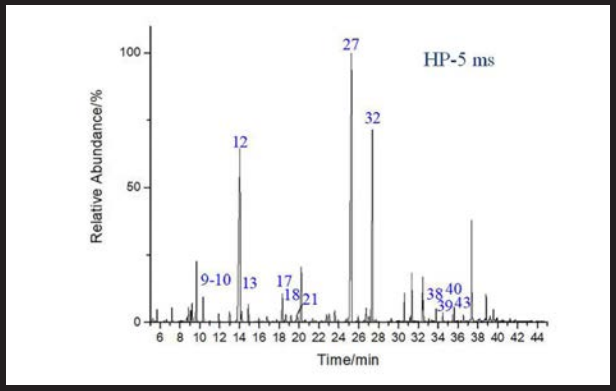
Their complexity in chemical composition allows EOs to have multiple simultaneous effects. One study showed that although some components of bitter orange EO from the leaves and twigs (petitgrain) act on the parasympathetic nervous system to create a sedative effect, others act on the sympathetic branch to yield a stimulating effect. Subjects of this study demonstrated a balanced overall response, with reduced stress levels yet increased attentiveness and alertness, facilitating workplace performance (19).

Pharmacology/Pharmacokinetics

EOs are aromatic, volatile oils that often contain terpenoids, including monoterpenes, sesquiterpenes, and diterpenes. Due to their lipophilic nature, they easily traverse cell membranes and exhibit pharmacologic effects at nanomolar concentrations (20).

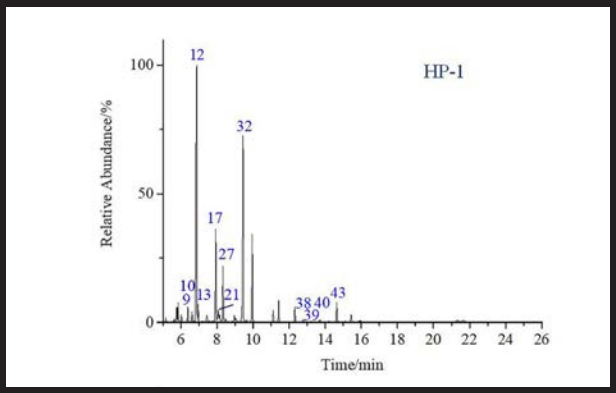
EOs have coevolved with plants to defend against bacteria, fungi, viruses, and parasites; attract pollinators; and help contain areas of trauma. To effectively communicate a variety of smell messages, EOs need a diverse chemi-

Figure 1A



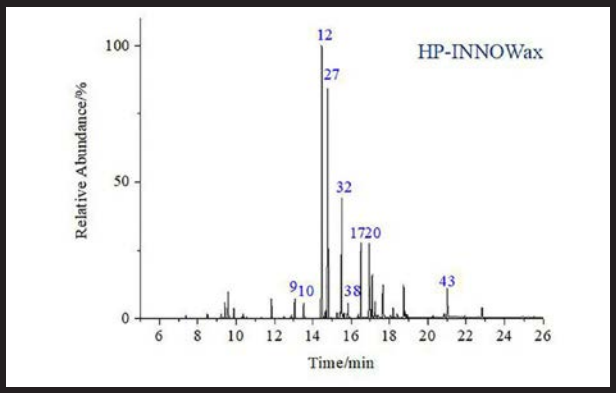
Chromatograms of LEO separated by silica gel column chromatography and preparative gas chromatography with 3 capillary columns. Figure 1A: Capillary column HP5-ms.

Figure 1B



Capillary column HP-1.

Figure 1C



Capillary column HP-INNOWax.

Numbers correspond to isolated individual compounds. Example: Peak 12 is linalool, and peak 27 is linalyl acetate (18). (Figures reprinted under the terms and conditions of the Creative Commons Attribution (CC BY) license [http://creativecommons.org/licenses/by/4.0/]).

cal vocabulary. Their complex pharmacology reflects the multitude of chemical constituents (up to several hundred) in a single essential oil).

Although historical records and anecdotal reports describe some of the profound effects that EOs have on the body, more recent advances in technology are facilitating the ability to reveal specific mechanisms of action. To simplify research on EO pharmacology and pharmacokinetics, current investigations often focus on a small number of isolated or synthetic EO constituents.

EOs act within seconds on the amygdala, the emotional center of the brain, making them especially useful as potential anxiolytic agents. Some citrus EOs could be useful in reducing stress-induced anxiety (14). For example, rats that inhaled bitter orange EO spent more time in active social interaction compared with control subjects, and mice given oral bitter orange EO spent more exploration time in the open arms of an elevated plus maze (14, 21). Bitter orange EO also demonstrated significant anxiolytic effects in other animal models studies, corroborated by different research groups (22).

One animal model experiment showed that these anxiolytic-like effects were reversed by a 5-hydroxytryptamine 1A (5-HT1A) receptor antagonist but not by a benzodiazepine antagonist (flumazenil), suggesting serotonergic mediation. Other animal model studies support GABAA/benzodiazepine mediation (14, 21).

Another citrus EO, lemon (*Citrus limon*), also increased the time that mice spent on the open arms of an elevated plus maze (21). The benzodiazepine antagonist flumazenil as well as a 5-HT1A receptor agonist and a nonselective dopamine agonist all blocked the effect of lemon EO in the maze, suggesting that the anxiolytic effect may be mediated by either GABAA/benzodiazepine, serotonergic, and/or dopaminergic neurotransmissions (21).

Linalool is a constituent of certain EOs, such as lavender and lemongrass (*Cymbopogon citratus*), which have shown anxiolytic-like effects. Mice that inhaled 3% linalool for 60 minutes spent more time in the light side in a light/dark test, and mice that inhaled 1% linalool for 60 minutes demonstrated increased social interaction. An amnesic effect (impaired step-down inhibitory avoidance) was also seen in the linalool group as well as in a diazepam group (positive control). Linalool interacts with GABAA receptors and potentiates GABA transmission. Linalool has also been shown to prevent voltage-operated calcium channel activation, similar to the effect of pregabalin (21).

As one of the most popular and versatile EOs, lavender has been referred to as the "Swiss army knife" of EOs. Some of the most important therapeutic components of LEO include linalool, linalyl acetate, camphor, terpinen-4-ol, ß-ocimene, and 1,8-cineole (22). Linalool concentrations may reach as high as 51%, and linalyl acetate may approach 35% (23). Variations in the concentrations of these and other components occur depending on the subspecies as well as cultivation and extraction techniques.

In order to facilitate research design and eliminate the inherent variability associated with plants grown in different microclimates, a standardized lavender oil (SLO) extract has been formulated.

Potential mechanisms of action of LEO in anxiety-related conditions appear to be related to inhibition of voltage-gated calcium channels, reduction of 5-HT1A receptor activity, and increased parasympathetic tone (20). SLO also exhibits many desirable properties of an anxiolytic agent, including a calming effect without sedation as well as a lack of dependence, tolerance, or withdrawal. In addition, SLO has a relatively benign side effect profile in short-term studies, and its onset of action is more rapid than current first-line pharmaceutical agents (20).

An SLO produced by the steam distillation of lavender flowers, Silexan (a), contains 36% linalool and 34% linalyl acetate. In animal model studies, Silexan was as effective as pregabalin and diazepam in exerting an anxiolytic effect. Silexan inhibited calcium influx into synaptosomes and hippocampal neurons by blocking N-and P/Q-type voltage-dependent calcium channels but acted at a site different from pregabalin (21, 24, 25). Whereas pregabalin may cause sedative or hypnotic side effects, Silexan does not (25).

Silexan improves several aspects of neuroplasticity (25). It has shown a clinical anxiolytic effect in controlled studies of patients with generalized anxiety disorder and those with sub-syndrome anxiety disorder. Silexan administration shows reduced 5-HT1A receptor binding in certain areas of the brain, such as the hippocampus, in healthy volunteers, reinforcing the hypothesis that serotonin mediates the anxiolytic effect of LEO (21).

It appears that the effect of LEO and its major constituents vary significantly depending on the areas of the nervous system examined (24).

Clinical Trials/Safety

EOs have been used since ancient times by many cultures for physical, emotional, and spiritual well-being. Modern science substantiates their role in supporting well-being.

EOs and well-being have been explored in 12 recent publications, including 3 meta-analyses, 4 clinical trials, 4 pilot studies, and 1 animal model study (**Table 1**) (7, 8, 10-12, 17, 23, 26-30). Several of the studies were conducted at hospitals or other health care facilities using nursing staff and/or other health care professionals as subjects (23, 26, 27). No adverse events associated with EO use were reported for these studies. One study included the statement that no allergic reactions or incompatibilities were observed (27). Another study indicated that no subjects had any reaction to a pre-trial EO patch test (24).

The ubiquity of unregulated EO products makes safety a key concern. The EO growing, harvesting, and manufacturing processes should contain multiple quality control points to verify that products are correctly sourced, accurately labeled (including genus and species), and unadulterated.

Given the tremendous variation in the quality of available EO products on the market, EO selection requires some research and judiciousness. Reviewing manufacturer quality control protocols and selecting EOs that are compatible with the desired purpose can help ensure a positive and safe outcome (31).

Although a full discussion of EO safety is beyond the scope of this article, it is important to be familiar with potential

Table 1. Summary of Literature on EOs and Well-Being

Author	Year	EO	Study Type	Results
Chandharakool et al. (11)	2020	Tangerine	Clinical trial	Reduced sleep latency
Chen et al. (26)	2015	Lavender	Clinical trial	Reduced stress
Hwang et al. (8)	2015	Bergamot Lavender	Meta-analysis of 12 studies	Promoted sleep
Kang et al. (28)	2019	Lavender	Meta-analysis of 22 studies	Relieved anxiety
Ko et al. (12)	2021	Lavender	Pilot study (single-blinded)	Improved sleep quality
Lin et al. (10)	2019	Bergamot Grapefruit Lavender Lemon Marjoram Orange (and others)	Meta-analysis of 31 studies	Improved sleep quality
Montibeler et al. (23)	2018	Geranium Lavender	Pilot study (randomized, controlled)	Decreased heart rate and blood pressure; lowered perceived work stress
Ogata et al. (17)	2020	Lavender	Pilot study (randomized)	Improved mood; reduced blood pressure
Okano et al. (7)	2019	Frankincense	Animal model study	Countered stress; relieved sleep debt
Steflitsch et al. (27)	2015	12 EOs (product names unavailable)	Clinical trial	Reduced stress
Toda and Matsuse (30)	2020	Lavender	Clinical trial (randomized, controlled)	Relieved stress
Varney et al. (29)	2013	Peppermint Basil Helichrysum	Pilot study (randomized, double-blind, controlled)	Reduced mental exhaustion and/or burnout

adverse events and establish safety guidelines (32, 33). Almost all cases of serious poisoning from EOs involve oral ingestion of large amounts of undiluted oil (32). EOs should be kept out of reach of children and animals to minimize the risk of accidental ingestion.

Other adverse events can occur in humans, including skin reactions (irritant, allergic, and pigmented contact dermatitis and photosensitization; cheilitis; stomatitis). In general, to help avoid irritation, inflammation, and/or allergic reactions, undiluted EOs should not be applied to the skin (especially damaged skin), eyes, or mucous membranes.

For topical EO use in adults, a dilution of at least 2.5% (25 drops EO per ounce of vegetable oil diluent, such as coconut oil or jojoba oil) is recommended. In addition, inhalation of undiluted EOs should generally be limited to 30 minutes or less to minimize risk of headache, lethargy, nausea, and vertigo (32). EO degradation can lead to increased risk of adverse events. To help avoid oxidation of some terpene chemical constituents, EOs should be stored in dark glass containers away from heat and direct sunlight (32).

Implementing a Stress Management Plan With EOs: Code Lavender®

The passion in the compassion provided on a daily basis often leaves veterinarians depleted. Without actively promoting their well-being, veterinarians and their team members commonly experience burnout, compassion fatigue, or secondary traumatic stress.

One of the recommendations of the Merck Animal Health Veterinarian Wellbeing Study II is to create a stress management plan. Respondents of the survey of practicing and nonpracticing veterinarians who indicated they had a stress management plan had a lower prevalence of serious psychological stress and a higher prevalence of well-being than other respondents (4). However, other than providing links to some online resources, the report does not specifically address how to create and implement a stress management plan.

Although the veterinary profession has done a great job detailing the consequences of stress, burnout, compassion fatigue, and insomnia, other health care professionals have been more proactive in implementing stress management plans (3, 5). Medical and nursing training programs, hospitals, and other health care facilities have already incorporated EOs into many of these plans (23, 26, 27, 34, 35).

In 2004, upon recognizing that action was needed in human medicine to help prevent burnout and compassion fatigue, North Hawaii Community Hospital and Ohio's Cleveland Clinic were among the first to establish unique crisis interventions called Code Lavender® (36). Code Lavender® is a formalized, rapid response program designed to support health care personnel in times of emotional distress (37). Following a stressful event, team members may call a Code Lavender® for themselves or a coworker. Code Lavender® incorporates EOs and other evidence-based relaxation and restoration interventions, such as massage, meditation, prayer cards, and mandalas, that provide psychological first aid (34-38).

A pilot study at a university hospital in San Diego found that 100% of those who had received Code Lavender® intervention found it helpful, and 84% would recommend it to others. The intervention package included a lavender-colored drawstring bag containing a lavender aromatherapy vial that could be privately smelled by the hospital employee to simulate a sense of calmness, along with a piece of chocolate, a small card with an encouraging quote, and a lavender-colored sticker to be worn by the employee as a visual signal to coworkers that the wearer is experiencing a stressful day (34).

Another study at the Cleveland Clinic found that 99% of employees surveyed reported that Code Lavender® services met or exceeded their expectations, and 98% reported that they would recommend the program to a friend. Employees expressing a willingness to call for Code Lavender® interventions highlights the importance of implementing a coordinated effort to fight off secondary traumatic stress, compassion fatigue, and general burnout (36).

Because stress affects everyone differently, there is no cookie-cutter approach to designing and implementing a stress management plan with EOs. Some general ideas for veterinarians include carrying a small bottle of an EO or an essential oil blend (EOB) and inhaling it periodically, placing a drop of EO on their feet or in their shoes, wearing jewelry containing a reservoir to fill with EOs, and placing dried lavender sachets in drawers and on doorknobs. In addition, EOs can be incorporated into recipes (eg, lavender lemonade) in minute quantities. EOs also pair well with other aspects of a wellness plan, such as massage therapy, meditation, and yoga.

In the workplace, an EO or EOB may be diffused; however, it is important to obtain permission from clients and/or

coworkers if diffusing in a common area or to restrict use to a private space. A variety of styles and sizes of diffusers are available, including USB and travel models. In addition, a caregiver support team may be developed to design and implement a Code Lavender® program for a work environment (2, 32, 37). Tisserand et al. provide a strategy for implementation, including guidelines and monitoring tools, as a video presentation (32).

Many EOs have demonstrated anxiolytic properties, including currently popular varieties, such as bergamot (*Citrus aurantium bergamia*), copaiba (*Copaifera reticulata*), lavender, lemongrass, and sandalwood (*Santalum album*), and less popular varieties, such as Angelica root (*Angelica sinensis*) (also used as Dang Gui in traditional Chinese veterinary medicine [TCVM]), Hinoki cypress (*Chamaecyparis obtuse*), Malkagani seed (*Celastrus paniculatus*), and Sakhalin fir (*Abies sachalinensis*) (19). There are numerous beneficial EOs that can be part of a stress management plan (**Tables 2-5**) (39). The author has found several effective EOs to use as a starting point (**Table 2**). However, to obtain the most successful results, it is important to examine the intended purpose and select EO species and chemotypes that best fit that purpose. The thought process is similar to selecting the best medication or therapy for a patient treatment plan. Alternate EOs should be chosen if needed until the desired results are obtained.

Conclusion

Research has demonstrated that aromas produce specific effects on human neuropsychological and autonomic function, suggesting the beneficial use of EOs in the context

Table 2. Using EOs to Enhance Well-Being

Issue	EO Common Name	EO Scientific Name	Goals
Burnout	Basil Clary sage Jasmine Lemon Marjoram Patchouli Peppermint Vetiver	*Ocimum basilicum* *Salvia sclarea* *Jasminum officinale* *Citrus limon* *Origanum marjorana* *Pogostomon cablin* *Mentha piperita* *Vetiveria zizanoides*	Reduce physical/mental exhaustion
Compassion fatigue	Bergamot Ylang Ylang	*Citrus bergamia* *Cananga odorata*	Help boost spirit and uplift
Reduced focus	Peppermint Rosemary	*Mentha piperita* *Rosmarinus officinalis*	Improve focus and concentration
Insomnia	Bergamot Lavender Valerian	*Citrus bergamia* *Lavandula angustifolia* *Valeriana officinalis*	Promote relaxation; reduce sleep latency; improve sleep quality
Stress	Bergamot Bitter orange leaf/twig (petitgrain) Geranium Lavender Melissa Sandalwood Valerian Ylang Ylang	*Citrus bergamia* *Citrus aurantium* *Pelargonium graveolens* *Lavandula angustifolia* *Melissa officinalis* *Santalum album* *Valeriana officinalis* *Cananga odorata*	Reduce anxiety; calm; uplift

Table 3. EO Compassion Fatigue Recipe (39)

EO Common Name	EO Scientific Name	Drops per Ounce of Carrier Oil
Bergamot	*Citrus bergamia*	8
Geranium	*Pelargonium graveolens*	7
Patchouli	*Pogostomon cablin*	5
Rose	*Rosa damascena*	10

Table 4. EO Burnout Recipe (39)

EO Common Name	EO Scientific Name	Drops per Ounce of Carrier Oil
Clary sage	*Salvia sclarea*	2
Lavender	*Lavandula angustifolia*	3
Lemon	*Citrus limon*	7
Marjoram	*Origanum marjorana*	3

Table 5. Anxiety-Related Insomnia Recipe (39)

EO Common Name	EO Scientific Name	Drops per Ounce of Carrier Oil
Lemon	*Citrus limon*	5
Roman chamomile	*Chamaemelom nobile*	10
Sandalwood	*Santalum album*	15

of stressful and adverse psychological conditions (40). Common EO constituents such as linalool and linalyl acetate, which are found in high concentration in lavender and other EOs, improve the feeling of well-being, support mental alertness, suppress anxiety, and facilitate restful sleep (41).

Aromatherapy with lavender and other EOs offers a simple, convenient, and noninvasive method of stress relief for veterinarians (13). EOs may be used safely and successfully—anywhere and anytime—as part of a proactive stress management plan.

Endnotes

a. Silexan is the active substance of Lasea soft capsules (Dr. Willmar Schwabe GmbH & Co. KG, Karlsruhe, Germany)

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