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File: ■ Lavender (*Lavandula* spp.)
■ Neurological Effects
■ Anxiety, Depression, Pain, Sleep

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RE: Neurological Effects of Lavender Essential Oil

Koulivand PH, Ghadiri MK, Gorji A. Lavender and the nervous system. *Evid Based Complement Alternat Med*. March 14, 2013;2013:681304. doi: 10.1155/2013/681304.

Lavender (*Lavandula* spp.) has been used for centuries as an antiseptic and a treatment for neurological and psychological conditions. Common routes of administration are oral, topical application, and inhalation. Reports suggest that lavender has anticonvulsant, analgesic, anxiolytic, sedative, and calming properties. This article reviewed and summarized published reports of the neurological effects of lavender. It should be noted that the authors provided a topline summary of the data, and in many cases did not detail the dosages, trial duration, or the specific products evaluated.

The results of numerous animal studies support the anxiolytic, sedative, analgesic, anticonvulsive, and neuroprotective effects of lavender. Mice exposed to lavender essential oil exhibited reduced anxiety and depressive behavior, anti-conflict behavior, reduced aggressiveness, and increased social interaction. In rats and gerbils, lavender oil inhalation had antianxiety effects comparable to the anxiolytic drugs chlordiazepoxide and diazepam, respectively.

Sedative effects in mice were reported in 3 studies evaluating lavender inhalation and in another study assessing lavender methanolic extract (200-600 mg/kg) ingestion. A conjunctival reflex test in rabbits indicated lavender had local anesthetic effects. In a series of experiments, ingested, inhaled, and injected lavender essential oil reduced the response to chemical and thermal pain in mice. The analgesic effects of lavender have been linked to opioid and cholinergic neurotransmission.

Lavender also had anticonvulsant and neuroprotective effects in animals. In mice, oral aqueous-alcohol lavender extract and lavender inhalation reduced seizures induced by electroshock or drugs. Lavender oil and lavender aqueous extract reduced brain injury following cerebral ischemia/reperfusion in rats and mice. In a rat model of Alzheimer's disease, aqueous extracts of lavender reversed spatial learning deficits. Lavender's neuroprotective properties have been attributed to its antioxidant activity, reduced

glutamate-induced neurotoxicity, and direct interaction with gamma-aminobutyric acid (GABA) receptors.

Lavender's neurological mechanism of action has not been fully elucidated. In vitro studies suggest that enhanced dopamine receptor activity, GABA neurotransmission, and cholinergic inhibition play a role in lavender's analgesic, antidepressant, and anticonvulsant effects. Lavender reduced gene expression of c-fos, a nuclear transcription factor protein that is an early marker of neuronal activation. It dose-dependently inhibited histamine release and tumor necrosis factor-alpha secretion, and may inhibit sympathetic nerve activity and lipolysis by activating histamine (H3) receptors.

Lavender is approved in Germany for the treatment of restlessness and/or insomnia. In 3 randomized, controlled trials (RCTs), an oral lavender essential oil formulation (Silexan®; Dr. Willmar Schwabe GmbH & Co. KG; Karlsruhe, Germany) given at a dose of 80 mg/day reduced anxiety, restlessness, and sleep complaints in people with anxiety disorders. One of these trials found that the effect of lavender oil was comparable to that of lorazepam (0.5 mg/day). In an RCT evaluating oral *L. angustifolia* oil (n=97), a dose of 200 µl had anxiolytic effects in subjects viewing anxiety-provoking film clips. Patients who received 1% lavender oil aromatherapy while in the intensive care unit showed improvements in mood and anxiety. Lavender aromatherapy reduced anxiety in RCTs evaluating dental patients, and it was deemed to provide a low-risk, cost-effective intervention for pre-operative anxiety in surgical patients. An RCT also found lavender to be effective in the calming of agitated behavior of patients with dementia.

Postpartum women at high risk of postnatal depression reported improvements in anxiety and depression after 4 weeks of 2% lavender oil aromatherapy. Adults with mild-to-moderate depression (n=48) had earlier improvement and fewer adverse side effects when taking 60 drops/day of 1:5 lavender tincture and the antidepressant imipramine (100 mg/day), compared to those receiving placebo and imipramine. Individuals with insomnia (n=10) had improved sleep quality with lavender aromatherapy. People with mixed anxiety disorder (n=221) experienced improvements in sleep quality and duration while taking oral lavender oil (80 mg/day). In other RCTs, lavender aromatherapy was reported to improve sleep quality in 15 healthy students, 64 patients with heart disease, 31 patients who were hospitalized, and 34 midlife women with insomnia.

Topical and inhaled lavender is reported to reduce acute and chronic pain. Foot massage with lavender oil on patients in the intensive care unit (n=100) reduced blood pressure, heart rate, and pain. Topical treatment of canker sores with lavender oil (n=115) relieved pain and promoted healing significantly better than a placebo. Lavender aromatherapy reduced pain in women after cesarean section (n=200) or episiotomy (n=60). Lavender aromatherapy (2 drops of 2% concentration) delivered through an oxygen mask reduced the demand for pain relievers in patients after breast biopsies (n=25) and after laparoscopic surgery for gastric banding (n=54). Rubbing a few drops of lavender oil on the upper lip reduced pain severity and other symptoms in early stages of a migraine attack (n=47).

Few studies have evaluated the effect of lavender on cognition and mood in humans. In 144 healthy volunteers, lavender aromatherapy diminished performance in tests of working memory and reduced reaction times for memory and attention tasks. However, subjects receiving lavender aromatherapy were more contented after the battery of

cognitive tests than subjects receiving no aromatherapy. In 50 patients with neurasthenia or post-traumatic stress disorder, taking 80 mg of oral lavender oil daily for 6 weeks improved general mental health status and quality of life.

Neuroimaging studies using positron emission tomography (PET) and magnetic resonance imaging (MRI) indicate that lavender aromatherapy induced changes in brain metabolic activity consistent with relaxation and improved mood. In electroencephalography (EEG) studies, inhalation of 10% lavender oil increased alpha and theta wave activity in the brain, patterns which are also consistent with relaxation and better mood.

Evidence to date suggests short-term therapy with lavender is safe, but long-term safety data are lacking. Studies conducted in human cell lines show that lavender oil has estrogenic and antiandrogenic effects. People taking oral lavender oil in clinical trials have reported adverse side effects such as nausea and indigestion.

The authors conclude that oral lavender has promising potential in the treatment of neurological disorders, either alone or as an adjuvant therapy, but the use of lavender aromatherapy, inhalation, or massage "is not currently supported by good evidence of efficacy." Methodological inadequacies in published clinical trials include small sample size; short duration; lack of a placebo or control group; variability in dosage and route of administration; failure to control for factors such as temperature, room volume, and baseline olfactory function; lack of tolerability and adverse event data; and failure to identify the composition of the lavender product. The authors emphasize, "It is essential that all future clinical studies specify the exact derivation of the oils used in the study" (i.e., botanical identity, including variety, source, chemical profile, concentration, and carrier oil). Well-designed, long-term trials and observational studies are needed to establish the safety and efficacy of lavender use in people with neurological and psychological disorders.

—Heather S. Oliff, PhD

Referenced article can be found at www.hindawi.com/journals/ecam/2013/681304.