

An Influence of Topical Treatment Lavender Essential Oil on Wound Healing Process Through Enhanced Collagen Synthesis and Anti-Microbial Effects: A Literature Review

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ABSTRACT

Summary: Aromatherapy, that employs essential oils extracted from numerous plants and herbs, is wide used and is turning into a significant complementary and alternative medicines. Among numerous complementary and various medicines, inhalation aromatherapy has particularly received attention principally for its effects of relaxation and improvement of emotional or psychological conditions, and a few clinical trials have recommended the potential of aromatherapy for anxiety, insomnia, stress, and pain. In in vitro and in vivo experiments, some essential oils were recommended to act as anti-inflammatory drug, anti-viral, anti-tumor, anti-hyperglycemic, anti-carcinogenic agents, support treatment of wounds, and facilitate healing. Lavender volatile oil is anticipated to possess a useful result on wound healing as a result of some evidence for its result were already rumored. The last study rumored that topical treatment with lavender oil on aphthous ulceration showed a big ulcer size reduction as compared to control in both an animal experiment and a clinical study.

KEYWORDS: Lavender Essential Oil, Wound Healing, Collagen Synthesis, Anti-Microbial

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INTRODUCTION

Wound healing is a natural physiological process that develops in response to tissue damage, to restore the function and integrity of damaged skin tissues. The wound healing process is divided into four overlapping phases; blood clotting, inflammation, new tissue formation, and tissue remodeling. These processes, especially new tissue formation and tissue remodeling, consist of sequential and coordinated events including angiogenesis, cellular proliferation, collagen synthesis followed by formation of granulation tissue, matrix degradation followed by replacement of collagen, wound contraction, and scar formation.¹

Lavender essential oil consisting of different types of compounds like linalool and linalyl acetate is widely used in the food industry because of its biological properties. Some studies have shown that lavender essential oil has analgesic, anti-inflammatory, antioxidant, antibacterial, anti-fungal, sedative, and antidepressant effects and can effectively heal burns and insect bites. One study examined the topical application of lavender essential oil in skin wound healing.

Their data suggest that lavender essential oil enhances the healing process through granulation tissue formation, tissue remodeling, and wound contraction.²

Role of Lavender Oil in Wound Healing Process

Most studies have identified the use of lavender EO in wound healing, suggesting some unique mechanisms by which this oil exerts such an effect. In one study, lavender EO was used to significantly increase the levels of TGF- β and type I collagen). TGF- β induces fibroblast proliferation and subsequent differentiation into myofibroblasts.³ Myofibroblasts play an important role in wound contraction due to tissue contraction., evidencing the clinical finding of increased and rapid wound contraction in the lavender-treated group compared to the control group.⁴

A novel finding of the current study is the induction of TGF- β expression by treatment with lavender oil. There has been no report of a complication of TGF- β induction in the wound healing activity of essential oils. TGF- β has been reported to stimulate angiogenesis, fibroblast proliferation and matrix production by fibroblasts, and that it could be one of key

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molecules in the wound healing process. These previous reports suggest that TGF- β plays an important role in cutaneous wound healing by promoting granulation tissue

formation accompanied by increased collagen production by fibroblasts.^{3,4,5}

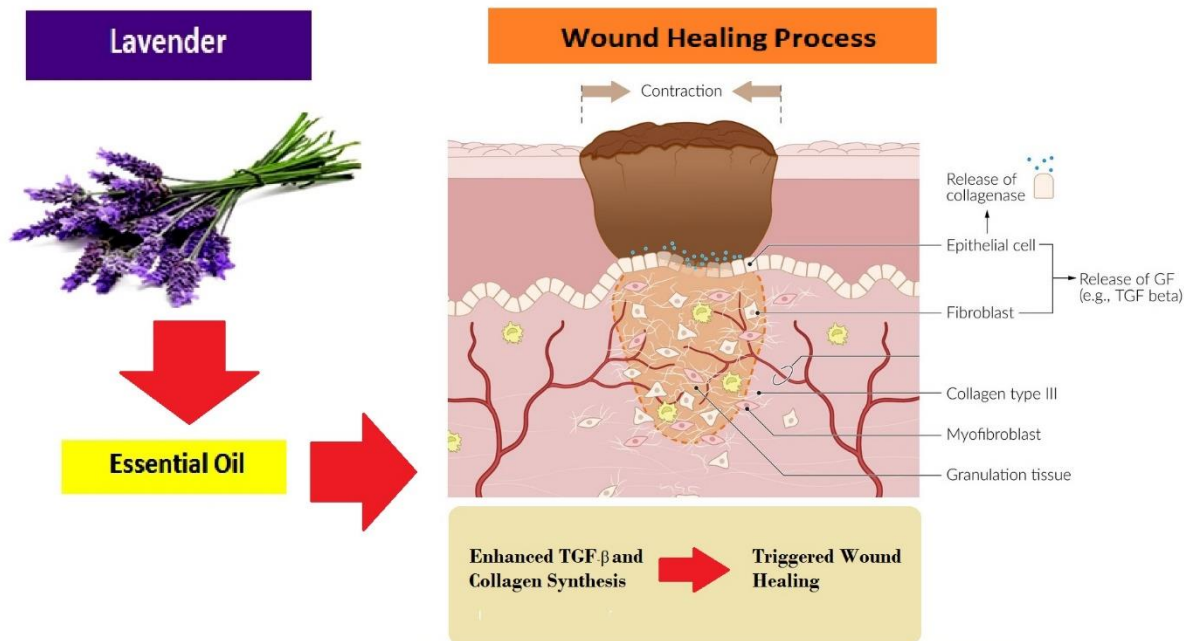


Figure 1. Role of Lavender Essential Oil on Wound Healing Process

Therefore, the upregulation of TGF- β by treatment with lavender oil observed in the present study could reasonably explain the proliferation of collagen-synthesizing fibroblasts and the increased mRNA expression of collagen. TGF- β and collagen are considered to be expressed in a coordinated manner to form granulation in the wound. It has also been reported that TGF- β induces the secretion of MMP-13, so-called collagenase-3, by fibroblasts.³ MMP-13 is essential for the degradation of type III collagen, which is then replaced by type I collagen, resulting in tissue remodeling during wound healing. In the current study, despite a significant increase in type III collagen 4 days after the start of topical lavender oil treatment, it rapidly decreased to control levels after 7 days. The rapid degradation of type III collagen is strongly suspected to be mediated by MMP-13 induced by TGF- β upregulation. Taken together, these findings indicate that induction of TGF- β by lavender oil promotes not only granulation tissue formation, but also collagen replacement.^{3,4}

Another important result of the present study is that topical treatment with lavender oil promoted the differentiation of fibroblasts into myofibroblasts in the wound granulation during the early stages of wound healing. This could also be explained by the upregulation of TGF- β , as it has been reported that TGF- β stimulates the differentiation of

fibroblasts to myofibroblasts. Stimulation of the TGF- β signaling pathway by angiotensin II has also been reported to induce granulation tissue contraction via the angiotensin type 1 receptor. Thus, the present data also showed that induction of TGF- β by topical application of lavender oil promotes not only formation of granulation tissue, but also wound shrinking/contraction.⁶

Anti-Microbial Effect of Lavender Essential Oil

As with all natural extracts, lavender EO's antibacterial activity depends on its chemical composition and the amounts of each component. Many of the antibacterial compounds are constitutively expressed by plants, while others are synthesized as self-defense mechanisms in response to pathogens.⁷

Lavender EO showed much better antibacterial activity. In dermatology, Lavender EO can be used to treat ulcers, burns, and scars that are difficult to heal. It is worth noting that the EO of *L. angustifolia* Mill. has a strong antiseptic effect against antibiotic-resistant strains, e.g., *Staphylococcus aureus* (MRSA) resistant to methicillin or vancomycin-resistant strains of *Enterococcus* sp. (VRE).⁸ The essential oil induced susceptibility of the strain to this antibiotic by altering the permeability of the outer membrane indicated by a decrease in bioluminescence.⁹

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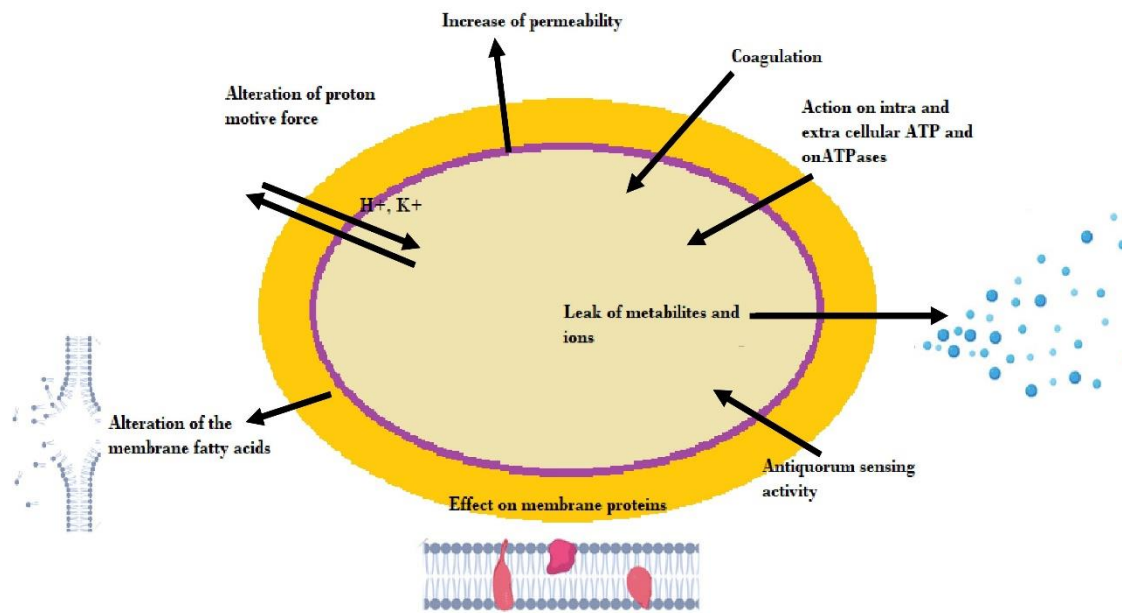


Figure 2. Mechanism of action and target sites of the Lavender essential oils on microbial cells.

Various mechanisms have been described to explain the activity of lavender oil against bacterial cells. The activity of lavender oil can affect both the outer skin and the cytoplasm of cells. The typical hydrophobicity of lavender oil is involved in the disruption of bacterial structures, making lavender oil inseparable from the bacterial cell membrane. The permeability barrier provided by the cell membrane is essential for many cellular functions, including maintenance of the cell's energy state, membrane-bound energy conversion processes, solute transport, and metabolic regulation.^{7,9,10}

Mechanisms of action of lavender essential oil include cell wall disruption, cytoplasmic membrane damage, cytoplasmic coagulation, membrane protein damage, increased permeability leading to leakage of cell contents, decreased proton motive force, decreased ATP synthesis and hydration.⁷ It includes a decrease in intracellular ATP pools for increased degradation. It is separate from increased membrane permeability and decreased membrane potential due to increased membrane permeability. In some cases, essential oils alter membrane permeability by disrupting the electron transport chain, and many components of lavender essential oil, such as carvone, thymol, and carvacrol, cause an increase in intracellular ATP levels. Accompanied by disruptions attached to the microbial membrane.^{11,12}

CONCLUSION

Lavender Essential Oil as an alternative medicine has a promising effect as an antimicrobial and also plays a role in tissue remodeling in wound healing.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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