

Precision grounding augments the therapeutic benefits of simultaneous topical essential oil application

Madiha Khalid¹, Jeremy Madvin^{2*}

¹Department of Pharmacy Sciences, Humdard University, Islamabad Campus, Islamabad 44000, Pakistan. ²Department of International Business, The University of Redlands, California 91361, United States.

*Corresponding to: Jeremy Madvin, Department of International Business, The University of Redlands, Thousand Oaks, California 91361, United States. E-mail:jeremymadvingmail.com.

Author contributions

Jeremy Madvin developed the idea for the study. Madiha Khalid performed the research, wrote original draft the paper; analyzed the data analysis; Jeremy Madvin provided assistance in the writing of the article and improved the quality of the paper.

Competing interests

The authors declare no conflicts of interest.

Acknowledgments

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Peer review information

TMR Non-Drug Therapy thanks all anonymous reviewers for their contribution to the peer review of this paper.

Abbreviations

CAM, complementary and alternative medicine; ANS, autonomic nervous system; BF, Blood flow; UV, Ultra violet.

Citation

Khalid M, Madvin J. Precision grounding augments the therapeutic benefits of simultaneous topical essential oil application. *TMR Non-Drug Ther.* 2023;6(3):13. doi: [10.53388/TMRND2023013](https://doi.org/10.53388/TMRND2023013).

Executive editor: Jing-Fang Han.

Received: 25 May 2023; Accepted: 30 June 2023; Available online: 7 July 2023.

© 2023 By Author(s). Published by TMR Publishing Group Limited. This is an open access article under the CC-BY license. (<https://creativecommons.org/licenses/by/4.0/>)

Abstract

Grounding or earthing involves making physical contact with the Earth's surface by walking barefoot on natural surfaces or using grounding devices that simulate direct contact with the Earth. Precision Grounding is believed to balance the electrical charge in the human body and has potential physical and psychological benefits, including reduced inflammation, improved sleep quality, and decreased anxiety and depression symptoms. Combining earthing therapy with essential oils is gaining popularity as a natural and effective therapeutic technique. Essential oils contain antioxidants and anti-inflammatory chemicals that complement the benefits of earthing therapy. This study aims to highlight a novel method for reducing inflammation by combining essential oils with precision grounding and to emphasize the significance of the duration and intensity of grounding on inflammation and injury. The findings indicate that essential oils combined with precision grounding can reduce pain and alter the levels of neutrophils, lymphocytes, and inflammation-related chemicals in circulation. The review underscores the potential of earthing with essential oils as a simple and widely available clinical intervention with potentially significant therapeutic implications. Precision Grounding therapy is safe and theoretically beneficial for most people, but medical advice should be sought before beginning any new wellness practice.

Keywords: aromatherapy; CAM; earthing; essential oils; grounding; inflammation; pain

Introduction

The term “aromatherapy,” which combines the words “aroma” and “therapy,” refers to a natural approach to healing the body, mind, and soul [1]. Ancient civilizations, including Egypt, China, and India, have used fragrant plant extracts for medical purposes for at least 6,000 years [2]. Due to its significance and broad use, aromatherapy is now widely accepted as a significant complementary and alternative medicine known as aroma science therapy [3].

Essential oils, which are highly concentrated chemicals taken from various plant parts, including flowers, leaves, stalks, fruits, and roots, are the main therapeutic components utilized in aromatherapy [4] and are also made from resins; they are distillates. Essential oils are complex mixtures of alcohol, aldehydes, esters, ethers, ketones, oxides, phenols, and terpenes that give off distinctive smells [5]. They also contain both saturated and unsaturated hydrocarbons. They are liquids with a high refractive index that are colorless and pleasant to the olfactory. These oils may work on pressure points and rejuvenate since they are so potent and concentrated.

Plants contain essential oils in various locations, including pockets and reservoirs, glandular hairs, specialized cells, and intercellular spaces. The plants are protected from bacterial attack when these essences evaporate from them, and the warming aura created by the essences shields the plant from temperature changes [2].

Essential oils can be administered using various techniques in aromatherapy, including inhalation, massage, or direct surface application to the skin. They are hardly ever ingested [6]. The fundamentals of aromatherapy are the inhalation and external use of these oils for physical and mental equilibrium. These oils reduce stress, revitalize, and replenish the person for the job the next day. These essential oils work on the olfactory nerves that connect the nose to the brain.

Essential oils' antibacterial, antibiotic, and antiviral capabilities have all been well-documented as medicinal benefits. They may be helpful for several different conditions, including Alzheimer's, cardiovascular, cancer, and pregnancy-related labor pain [7]. Cancer and sleep difficulties are two conditions that aromatherapy is increasingly being utilized to treat [8]. The organic nature of essential oils and their capacity to interact with the body in a supportive way can give users a sense of well-being [9].

Recent research has demonstrated that inhaling rosemary essential oils can significantly boost mice's locomotor activity. In phytotherapy, rosemary is utilized as an energizing and rejuvenating treatment for fatigue [10]. According to these studies, essential oils may benefit physical and mental health and well-being.

Numerous research has been conducted to examine the effects of aromatherapy on the human brain and emotions, and it has come to support holistic medicine throughout time. Researchers are working to understand how it affects workability, response time, and spontaneous behaviors through electroencephalogram patterns and functional imaging studies [11]. Recent scientific discussions have focused on its involvement in mood, alertness, and mental stress. Synthetic scents, which can contain irritants like propellants and solvents that might irritate some people, are inferior to essential oils. According to aromatherapists, synthetic odors lack essential oils' organic or life energy. Aromatherapy has become a powerful substitute for artificial perfumes, offering a more organic and holistic approach to healing and wellness.

How does aromatherapy work?

Essential oils are highly concentrated plant extracts with curative potential due to their antibacterial, antiviral, anti-inflammatory, and immune-boosting properties [12]. Moreover, these oils have emotional, hormonal, circulatory, glandular, calming, and alertness-enhancing effects, which have been well-acknowledged by many scientists [13].

Aromatherapy has been extensively researched, and many pilot projects and studies on humans have been undertaken to determine its

nature and significance for managing various diseases and disorders [14]. Essential oils have energy-specific properties, and their potency does not fade with time or age. This therapy is based on the idea that the stimulating capabilities of these oils are found in their structure, which closely mirrors those of original hormones [15].

One of the most essential aspects of aromatherapy is the ability of these oils to penetrate subcutaneous tissues, making their effects more potent and long-lasting. Due to the intricate structure and chemical properties of essential oils, the effects of aromatherapy are complicated and subtle. When inhaled, essential oils integrate into the biological signal of the cell receptors of the nose. The olfactory bulb sends the signal to the limbic and hypothalamic areas of the brain. These impulses trigger the central nervous system to release neurotransmitters such as serotonin, endorphins, and others, which connect our nerves and other body systems, resulting in the desired change and a sense of relaxation [16].

Different essential oils affect the mind and body depending on their chemical properties. For example, calming oils can release serotonin to induce a feeling of calmness. In contrast, euphoric oils can release endorphins to induce a feeling of euphoria, and stimulating oils can release noradrenaline to induce a feeling of stimulation.

Overall, aromatherapy is a holistic therapy that promotes mental, physical, and emotional well-being using natural plant extracts with curative potential. Its subtle yet profound effects have been shown to benefit the mind and body significantly.

The skin is another common pathway to enter the body. When rubbed onto the skin, essential oils are absorbed through the pores and can affect the body and mind.

Massage is one method for promoting the absorption of essential oils through the skin. The molecules are absorbed when essential oils are mixed with carrier oil and massaged into the skin. They can move to the upper respiratory system and the lower respiratory tract. They can then move to the pulmonary blood arteries, enter the bloodstream, and be carried to organs and tissues around the body [17].

In addition to entering the bloodstream, the skin route can also trigger olfactory stimulation. The essential oil's scent can trigger a physiological and mental response. For example, the scent of lavender oil may promote relaxation and help reduce anxiety and stress.

The skin pathway absorption of essential oils can also directly impact the body. When rubbed into the skin, essential oils can lower a patient's perceived stress, improve healing, and boost interactions among cells in the body [17]. For example, tea tree oil has been shown to have antimicrobial properties, making it helpful in treating skin infections and promoting wound healing.

Overall, the skin pathway is a meaningful and effective way for essential oils to enter the body and have various therapeutic effects. Whether through massage or topical application, essential oils can be an excellent tool for promoting health and well-being.

Our study explored using a grounded probe with topical essential oil massage. A trained professional typically performs essential oils massage, which can also be self-administered. This type of massage targets specific areas throughout the body, which can suffer from muscle spasms, stiffness, and severe pain. These areas may not always release on their own and can be caused by injuries, overuse, and stress. Pain can be released by physically stimulating these areas using hand massage or equipment such as a Grounding Acupressure Probe, and healing can be promoted. Using the grounded acupressure probe in essential oil massage is a safe, non-invasive, and effective treatment that can help individuals avoid pain medication and potentially risky surgeries with adverse side effects. (Figure 1)

What is Precision grounding?

Grounding, or earthing, refers to physical contact with the Earth's surface. It is typically done by walking barefoot on grass, soil, sand, or other natural surfaces or using grounding devices that simulate the effects of direct contact with the Earth. The concept behind grounding is that the Earth has a natural electrical charge that can help

neutralize and balance the electrical charge in the human body.

Precision grounding or earthing creates an easily measurable energy exchange between a person's body and the Earth. It is a simple method of directing a person's microcurrent through a precisely targeted body area. At the same time that a person's excess voltage leaves their body, nourishing ions from the Earth instantly flow into the same targeted area. Precision grounding can work synergistically with various skin care regimens, massage techniques, acupressure, and acupuncture. There are many health benefits associated with Precision Grounding. When microcurrent is incorporated into therapy, it can help the body release endogenous opioids, such as endorphins which help to reduce inflammation. This increased release of endorphins can also help reduce persistent discomfort and stress. Studies have also found that incorporating microcurrent into various treatments may help our bodies release the type of stem cell primarily found in our bone marrow. This safe and natural stem cell can help our bodies create different types of tissues and have other healing properties. Combining micro-current with other applications can help increase blood flow, relieve discomfort, and reduce chronic stress. Precision grounding is a groundbreaking approach allowing our bodies the energy to help aid in the healing process.

There are several potential benefits to precision grounding, both physical and psychological [18]. One of the most commonly cited benefits is reduced inflammation. Inflammation is a natural response of the immune system, but when it becomes chronic, it can contribute to a wide range of health problems, including pain, heart disease, and cancer. Some studies suggest that precision grounding can help reduce inflammation by decreasing certain inflammatory markers' levels at the body's specific part.

Precision grounding may also help improve sleep quality by regulating the body's circadian rhythm. Exposure to natural light and dark cycles is essential in regulating sleep, and grounding may help synchronize the body's internal clock with the external environment. It, in turn, may lead to better sleep quality and more restful sleep [19]. In addition to these physical benefits, precision grounding may also have psychological benefits. Some people report feeling more relaxed and less stressed after grounding, and some evidence suggests that grounding can help reduce anxiety and depression symptoms. It may be partly due to the release of endorphins and other "feel-good" chemicals triggered by the body's contact with the Earth [20].

Precision grounding appears to be a safe and potentially beneficial practice for most people. However, it is crucial to emphasize that it should not be used in place of medical care or guidance. Before beginning any new wellness practice, contacting a healthcare practitioner with any underlying health concerns is always a good idea.

Precision Grounding with essential oils:

Precision grounding therapy has been used for medicinal purposes for centuries, and new products utilizing earthing principles are expected to continue to emerge in the market in the coming years. The use of precision earthing remains a subject of interest for further research. However, paying attention to the combination of earthing with other procedures is essential. Additionally, there is a growing demand for essential oils that are ecologically friendly, and consumers highly emphasize the practice of earthing in such procedures.

Precision grounding therapy is considered in oriental medicine as the start of an electrochemical process that causes imbalanced physiological states to restore to their natural physiological equilibrium [21]. Similarly, physiologic treatment has been explained in modern medicine as an anatomical and hormonal regulatory process. Although not all responses to precision earthing therapy with essential oils result in brain reactions, some do. It can calm the mind quicker than essential oil therapy alone by stimulating the olfactory system and influencing the limbic system in the brain, which regulates emotions and mood. Some essential oils, such as bergamot,

chamomile, and lavender, have relaxing and calming effects on the body and mind [22].

Precision earthing therapy typically stimulates the skin, generating a small, ion-electric charge conveyed through various biological routes. If this ion-electric charge is disrupted, it can result in an imbalance of negative and positive charges in the body, causing discomfort and the development of chronic disease. Due to this effect, essential oils quickly absorb into the skin and travel to the side of action. Precision earthing synergizes the effects of essential oils. Earthing therapy can restore good health by redistributing the excessive or insufficient ion-electric charge. It suggests that bio-electric charge transmission is intimately related to earthing therapy [23]. Combining earthing therapy with essential oil products increases the likelihood of excellent outcomes with minimal problems. Extrinsic or intrinsic factors can both contribute to the generation of radicals that are free in the body, which can be harmful. Free radicals are unstable molecules that steal electrons from the human body, causing it to malfunction. Essential oils contain antioxidants that help to protect and preserve healthy skin. Anti-aging, anti-inflammatory, and antioxidant qualities can be found in skincare products [24]. Antioxidants protect the skin by acting as a shield and supplying free electrons. Earthing therapy is a natural antioxidant that helps the body retain excellent health by transferring electrons.

Essential oils have anti-inflammatory chemicals that help relieve discomfort and reduce swelling while preventing severe diseases. Precision earthing increases blood flow, which lowers pain and tightens muscles, helping the inflammatory reaction to occur quickly and treating the inflammation [25].

Precision grounding therapy has become popular as a primary therapeutic technique because of its minimal side effects and potential therapeutic efficacy. Despite increasing demand, the role of earthing treatment has yet to be thoroughly researched. However, the two procedures are frequently employed in tandem to provide a synergistic impact, and this technique causes cautious belief, significantly when localized blood supply improves considerably.

It uses a unique grounding probe that injects electrons into the body without external power sources. However, targeting a particular portion of the body with pressure while using external power sources can bring further difficulties.

The essential oil is first applied on the skin to the relevant body part being treated (Figure 1). Precision grounding has been shown to promote microcirculation and absorption. These devices give patients several options for treating individual symptoms while addressing more broad inflammatory or immunological diseases. Using a unique earthing massager allows one to target a particular body area. To maximize stimulation, select the entry and exit points for surplus voltage; users of earthing therapy can enhance stimulation and promote unblocking specific areas in the body or muscle groups. This targeted approach is thought to increase blood flow to the ground region. Improved blood flow is a well-known benefit of earthing. The zeta potential is crucial in maintaining the distance between blood cells. More charge on the blood leads to more viscosity, which can impede flow and make it more difficult for cells to push past each other, resulting in clumping.

Precision earthing therapy appears to help reduce blood clogging and viscosity, thereby thinning the blood and improving its flow [25]. This reduction in blood viscosity and improved flow can significantly impact overall cardiovascular health. It is likely due to the transfer of electrons from the Earth's surface to the body, which helps to neutralize excess positive charge in the blood.

In addition to promoting grounding and stability, essential oils can help soothe the nervous system and promote relaxation. It can be beneficial for those who struggle with anxiety or stress [26].

Overall, precision grounding, combined with essential oils, is a simple and accessible way to promote a sense of inner calm and connection to the Earth. With a few drops of oil and a little intention, one can create a powerful practice that supports overall well-being.

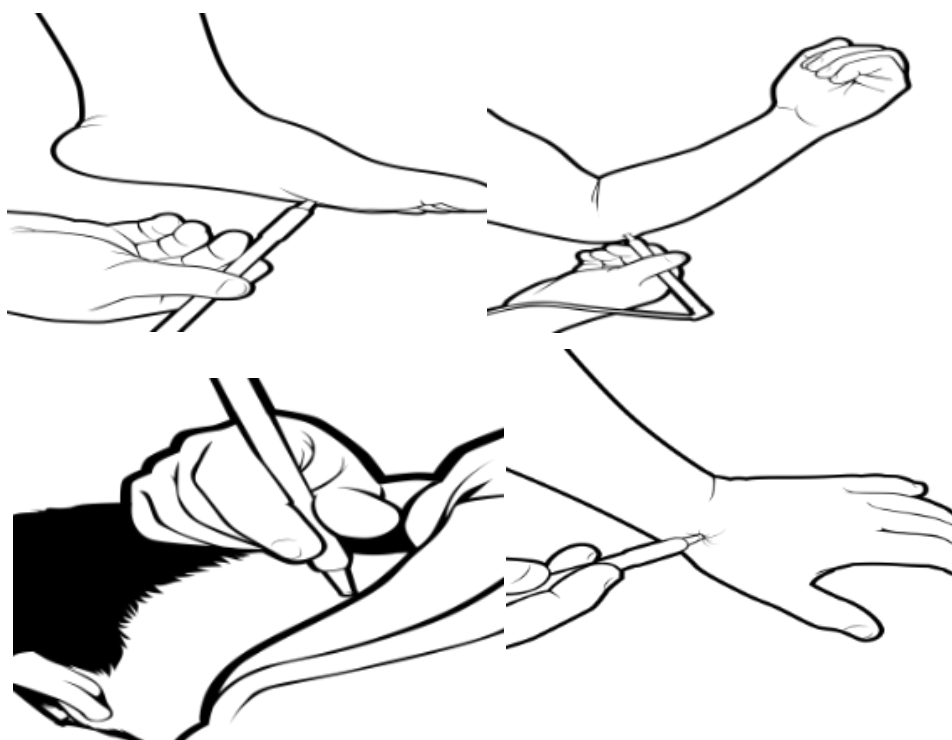


Figure 1 Use of earthing probe at Different parts of the body

Discussion

Precision earthing simultaneously combined with essential oil has been found to have multiple benefits. One of these benefits is reducing physical feelings of stress, which can impact overall health. Studies have shown that sleep disorders caused by significant stress can negatively affect health. However, previous grounding studies have shown that grounded participants reported better sleep and less stress [27]. Essential oils have also been used for centuries for their therapeutic properties, and many people use them to help reduce stress and promote relaxation. Some essential oils like lavender have been found to have calming and soothing effects on the body and mind, which may help reduce stress [28]. These oils are often used in aromatherapy, inhaling or applying topically to the skin. This effect is likely enhanced with precision earthing.

Precision grounding also appears to improve the balance of the sympathetic-parasympathetic autonomic nervous system (ANS), which impacts stress reduction. Furthermore, precision grounding has been shown to lessen inflammation in several studies. One of the primary causes of any disease is oxidative stress. It damages protein, changes the renewal of cell cycles, increases protein cross-linking, damages DNA, and produces pro-inflammatory mediators, all of which can contribute to inflammatory disorders. UV radiation-generated free radicals can potentially induce allergic responses. Precision grounding with essential oils has a strong antioxidant impact and helps to decrease oxidative stress damage.

According to the findings of this study, precision grounding with essential oils may result in further developments that are advantageous in this industry. As a result, precision grounding should be incorporated into supplementary, preventative, and lifestyle clinical training because many of these strategies can benefit health.

Results

According to new research, our planet Earth has a natural source of electrical energy that is easily accessible and useful to human health in various ways. Precision grounding in simultaneous combination with essential oil is a non-invasive technique that may offer broad benefits. Precision grounding has been demonstrated to be helpful in

treating various acute and chronic diseases. Adequate BF is critical for absorbing essential ingredients from the oil to the skin. Precision grounding has been found to enhance blood flow, reduce pain, and provide other positive effects without significant side effects. However, more research is necessary with larger comparison groups, more extended testing periods, and more advanced techniques to confirm earthing's unique role as a protector of the body. Overall, incorporating precision grounding with essential oils can provide various benefits, making it a promising technique for CAM therapy.

Grounding, connecting the human body with the Earth's surface through direct skin contact, has been used for medicinal purposes for centuries. However, further research is needed to fully understand this practice's benefits and potential risks, especially when combined with other procedures. As we move forward, we are expected to see more products based on the principles of earthing emerge in the market. Additionally, consumers' growing demand for ecologically friendly skin care products has highlighted the potential use of precision earthing in formulating such products.

References

1. Worwood VA. *Aromatherapy for the Healthy Child: More Than 300 Natural, Nontoxic, and Fragrant Essential Oil Blends*. New World Library; 2000.
2. Alok K, Rakesh T, Sushil K. Aromatherapy-an alternative health care through essential oils. *J Med Aromat Plant Sci* 2000;22(1B):798–804. Available at: <https://www.cabdirect.org/cabdirect/abstract/20013071731>
3. Esposito ER, Bystrek MV, Klein JS. An Elective Course in Aromatherapy Science. *Am J Pharm Educ* 2014;78(4):79. Available at: <http://doi.org/10.5688/ajpe78479>
4. Dunning T. Aromatherapy: Overview, safety and quality issues. *OA Altern Med* 2013;1(1). Available at: <http://doi.org/10.13172/2052-7845-1-1-518>
5. Wildwood C. *The encyclopedia of aromatherapy*. Healing Arts Press; 1996 .
6. Svoboda K, Hampson J, Hunter EA. Production and bioactivity of essential oils in secretory tissues of higher plants.

- InProceedings of The World of Aromatherapy II Conference of the National Association for Holistic Aromatherapy (NAHA) 1998;(Vol. 25).*
https://scholar.google.com.hk/scholar?hl=zh-CN&as_sdt=0%2C5&q=Production+and+bioactivity+of+essential+oils+in+secretory+tissues+of+higher+plants.+&btnG=
7. JIMBO D, KIMURA Y, TANIGUCHI M, INOUE M, URAKAMI K. Effect of aromatherapy on patients with Alzheimer's disease. *Psychogeriatrics* 2009;9(4):173–179. Available at: <http://doi.org/10.1111/j.1479-8301.2009.00299.x>
 8. Lee SH, Kim JY, Yeo S, Kim SH, Lim S. Meta-Analysis of Massage Therapy on Cancer Pain. *Integr Cancer Ther* 2015;14(4):297–304. Available at: <http://doi.org/10.1177/15347354155572885>
 9. Farooqi AH, Srikant S. Aromatherapy-a promising holistic system. *J Med Aromatic Plant Sci* 2000;22(1B):704–706. <https://www.cabdirect.org/cabdirect/abstract/20013071707>
 10. Kovar K, Gropper B, Friess D, Ammon H. Blood Levels of 1,8-Cineole and Locomotor Activity of Mice After Inhalation and Oral Administration of Rosemary Oil. *Planta Med* 1987;53(04):315–318. Available at: <http://doi.org/10.1055/s-2006-962725>
 11. Buchbauer G, Jirovetz L, Jäger W, Plank C, Dietrich H. Fragrance Compounds and Essential Oils with Sedative Effects upon Inhalation. *J Pharm Sci* 1993;82(6):660–664. Available at: <http://doi.org/10.1002/jps.2600820623>
 12. Baratta MT, Dorman HJD, Deans SG, Figueiredo AC, Barroso JG, Ruberto G. Antimicrobial and antioxidant properties of some commercial essential oils. *Flavour Fragr J* 1998;13(4):235–244. Available at: [http://doi.org/10.1002/\(SICI\)1099-1026\(199807\)13:4<235::AID-FFJ733>3.0.CO;2-T](http://doi.org/10.1002/(SICI)1099-1026(199807)13:4<235::AID-FFJ733>3.0.CO;2-T)
 13. Svoboda KP, Deans SG. BIOLOGICAL ACTIVITIES OF ESSENTIAL OILS FROM SELECTED AROMATIC PLANTS. *Acta Hort* 1995;(390):203–209. Available at: <http://doi.org/10.17660/ActaHortic.1995.390.28>
 14. Liu S-H, Lin T-H, Chang K-M. The Physical Effects of Aromatherapy in Alleviating Work-Related Stress on Elementary School Teachers in Taiwan. *Evid Based Complement Alternat Med* 2013;2013:1–7. Available at: <http://doi.org/10.1155/2013/853809>
 15. Colegate SM, Molyneux RJ, editors. *Bioactive natural products: detection, isolation, and structural determination*. CRC press; 2007.
 16. Buchbauer G, Jirovetz L. Aromatherapy—use of fragrances and essential oils as medicaments. *Flavour Fragr J* 1994;9(5):217–222. Available at: <http://doi.org/10.1002/ffj.2730090503>
 17. Wang Q, Wei L, Luo Y, et al. Effectiveness of Aromatherapy on Ameliorating Fatigue in Adults: A Meta-Analysis. *Evid Based Complement Alternat Med* 2022;2022:1–16. Available at: <http://doi.org/10.1155/2022/1141411>
 18. Ober C, Sinatra ST, Zucker M. *Earthing: the most important health discovery ever?* Basic Health Publications, Inc.; 2010.
 19. Sokal K, Sokal P. Earthing the Human Body Influences Physiologic Processes. *J Altern Complement Med* 2011;17(4):301–308. Available at: <http://doi.org/10.1089/acm.2010.0687>
 20. Chevalier G. The Effect of Grounding the Human Body on Mood. *Psychol Rep* 2015;116(2):534–542. Available at: <http://doi.org/10.2466/06.PR0.116k21w5>
 21. Becker RO. Exploring New Horizons in Electromedicine. *J Altern Complement Med* 2004;10(1):17–18. Available at: <http://doi.org/10.1089/107555304322848904>
 22. Kim C, Song C. Physiological and Psychological Relaxation Effects of Fir Essential Oil on University Students. *Int J Environ Res Public Health* 2022;19(9):5063. Available at: <http://doi.org/10.3390/ijerph19095063>
 23. Chevalier G, Sinatra ST, Oschman JL, Sokal K, Sokal P. Earthing: Health Implications of Reconnecting the Human Body to the Earth's Surface Electrons. *J Environ Public Health* 2012;2012:1–8. Available at: <http://doi.org/10.1155/2012/291541>
 24. Miguel MG. Antioxidant and Anti-Inflammatory Activities of Essential Oils: A Short Review. *Molecules* 2010;15(12):9252–9287. Available at: <http://doi.org/10.3390/molecules15129252>
 25. Chevalier G, Sinatra ST, Oschman JL, Delany RM. Earthing (Grounding) the Human Body Reduces Blood Viscosity—a Major Factor in Cardiovascular Disease. *J Altern Complement Med* 2013;19(2):102–110. Available at: <http://doi.org/10.1089/acm.2011.0820>
 26. Sokal P, Sokal K. The neuromodulative role of earthing. *Med Hypotheses* 2011;77(5):824–826. Available at: <http://doi.org/10.1016/j.mehy.2011.07.046>
 27. Yum BS, Park JB, Kim KY. Effect of Earthing Mat on the Quality of Sleep. *J Environ Health Sci* 2020;46(1):103–109. Available at: <https://www.e-jehs.org/journal/view.html?pn=&uid=1957&vmd=Full>
 28. Lee M, Lim S, Song JA, Kim ME, Hur MH. The effects of aromatherapy essential oil inhalation on stress, sleep quality and immunity in healthy adults: Randomized controlled trial. *Eur J Integr Med* 2017;12:79–86. Available at: <http://doi.org/10.1016/j.eujim.2017.04.009>