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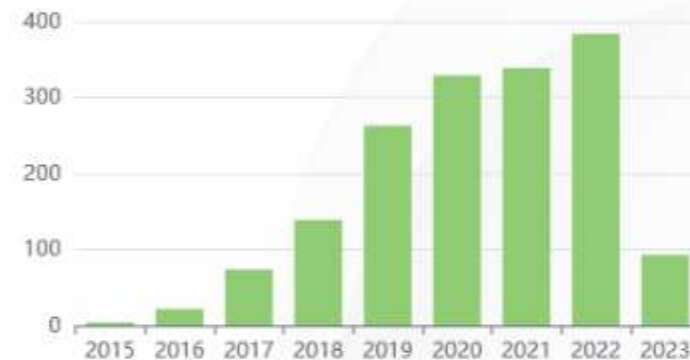
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The use of *Helichrysum italicum* essential oil in virgin coconut oil for wound healing: serial case reports

^{1*} Dian Pratiwi, ² Theresia Santi, ³ Marsia Rusfianti, ⁴ Linda Julianti Wijayadi

¹) Puspa Dermatology Clinic – Jakarta, ²) Departement of Pediatrics, Siloam Hospitals Lippo Cikarang,

³) Departement of Dermatology & Venereology, Siloam Hospital Lippo Cikarang – Cikarang, ⁴) Departement of Dermatology & Venereology, Tarumanegara University – Jakarta

*E-mail: drdianpratiwi@gmail.com

Abstact. Essential oils (EO) have gained importance in therapeutic uses. Scientists have documented their versatile character with antibacterial, antiviral, anti-inflammatory and wound healing effects. Although there are many published reports on the wound healing and antimicrobial activity of *Helichrysum italicum* (Hi) EO, limited publications could be found for the use of Hi in the treatment of wounds in vivo. Coconut oil has long been used for skin disorders including wound healing and microbial infections. We report 4 patients with wound, seen in the dermatology clinic via teleconsultation due to the pandemic in Indonesia. All the wounds were treated with topical Hi 10% in virgin coconut oil (VCO), 3 (three) times a day for 7 days to 28 days until the wound completely healed. All cases showed good wound healing with no secondary infection. No skin reactions nor irritation were seen at the wound area during the wound healing process. The use of 10% Hi EO in VCO for wound care in this case report showed a good result. It brought the benefit of antimicrobial, anti-inflammatory, and promote wound healing making it an ideal alternative therapy for wound healing, thus deserving further studies.

Keywords: *Helichrysum italicum*, virgin coconut oil, essential oil, wound healing, alternative therapy

Background

Wound healing is characterized by several stages that begin with inflammation, neovascularization and granulation tissue followed by re-epithelialization, new extracellular matrix formation and lastly new tissue remodeling. Although the wound healing process takes place by itself, an infection may delay the healing process. In vitro studies showed that plant oils are useful in wound healing, including *Helichrysum italicum* (Hi) essential oil (EO) and coconut oils.^{1,2,3,4} They may promote the wound healing process by their anti-inflammatory, anti-oxidative, and antimicrobial functions, also improved capabilities for cell proliferation, stimulation of dermal reconstruction, improvement in collagen synthesis, and the repairs of the skin's lipid barrier function.¹ *Helichrysum italicum* EO is useful in immediate treatment of injuries, especially bleeding wounds, and after surgery to reduce hematomas, improve healing, and prevent keloid scars.⁵

To the best of the author's knowledge, only limited publications could be found for in vivo use of Hi and virgin coconut oil (VCO) in the treatment of wounds. This study reports cases of wounds where Hi EO in VCO is utilized as the main treatment.

This study aims to provide data in the usage of Hi EO in VCO to promote wound healing that may serve as foundation for it's further studies.

Case presentation

We report 4 (four) patients with wounds, seen in the dermatology clinic via teleconsultation due to the pandemic situation in Indonesia. Informed consent was taken from the patients for using their photos and related information. All patients (or the parents in child patients) were avid aromatherapy users and all preferred to use essential oils as their choice of treatment.

All patients were treated with topical Hi 10% in VCO, applied 3 (three) times a day for the wound until the wound completely healed. The Hi EO was from Young Living™, USA that originates from Yugoslavia, Corsica, Croatia, Spain. Whereas this oil is extracted using steam distilled method from its sources, mainly from the flowers of the plants. Constituents found from this source are neryl acetate (3-35%), gamma curcumene (10-28%), alpha pinene (15-32%), beta caryophyllene (2-9%), and beta seline (4-8%).⁶ The VCO was from Niura™,

Indonesia and the materials originates from Indonesia. The key constituents are lauric acid 49.3%, myristic acid 20.3%, palmitic acid 11.1%, oleic acid 8.41% and linoleic acid 1.91%.

Patient 1 is a 45 years old female, Fitzpatrick skin type III, presented with second degree burns on dorsal right hand due to a hot frying oil accident. There was no history of keloid. Clinical examination showed a large bulla, some areas with epidermolysis, and areas with red skin. She consulted a doctor and was given creams and a one-week dose of oral antibiotics from the doctor. She tried the cream for a day but the skin became redder, with burning sensation and throbbing pain. She preferred to use essential oil and continue with the oral antibiotics. Topical Hi 10% in VCO was given for 26 days from day 2 after the accident until the wound healed. Other than a 6-day dose of antibiotic on day 2 until day 7 after the accident, there was no other topical or oral medication used. One year follow up showed no scar and very mild dyspigmentation. (Figure 1)

Figure 1: Patient 1, from top left to bottom right : day 2, day 3, day 10, day 13, day 28, and 1 year follow up. Topical Hi EO 10% in VCO was given from day 2 until day 28



Patient 2 is a 46 years old female, Fitzpatrick skin type IV, presented with asphalt scratch abrasion wound on the right knee due to a biking accident. She had a history of keloid. Clinical examination showed a

wound with the center of the wound darkened with dirt and debris from the asphalt still embedded deeply in the wound. The wound was then cleaned at home. She preferred to care for the wound at home with essential oils and refused direct examination at the clinic during the pandemic time. Topical Hi 10% in VCO was given for 21 days until the wound healed. There was no other topical or oral medication used. The wound felt itchy during healing and she couldn't resist scratching and peeling the crust. One year follow up showed no scar, with hyperpigmentation and little areas with asphalt pigment. (Figure2)

Figure 2 : Patient 2, from top left to bottom right : day 1, day 6, day 21, and 1 year follow up. Topical Hi EO 10% in VCO was given from day 1 until day 21



Patient 3 is a 6 years old boy, Fitzpatrick skin type III, presented with an incised wound on the dorsal left hand due to an accidental sharp plastic toy cut. He had a family history of keloid. Clinical examination showed a crescent shape clean incised wound. The wound was cleaned at home. The mother preferred to try essential oil first. Topical Hi 10% in VCO was given for 7 days until the wound healed. There was no other topical or oral medication used. Two year follow up showed mild eutrophic scar and no dyspigmentation. (Figure 3).

Figure 3: Patient 3, from top left to bottom right: day 1, day 2, day 3, day 5, day 7 and 2 years after. Topical Hi EO 10% in VCO was given from Day 1-7



Patient 4 is a 7 years old girl, Fitzpatrick skin type IV, presented with a dehiscence due to broken suture on her laceration wound on the upper lip. She had a family history of keloid. Four days prior, she

accidentally crashed on rocks, and the wound was sutured by a plastic surgeon on the same day. She was on the fourth day of a one-week dose of oral antibiotics when the suture broke. The plastic surgeon decided to observe for 3 days and planned to restitch the wound. The mother preferred to try essential oil before follow up with the plastic surgeon. Clinical examination showed a rough irregular wound with dehiscence, covered in crust. Topical Hi 10% in VCO was given for 24 days from day 4 after the accident until the wound healed. Three days after using the oils, on a follow up visit the plastic surgeon decided restitching was not needed anymore. Other than 3 days doses of antibiotics on day 4 until day 7 after the accident, there was no other topical or oral medication used. Ten months follow up showed mild hypertrophic scar with no dyspigmentation. (Figure 4)

Figure 4: Patient 4, from top left to bottom right: Day 4 Wound Dehiscence due to broken suture, Day 5, Day 6, Day 11, Day 14 and follow up 10 months after. Topical Hi EO 10% in VCO was given from Day 4 until 1 month.



The patients were reviewed until the wound completely healed and a follow up after. All patients showed good wound healing results with no secondary infection.

Discussion

Essential oils (EO) have gained their importance in therapeutic uses. As therapeutic agents, EOs are highly concentrated substances extracted from flowers, leaves, stems, fruits and roots, and also distilled from resins. Their versatile character with antibacterial, antiviral, anti-inflammatory and wound healing effects have been well documented.⁷ In the past years, genus *Helichrysum* draws a lot of attention, with some species are being widely studied, including *Helichrysum italicum* (Hi). The growing interest in

this species is driven by their therapeutic efficacy as traditional medicine.⁴

Various types of extracts of Hi could be produced and the resulting products could be differentiated by their chemical composition with distinct chemotypes. According to Viegas, 2014 there are three chemotypes from *Helichrysum italicum subsp. italicum*: one constituted by an elevated percentage of monoterpenes such as neryl acetate, neryl propanoate and -pinene, another characterized by a high amount of geraniol and geranyl acetate and a third one with a large proportion of sesquiterpenes. The other subspecies, *Helichrysum italicum subsp. microphyllum* has two main chemotypes: one high in nerol, neryl acetate, neryl propionate, linalool and limonene, and another constituted by a high amount of ar-curcumene, -curcumene and rosifoliol.⁴ No information on the subspecies and chemotype of the Hi EO used in this report, but the key constituents are neryl acetate, gamma curcumene, alpha pinene, beta caryophyllene, and beta selinene, suggesting the subspecies *Helichrysum italicum subsp. italicum* with elevated percentage of monoterpenes chemotype.

Helichrysum italicum EO displays antimicrobial activity, antioxidant properties, also anti-inflammatory effect against the in vitro denaturation of protein, and antiaging effect by inhibiting collagenase and elastase in vitro.^{8,9} In this case report, Hi EO was used due to these reported effects. The Hi EO from Corsica and Yugoslavia work well for wound and scar treatments.⁵ The Hi EO used in this case report originated from the same area.

The antimicrobial activity of Hi EO is attributed to its chemical composition. Oxygen-rich compounds such as neryl acetate, geranyl acetate, geraniol, and nerol are considered as the source of the antimicrobial activity of the Hi EO, which are found in elevated percentages. Another anti-microbial properties could also be attributed to possible synergistic relationship of the minor constituents of the EO. Constituents such as a pinene, b-pinene and limonene have a strong antibacterial activity. According to Djihane B, 2017 Hi EO shows higher effectivity against the Gram-positive bacterium *Staphylococcus aureus* than against the Gram-negative strains *Escherichia coli*, *Enterobacter aerogenes*, and *Pseudomonas aeruginosa*.⁸ In this case report, there was no secondary infection on the wound healing phase of all 4 patients, which may be attributed to antimicrobial activity of Hi EO. Patient 1 and patient 4 were on oral antibiotics for only 6 days and 3 days respectively since starting the topical Hi 10% in VCO, while the wound healing process took one month to complete. Patient 2 and patient 3 had no other

treatment besides the topical Hi 10% in VCO during the wound healing process.

Helichrysum italicum EO also demonstrated significant in vitro anti-inflammatory effect against the denaturation of protein. Polyphenols are well known to display important biological properties. Djihane B in 2016 reported three phenols (thymol, eugenol and 3-isopropylphenol) and twenty seven volatile carboxylic acids were identified in Hi EO. The in vitro anti-inflammatory activity of Hi EO may be attributed to its synergistic several polyphenols contents effect.¹⁰ Patient 1 had large bullae with erythema and patient 4 had severe edema which are signs of inflammation. These signs of inflammation rapidly decrease, which can be seen as early as 1 day after starting the topical Hi 10% in VCO, which may be attributed to Hi EO anti-inflammatory effect.

Antimicrobial, anti-inflammatory and wound healing activity of Hi EO are key factors to use as a therapeutic agent in wound healing.⁵ In this case report, Hi EO was chosen because of its antimicrobial, anti-inflammatory and wound healing activity which all is supportive to wound healing. To be able to utilize a single preparation from only one essential oil with multi therapeutic effects certainly has its advantage. Versatility is one of the main characteristics of essential oils, including Hi, which is not common in modern western medicine.

In recent decades, the application of undiluted EO to the skin is controversial due to safety concerns. However, there are some exceptions, in which undiluted EO can be safely and effectively applied to the skin, possibly in small localized skin problems, localized infections, and where the usage benefits could outweigh risks. According to Tisserand 2014, in the case of wound healing where epidermal barriers are absent, therapeutic concentrations of one or two orders of magnitude higher than in vitro cytotoxic concentrations present no apparent irritation risk. Range of dilution of 4 - 12% is considered safe and effective.¹¹ The Hi EO concentration used in this case report was 10%. There were no adverse effects seen in all 4 patients with this concentration. The 10% concentration appeared to be safe to use for open wounds in all 4 patients.

Vegetable oils are commonly used in topical skin care products, as they are readily available and relatively inexpensive. They might be used as primary ingredients, minor ingredients and as carrier medium. They have shown efficacy to promote the wound healing process through its anti-oxidative, anti-inflammatory, and antimicrobial capabilities, also by

increasing the synthesis of collagen, promoting cell proliferation, stimulating dermal reconstruction, and also repairing the skin's lipid barrier function.¹

Coconut oil is extracted from mature coconuts (*Cocos nucifera*) specifically its seeds from the Indian-Indonesian region. It is composed of mainly saturated fatty acids, phenolic compounds, triacylglycerol, phospholipids, sterols, tocopherols, and volatile substances.¹² VCO is extracted from the fresh kernel without high heat or chemical treatment. Compared to coconut oil, VCO contains higher amounts of phenolic compounds such as catechin, ferulic acid, p-coumaric acid, which has antioxidant activity.¹² VCO has traditionally been used by ethnic groups of Ngada of Flores, an eastern Indonesian island for various skin conditions including wound healing and skin infections.¹³ It has antimicrobial activity and skin-barrier repairing properties in many skin conditions including acne, xerosis, and atopic dermatitis. Monolaurin is the responsible constituent for the antibacterial activity against *Cutibacterium acnes*, *Staphylococcus aureus*, and *Staphylococcus epidermidis*. It exerts its antimicrobial activity by disrupting membranes of microbial organisms.¹⁴ Other study also concluded that topical application of VCO oil may promote faster wound healing process through accelerated epithelization.¹⁵ With this in mind, 10% dilution of Hi EO with VCO as carrier oil was selected for the report. The cumulative effect of these compounds may be beneficial to the wound healing process. VCO antimicrobial activity and skin-barrier repairing properties are synergistic to Hi EO antimicrobial, anti-inflammatory and wound healing properties and further support and fasten the wound healing process.

Biochemical effects of Hi EO such as its antimicrobial and anti-inflammatory properties contribute to its potential to promote wound healing. It might enhance wound healing by protecting against bacterial infection during inflammation and formation of granulation tissue stage until complete epithelialization, and reduce the inflammatory response during inflammation stage. VCO further supports these processes and the high amount of antioxidants is beneficial in scavenging free radicals which cause inflammation stage in wound healing. In this case report, all cases showed good wound healing with no secondary infection, with normal to faster rate compared to natural wound healing. Complete epithelialization in patient 3 took 7 days, which is fast, while for other patients took 3 – 4 weeks which is the normal time for natural wound healing. All wounds had no skin reactions or irritation during the wound healing process. Mild dyspigmentation seen in patient

1 and 2. Dyspigmentation is a temporary adverse event that will diminish with time. Mild eutrophic scar in patient 3 and mild hypertrophic scar in patient 4. Hypertrophic scar will usually subside in one year.

These adverse events are similar to those seen in wounds treated with modern western medicine. Despite the adverse events, all 4 patients were satisfied with the outcome.

Conclusion

The use of 10% Hi EO in VCO for wound care in this case report showed a good wound healing with no secondary infection. No skin reactions nor irritation were seen at the wound area during the wound healing process. This treatment brought the benefit of antimicrobial, anti-inflammatory, and wound healing actions in one preparation only a single essential oil in a single carrier oil, making it an ideal alternative therapy for wound healing, thus deserving further studies.

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