



Virgin Coconut Oil (VCO) Accelerated Wound Healing Process in Diabetes mellitus (DM) Patients With Diabetic Ulcer in dr. Rasidin Hospital, Padang, Indonesia

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ABSTRACT

DM ulcer is one of the complications of DM that resulted in amputation even death. A DM ulcer usually a chronic wound which difficult to heal with antibiotics because of the presence of the Staphylococcus bacteria resulting in an antibiotic-resistant ulcer, requiring an alternative as the solution. VCO, one of the natural materials that are easily acquired have benefits for wounds and often used by the community. VCO contains lauric acid and flavonoids compounds work as antibacterial, anti-inflammatory, antioxidant, and analgesic. The purpose of this study is to determine the benefits of VCO on the healing of DM ulcers. This was a quasi-experiment study recruited 16 DM patients with ulcers treated at the Dr. Rasidin Hospital, Padang, Indonesia. The study participants are divided into 2 groups, 8 patients in the control group, and another 8 in the intervention group. The control group is given wound care using NaCl 0.9% and the intervention group carried out wound care with NaCl 0.9% plus VCO. VCO is produced using a stimulation technique. Wound care is performed for 4 days in both groups and the surface area of the wound is calculated after 4 days then the data precede using independent t-test. The results of the study showed a meaningful difference in surface wound between the control group and the intervention group with the value $P = 0,033$. VCO helps wound healing by reducing the surface area of the wound.

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Introduction

DM ulcer is a complication of DM caused by disorders of peripheral vascular and neuropathy caused by DM. This condition occurs in 4-10% of all DM complications (Xu, Zhang, & Graves, 2013; Setiawan, H., et. al, 2020). DM ulcer develops starting with decreasing of the sensitivity to the legs due to neuropathy (Dafriani Putri, 2019). Non-well-treated DM ulcer increases the incidence of infections and amputation. This affects the increase in morbidity and mortality rates, while also increasing the cost of health.

The entering of bacteria to the wound aggravates ulcers and high sugar levels became a supporting place for bacterial development. DM ulcers could not adequately handle only by using antibiotics but should be accompanied by performing a better wound care or rehabilitation by a surgical specialist (Amin & Doupis, 2016). Antibiotics are only suitable for acute wounds. However, DM ulcer is one of the chronic wounds. Giving antibiotics to DM ulcers often

caused antibiotic resistance. A dirty wound will be difficult to heal as the inflammatory process continues to occur. It can be fixed by conducting wound care.

One of the bacteria that often cause infections in DM ulcer is Staphylococcus aureus (Arista Adityasari Putri, 2016). This bacterium forms the biofilms on the basis of wounds thus complicating phagocytosis from Neutrophils. It causes the bacteria to live longer and slows the wound healing process (David G. Armstrong, D.P.M, 2017)

Wound healing consists of several phases, including the inflammatory phases, proliferation, and remodeling. Normal wounds will heal for 7-10 days. The length of the wound healing phase is influenced by many factors, one of which is a condition of hyperglycemia. In patients with DM wound healing lasts longer (Atalay et al., 2010)

Wound care is one of the nursing implementations aimed at providing a conducive environment for the wound

to be well resolved. Modern wound care finds that treatment of wounds by moist methods is much more effective for wound healing. In addition to stimulating wound granulation, treatment with moist methods also prevents infection (Pakyari & Farrokhi, 2013) Up until now, conventional wound care still has not shown faster-wound tissue repair. Methods of wound care using natural materials are expected to accelerate the repair of DM ulcers (Nurul Izzah Ibrahim, Sok kuan Wong, Isa naina Mohamed, Norazlina Mohamed, Kok-Yong Chin, 2018).

Despite using synthetic drugs, wound especially DM ulcers can be treated using material derived from nature. Many of these natural substances contain anti-inflammatory, antibacterial, antioxidant, and can stimulate collagen growth. Natural materials has been used widely by the community, whether for acute or chronic treatment of wounds (Bahramsoltani, Farzaei, & Rahimi, 2014)

VCO, derived from the fermentation of coconut milk, contains a variety of excellent benefits for the healing of wounds such as anti-inflammatory, antipyretic and has analgesic effect. It stimulates the establishment of new blood vessels on wounds. Good nutrient and oxygen flow can accelerate wound healing. In addition, VCO also has a high antioxidant which help the wound healing process (A. H. Ibrahim, S. S. Al-Rawi, A. S. Abdul Majid, O.A. Al-Habib, 2013) (Suhery, Febrina, & Permatasari, 2018). An invitro study proves that VCO can reduce colonization of Staphylococcus aureus bacteria. The purpose of this research is to determine the effect of giving VCO on the healing of DM patients DM in Padang city, Indonesia.

Method

This is a quasy experiment research take place at inpatient department of Dr. Rasidin Hospital, Padang, West Sumatera, Indonesia. The study participants are DM patients with ulcer, divided into 2 groups, 8 patients in the control group, and another 8 in the intervention group. The control group is given wound care using NaCl 0.9% and the intervention group carried out wound care with NaCl 0.9% plus VCO. VCO is produced using a stimulation technique (Aziz, Olga, & Puspita Sari, 2017) by adding 1-2 tablespoon of VCO into original coconut milk and stir them in a jar, and wait for 24 hours before filtering the oil and the residual pulp.

Wound care is performed by professional nurses working in the Dr. Rasidin Hospital, Padang for 4 days in both groups daily. The surface area of the wound is calculated after 4 days. The wound healing process is counted from the area of wound in both groups, and the result is calculated using statistical analysis using an independent t-test. Wound healing is measured from the surface area of the wound referring to the BWAT (Bates Jensen Wound Assessment Tool) (Bates-Jensen, 2001). Ethical clearance obtained from Medical Faculty of Ethics Commission of the University of Andalas with number 141/KEP/FK/2020.

Results and Discussion

Table 1
Average area of DM ulcer injuries after wound care in Group control

Ulcer Area	Mean	SD	Min/Max
Post Test in Group control	3,41	3,04	0,35/10,00
Post Test in Intervention Group	0,83	0,53	0,18/1,56

According to table 1 the average size of the wound obtained after the wound treatment in control group are 3,41 cm, *standard deviation* 3,04 cm, *minimum/maximum* 0,35/10,00 cm.

Wound care consists of the wound washing stage, the disposal of dead tissue, and the bandage. Wound washing using NaCl 0.9% can reduce dirt and bacteria on wounds. The disposal of necrotic tissue can stimulate the growth of new tissues. Wound conditions need to be maintained to remain moist in order to stimulate the acceleration of collagen growth in the proliferation phase. Based on the characteristics of wounds after treatment with NaCl 0.9%, the average surface area of the wound decreased compared with prior to wound care. Decreased surface area of the wound 0.1 cm² during 4 days wound care. After being treated with NaCl, the pus and redness are reduced; the granulation tissue appears on the edges of the wound. This occurs because the necrotic tissue on the edges of the wound has been lifted when the wound treatment.

Area of injuries after administration of VCO in the intervention group obtained *mean* 0,83 cm, *standard deviation* 0,533 cm, *minimum/maximum* 0,18/1,56 cm.

In the intervention group, the VCO is administering into the wound after using NaCl 0.9%. Anti-inflammatory content found in VCO improves wound healing by lowering the surface area of the wound. The decreasing area of the wound using VCO is 0.6 cm². This result is significant compared to control group which only using 0.9% NaCl. The flavonoid in the VCO lowers the levels of TNF- α and IL-6 arising from the macrophage reaction to the bacteria present in the wound. VCO also improves circulation on wounds by enhancing the process of angiogenesis, resulted the nutrients and oxygen needed in the wound healing process is well fulfilled. The edema was also reduced as the result of good circulation in the wound area. Antibacterial content of VCO reduced the process of infection in the wound, thus lowering the amount of exudates in the wound.

Table 2
The average difference in the area of DM ulcer injuries VCO administration in the intervention and control group

Ulcer Area	Group	Mean	SD	95% CI		P-Value
				Lower	Upper	
Post Test	Intervention	0,8300	0,53388	-4,92346	-,23654	0,033
Post Test	Control	3,4100	3,04396	-5,13364	-,02636	0,048

Table 2 shows that the statistical results using independent T-Test obtained $P = 0.033$ mean $P \leq 0.05$ (Equal Variances Assumed) in the intervention group. The result is statistically significant, means there is an influence of administering VCO to the DM ulcer compared to the usual wound care.

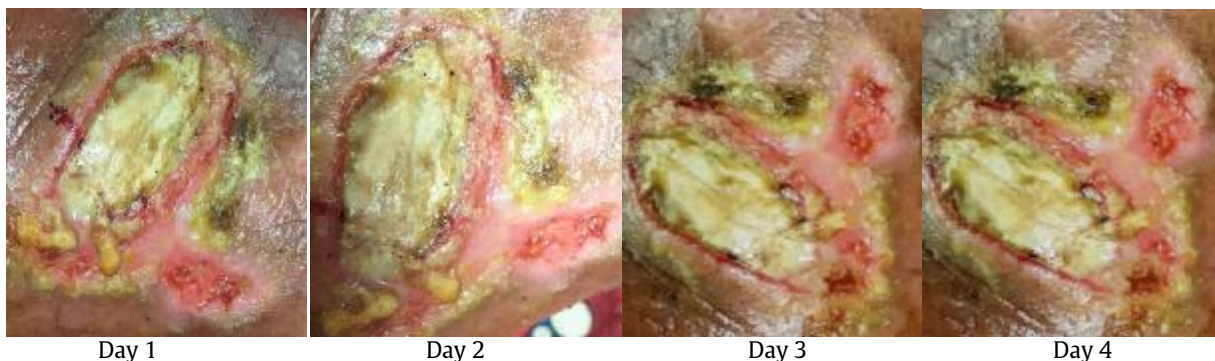
VCO contains various benefits in wound healing such as anti-inflammatory, antibacterial, antioxidant, antipyretic, and analgesic. In addition, VCO also has a high antioxidant content helped the wound healing process (Z. Ahmad, R. Hasham, N.F. Aman Nor, 2015). An invitro study proves that lauric acid found in VCO reduce the colonization of *Staphylococcus aureus* bacteria (Susanto, Sujatno, & Yuwono,

2015). Furthermore, lauric acid also stimulate collagen growth and improve wound healing faster (Ibrahim et al., 2017). Compared with the control group, the amount of exudates in the intervention group are fewer and odorless. Besides, the swelling and redness of the wound is also decreasing. The wound characteristic is significantly different from the control group, where adding te VCO into the wound treatment make the wound become dry and the formed of fibroblast tissue is also stimulated (K.G. Nevin T. Rajamohan, 2010). Based on the interviews to the patients, the pain scales of the patients are also significantly lowering.

Figure 1
DM ulcer in intervention group after 4 days with NaCl 0.9% and VCO administration



Figure 2.
DM ulcer in the control group after 4 days with administration NaCl 0.9%



Inflammatory reactions usually last up to 4 days, then it continues with the proliferation phase characterized by the formation of fibroblast tissues on the wound (Abdo, Sopko, & Milner, 2020). Performing wound care with NaCl 0.9% and adding the VCO improves the wound healing process especially in the inflammatory and proliferation phases. Since the study was only up to 4 days then wound healing in the remodeling phase could not be observed.

Conclusions and Recommendations

Performing wound care by combining NaCl 0.9% and VCO found to be significantly improve the wound characteristics compared to using NaCl 0.9% only. Using the VCO can improve wound healing because it contains a variety of compounds, especially flavonoids and lauric acid functioning as anti-inflammatory, antibacterial and antioxidant.

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Declaration of Conflicting Interests

The authors declared that no potential conflicts of interests with respect to the authorship and publication of this article.

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