

The New Paradigm of Wound Management Using Coffee Powder

Hendro Sudjono Yuwono *

Division of Vascular Surgery, Department of Surgery, Padjadjaran University, Jalan Eijkman 38, Bandung 40161, Indonesia

*Corresponding author: hsy47@bdg.centrin.net.id

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Abstract This study examines the results of a new freshly homemade coffee powder for the management of patients with a variety of acute and chronic wounds (n=130). They refused skin grafting. All wounds were treated using topical coffee powder as a wound dressing that was replaced once every 4 weeks until its healing. Coffee has a bactericidal capacity against methicillin-resistant *Staphylococcus aureus*, many antioxidants, deodorize, longer time to change wound dressing pads, maintain moistened wound, absorptive capacity, autolytic debridement, cost-effective, and no adverse reaction. The use of coffee powder as a wound dressing has a strong influence on the emergence of a new paradigm in the management of wounds.

Keywords: coffee powder, new paradigm, wound management, MRSA

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1. Introduction

Often effective wound dressing is not available in peripheral areas. The treatment for wound using freshly homemade coffee powder has long been recognized as a traditional medicine and a local wisdom considering its effectiveness in the healing of wounds. Many local health providers from the area of coffee plantations reported coffee powder sprinkled on various acute or chronic wounds (diabetes mellitus, sharp cuts, burns) does not cause infection. The coffee powder can be left on the wound until its healing. Lily M. Perry in Medicinal plants of East and Southeast Asia said coffee powder has been used to treat burns. [1] These reports gave motivation to conduct research regarding the role of coffee powder in wound healing.

2. Materials and Methods

All patients were treated as private patients in Dr. Hasan Sadikin Central General Hospital /School of Medicine Padjadjaran University in Bandung, Indonesia. This study was approved by the institution's ethical committee: 30/FKUP-RSHS/KEPK/Kep./EC/2005.

This prospective cohort study of all patients who accepted the treatment of their wounds using coffee powder and refused skin grafting.

2.1. Microbacterial Study

Zone of inhibition against methicillin-resistant *Staphylococcus aureus* (MRSA):

MRSA strain (ATCC 43300) bacterial culture medium on Mueller-Hinton agar plates were incubated in a temperature of 37°C for 24 hours showed inhibition zone that was done in the laboratory of microbiology in Bandung. Examination of the inhibition zone of coffee robusta powder (extract of coffee powder : water = 1: 2), Ag-sulfadiazine cream, Povidone-iodine 3% solution, respectively repeated four times observations in the culture of MRSA on agar plates of 90 mm diameter (Table 1). Inhibition zone diameter of water extract of coffee arabica or coffee robusta was more or less similar result.

2.2. Animal Study

A total of 18 of 200 gram-Wistar male-rats, after the subcutaneous injection with 0.5ml of 2% Lidocaine, and then the hair was shaved from the back of each rat (from the thoracic to the lumbar vertebrae region) using an electronic hair shaver and using a stemmed iron with circular edge heated by fire causing subcutaneous wound with a diameter of 4 cm. The animals were divided into three Groups with each consisting of 6 animals. Group A treated with coffee powder, Group B treated with Ag-sulfadiazine cream, and Group C as control group without any treatment. The rats were kept in separate cages, so every rat can not lick of each other or interfere with other rats. Then observations were carried out every week of fluid production (oozing) from the wound and when was the wound dry. The first sign of good healing process is a dry wound surface, that it means the entire wound surface covered by a thin epithelialization that can stop the production of wound fluid. [2] Acute wound fluid has major angiogenic effects, but chronic wound fluid has anti-angiogenic properties and inhibit granulation. [2]

Coffee powder seems to have the complete abilities to overcome both conditions.

All experimental procedures followed the Helsinki Declaration, World Medical Association Declaration of Helsinki [3].

2.3. Human Study

2.3.1. Preparation of the Coffee Powder

A new freshly made Robusta coffee powder (90 cases of wound) or Arabica coffee powder (40 cases of wound) used in this study, obtained from a local market (Aroma coffee shop, Bandung, Indonesia) derived from coffee plantations in Lampung and West Java provinces (Indonesia). The coffee beans that had been stored for 8 years, then roasted and milled to be a coffee powder. The coffee powder used in this study does not require sterilization. After completion of debridement, each wound was covered by coffee powder in large quantities and the outside covered by gauze rolls. The amount of coffee powder is given to close the wound, depending on the size of the magnitude and depth of the wound. For injuries at a diameter of 5 cm at a depth of about 0.5 cm, should be given as much as an adult handful of coffee beans (adult) or 80-100 grams, and should cover the entire surface and edges of the wound. Then covered with gauze pads that were fixed with adhesive tape (Figure 1). Everything must be kept dry and must not be wet for 4 weeks. But if in a few days it was wet by wound fluid production and cause odor, coffee can be replaced with a new one.

Healing of wounds using topical coffee powder (n=82) was compared with saline (n=78 with gauze dipped in NaCl 0.9%) in diabetic patients (Table 2).

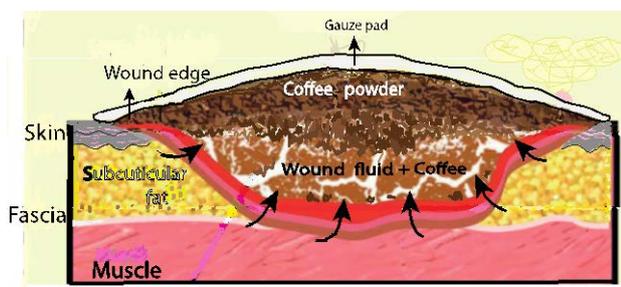


Figure 1. Schematic picture of coffee-treated wound

The amount of coffee powder should be pretty much to cover the wound so that it can absorb the wound fluid.

2.3.2. Selection Criteria of Wounds

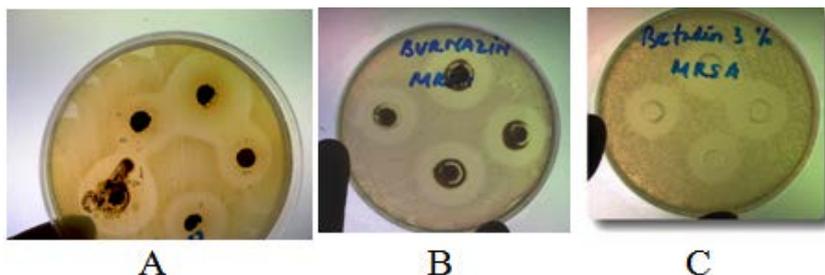


Figure 2. Zone of inhibition against MRSA of coffee robusta decoction (A), Ag-Sulfadiazine (B), Povidon-iodine 3% (C)

3.2. Animal Study

A total of 130 patients with wounds, collected from January 1, 2003 through January 1, 2014 were aged between 16 and 76 years refused skin grafting, i.e. diabetes mellitus type-2 (90 cases), autoimmune (1 case of juvenile rheumatoid arthritis), burn (6 cases), post-amputation wounds in Buerger's disease (15 cases), cellulitis (6 cases), venous malformation (10 cases), deep femoral soft tissue wound (2 cases), all wounds were treated using topical coffee powder which was replaced and assessed once every 4 weeks. All cases were not found any ischemic wound.

2.3.3. Statistic Analysis

All data were analyzed by Kruskal-Wallis test for Table 1, Mann-Whitney U test for Table 2, using SPSS for Windows version 18.0, and $p < 0.05$ considered significant.

3. Results

Coffee powder was selected to treat a variety of wounds, because coffee has been known as a safe beverage consumed. The wounds covered with coffee powder had no annoying flies, had a nice coffee aroma and immediately eliminated wound-odors (deodorized effect in 6 diabetic wounds and 5 cellulitis), did not cause any pain during dressing changes, speedy recovery, simple procedure of wound dressing replacement, without any one of adverse complication found, much longer dressing changes (every 4 weeks), and it was considered cost-effective.

3.1. Microbacterial Study

Coffee robusta powder has a strong zone of inhibition against methicilline-resistant *Staphylococcus aureus* (MRSA) culture. Zone of inhibition of Povidone-iodine 3% solution, Ag-sulfadiazine cream against MRSA, in comparison with coffee (Table 1) were not significant ($p > 0.05$).

Table 1. Zone of inhibition (in mm) against MRSA on an agar plate

Plate number	1	2	3	4	Mean
Coffee decoction*	25	26	23	25	24.75
Ag-sulfadiazine cream	25	25	25	23	24.5
3% Povidone-iodine liquid	20	22	24	24	22.5

*Zone of inhibition of coffee robusta is not statistically significant compared with others ($p > 0.05$) against MRSA culture. Coffee decoction was coffee powder in water steamed for 20 minutes (coffee powder : water = 1 : 2).

The experimental study of wound healing started with the treatment of subcutaneous burn wounds of rats using

topical coffee in cream forms, compared with Ag-sulfadiazine cream as the control group, showed no

significant difference in terms of the speed of wound drying in 4 weeks.



Figure 3. Animal study of healing speed in burn on 3 group-rats resulted non-significant differences ($p > 0.05$). Group A: Coffee powder, Group B: Ag-sulfadiazine. Group C: control

3.3. Human Study

3.3.1. Diabetic Foot Ulcer

The process of wound healing in diabetic foot is always in conjunction with the improvement of blood glucose levels and antibiotics as needed. All patients do not support recurring necrotomy. Patients and their families can help each other because the procedure to replace the coffee powder and wrap using gauze pads are very easy to do.

Depending on the magnitude of size and depth, the drying of the coffee-treated wounds occurred at week 8, and closure of the skin epithelium occurred at the 12th - 16th week that depending on the size of the wound.



Figure 4. A 63 year-old-male with diabetic foot ulcer treated using coffee powder

3.3.2. Juvenile Rheumatoid Arthritis

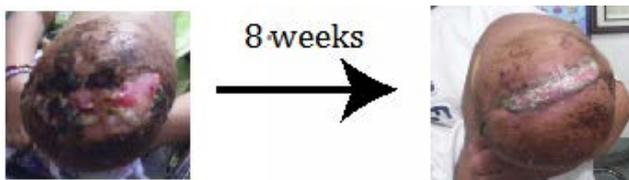


Figure 5. The healing of amputation ulcer in a 17 year-old female with Juvenile rheumatoid arthritis

In a patient with juvenile rheumatoid arthritis, who has been taking corticosteroid tablets throughout her life, she preferred wound healing by replacing the cover once a month only; the soft tissue and the skin had grown to close the wound with normal scar by the 8th week.

3.3.3. Venous malformations (Klippel-Trenaunay syndrome)

Coffee powder is able to stop the bleeding from the subcutaneous layer that was previously difficult to stop only with tight stitching. Bleeding is absorbed and clotted by the coffee powder after the 8th week.

All the patients love the coffee powder scent that can boost spirit for the wound healing process.

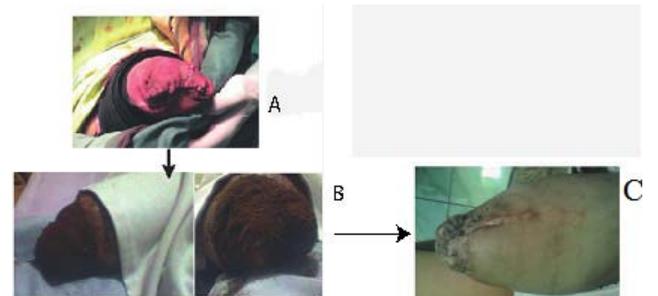


Figure 6. A. Intractable bleeding of transfemoral amputation stump. B. The stump covered by coffee powder and closed by gauzes. C. After 3 months the bleeding stump finally healed. Coffee powder was left for 3 months only one time the coffee should be added to close the wound

3.3.4. Coffee Powder Versus Saline

Distribution of patient in group of coffee powder consisted of 39 males and 43 males, and in group of saline consist of 40 males and 38 females ($p > 0.05$).

Table 2. Coffee powder versus saline in wound healing of diabetic patients. Wound diameter was the same in both groups: 3-5 cm. Wound dressing changes: every 4 weeks in coffee-group and daily in saline-group. The difference between coffee and saline in diabetic wound healing is statistically significant ($p=0.000$)

Wound location	Coffee powder	Saline
n	82	78
Foot-dorsum	45	46
Foot-plantar	27	23
Foot-dorsum and plantar	10	9

Table 3. Coffee powder versus saline in wound of diabetic patients. Wound diameter in both groups: 3-5 cm

Wounds dry (weeks) *	Coffee powder	Saline
8 weeks	20	10
10 weeks	44	13
12 weeks	18	33
12 – 14 weeks	0	22

*)The first sign of healing is a dry wound surface means the inflammatory phase will be passed to the next healing phase.

4. Discussion

Research study on coffee powder for the management of wounds is the first time ever done.

The use of coffee powder to cover all type of wounds is reported without causing adverse effects. Coffee powder was left on the wound tissue for many weeks without cleaning or wetting, the coffee powder was added occasionally until the wound was finally covered itself by epithelial cells. It is usually needed to do cleaning up the wound or debridement only in the beginning, and then covered by coffee powder.

Compared with honey, coffee powder absorbs easily the wound fluid. The coffee powder will stay firmly in place. The medicated honey tends to flow out of the wound and easily absorbed by the gauze.

In fact coffee powder is easier to get in packaging in shops or stores, because it is used daily as a popular beverage. Quick closure of the wound will reduce the occurrence of microbial contamination and prevent the incidence of infection. Activity increased after coffee powder mixes with wound fluid, resulting in a solution of coffee along with wound fluid which eventually has antibacterial effect and has a high antioxidant content, and others who will support wound healing quickly.

4.1. Longer Duration of Wound-Dressing Changes

Many patients were complaining about inconvenience and discomfort resulting from the frequent replacement of wound dressings, wound odor and sticky wound dressings. That is why coffee is preferred as a wound covering material after they getting full information.

In general, most patients prefer a wound dressing that does not need to be replaced frequently, has the ability to absorb wound fluid, has anti-inflammatory and antibacterial properties as well. Replacement of wound dressings will cause unpleasant feelings, interference and stress; moreover manipulation of the wound due to frequent replacement causes interference in the growth of new cells.

As direct results of infrequent changing of the bandage, the patients feel much more calm, the growth of new cells were not disrupted, leading to reduction of pain during removal of dressing from the wound surface, so it is also more comfortable to young patients. They will be much quieter, not waiting anxiously for the health provider to replace the bandage. Besides that, it allows the active substances contained in coffee powder to work in the best way possible.

Frequent washing of the wound with physiological saline or with other liquids, may cause a decrease in temperature of the wound causing disturbance to the very delicate growing cells [4].

4.2. Deodorize

One of the well-known physical properties of coffee powder is its fragrance, and this is a very useful nature to eliminate wound odor immediately when the coffee powder is sprinkled on a foul smelling wound. Approximately 800 aromatic compounds are the source of the scent of coffee beans, but it is not owned by honey or saline or any other wound dressing [5,6].

4.3. Antioxidant

Each cell of an injured tissue will produce a lot of radical oxygen species during the early phase of wound healing. That is why antioxidants are required to act as free radical scavengers to speed up the healing process. Coffee has many polyphenols known to act as antioxidants. [6,7] Function of topical antioxidants in coffee powder is particularly important in cases of diabetic ulcers or autoimmune (eg, juvenile rheumatoid arthritis). The role of these antioxidants is believed to be considered essential to accelerate the healing of a wound.

4.4. Absorptive Capacity

Coffee powder absorbs water very fast (hygroscopic), therefore it also play a role in continuously absorb wound fluids. With the presence of a thick layer of coffee powder, the fluid will be absorbed from the wound and so it will resemble the negative pressure to absorb wound fluid.

4.5. Moist Wound

The moisture in the wound tissue will be maintained as long as the wound is not yet covered by epithelial cells. The presence of antioxidant, antibacterial property, appropriate pH can accelerate the growth of normal cells ensure the healing. Coffee-pH (4.5-5.0) is almost the same with the natural skin-pH (4.5-5.5), creating an inhibition of bacterial growth. [8] The wound is closed by the coffee should not be wetted by any sterile-liquid, because it is not required. Flushing will cause the pH to rise and cause microbes derived from surrounding skin will enter the wound, resulting slowing down healing. That is why a dry wound management is prudent.

4.6. Antibacterial Activity

Coffee has strong inhibition against MRSA that is proven in agar plates, which may be due to phenolic acidity and hyperosmolarity formed when mixed with a liquid wound. [6,9] MRSA is a bacterial species usually found in an suppurative acute or chronic wounds. This antibacterial findings confirm the antibacterial strength will greatly assist the healing of acute or chronic suppurative wounds and help accelerate shortening the inflammatory phase of the wound healing process.

4.7. Hemostatic Property

Fine grains of coffee powder making large surface, thus providing the blood cells attached and aiming easier to stop minor bleeding. Figure 5 explains post surgical wound complicated stubborn minor bleeding which difficult to stop with tightened sutures, can be solved by covering the wound using coffee powder. In this case is finally stopped bleeding after the wound covered by coffee powder for 12 weeks (wound dressings were replaced 2 times) In case the image is finally stopped bleeding after injuries covered coffee beans for 2 x 6 weeks (wound dressings only replaced 2 times within 12 weeks).

4.8. The New Paradigm of wound Management

An ideal wound dressing should have a kind of sufficient antibacterial capacity, so that the inflammatory

phase is not interrupted. It also requires the ability to absorb wound fluids and cause the wound remain in a moist condition. Wound dressings preferably should not be changed too often, to prevent pain during wound dressing replacement and to prevent damage to the new growing cells. Longer duration of wound dressing change will activate antioxidants, antibacterial, and an unaltered wound temperature. The existence of those capabilities will certainly accelerate wound healing. Among wound dressings that meet these requirements are coffee powder, honey, and curcumin [10].

Malodorous wounds must be quickly eliminated by closing the wound, because disturbing the surrounding. It allowed provided that the wound closure is coffee.

4.9. Autolytic Debridement

Wound healing occurs within four weeks without replacing gauze bandage and coffee; this circumstances indicate necrotic tissue can be digested by macrophage, proteinase or collagenase, so it does not require debridement or necrotomy repeatedly. Cysteine proteinase contained in coffee is capable of carrying out the remodeling phase of wound healing [11].

5. Conclusion

The use of coffee powder as a wound dressing has a strong influence on the emergence of a new paradigm of thinking in the management of wounds, particularly longer dressing-change duration, maintenance of a moistened wound, many antioxidants, antimicrobial, absorbing and deodorizing properties, autolytic debridement, reduction of scarring, minimized pain by less frequent dressing change, cost-effective and no adverse reactions. This study gives confidence based on scientific investigation to use safely the coffee powder in assisting wound healing as a wound dressing.

Conflict of Interest

The author confirms that this article has no conflict of interest.

Acknowledgement

None.

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