

Principles of Diabetic Foot Ulcers Using Medicinal Plants in Treatment Culture Indonesian Traditional and Ayurvedic

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ABSTRACT

Diabetes mellitus is a major public health problem worldwide. In diabetic patients, wounds are very difficult to heal and are often prone to infection. The purpose of writing this literature review is to analyze scientific information regarding the use of medicinal plants for diabetic foot ulcers in Indonesian traditional medicine culture and ayurvedic and their applications. This study uses qualitative research methods and a descriptive approach. Secondary metabolites found in plants It has a pharmacological activity that is used to treat DFUs (diabetic foot ulcers), such as antibacterial, anti-inflammatory, antifungals, and so on. Principles of ayurvedic medicine in curing a disease must be based on the relationship between Tri-Dosha and Panca Maha Bhuta that is a disease whether it is Vata, Pitta, or Kapha. This is also in line with and explained in the culture of Ayurvedic medicine that Dushta Vrana (diabetic foot ulcers) can be treated with Sheeta (cold) medicinal ingredients. It can be concluded that the cultural principles of Indonesian traditional medicine and Ayurvedic have similarities, namely treating a disease based on the nature of the disease.

Keywords: Diabetic foot ulcers, Ayurvedic, Traditional medicine, Global health

1. INTRODUCTION

Diabetes mellitus (DM) is a major public health problem worldwide. Current global estimates indicate that this condition affects 415 million people and is set to escalate to 642 million by the year 2040 [1].

There are 1785 DM patients who have experienced complications such as neuropathy (63.5%), retinopathy (42%), nephropathy (7.3%), macrovascular (16%), microvascular (6%), and diabetic foot ulcers (15%). While the mortality rate due to diabetic foot ulcers and gangrene reached 17-23% and amputations reached 15-30%, in addition, the 1-year mortality rate after amputation was 14.8% [2].

Previous studies that have been conducted using meta-analytical studies show that the prevalence of diabetic ulcers in the world is 6.3%. North America shows a prevalence of 13%, Oceania at 3%, Africa at 7.2% which is bigger than Asia which shows a prevalence of 5.5%, Europe shows a prevalence of 1.5%, Belgium at 16.6% followed by

Canada at 14.8%, the USA at 13%, and India at 11.6%[3].

Current diabetes mellitus and its complications such as incurable wounds are a challenge for surgeons. In diabetic patients, wounds are very difficult to heal and are often prone to infection.

In Ayurvedic, herbal or herb-mineral formulations are suggested for wound healing, but the available evidence on diabetic wound healing is limited. Despite the many advances in modern surgery, the management of diabetic wounds is still a problem for surgeons. Patients prefer Ayurvedic treatment as a last resort. Acharya Sushruta describes 60 procedures for the management of Vrana (wounds), which represent a unique therapeutic approach to wound management.

People with diabetes mellitus take treatment for years or even a lifetime. High glucose levels can cause fatal complications such as diabetic ulcers, where these complications are an increasing problem in public health and are a major cause of admission, amputation, and death in diabetic patients.

Diabetic foot ulcers are partial (partial thickness) or full-thickness (full thickness) damage to the skin that extends to

the tissues under the skin, tendons, muscles, bones, and joints that occurs in someone who has diabetes (DM). If the foot ulcer is infected and gangrene occurs where the tissue is necrotic, then amputation is necessary.

2. METHOD

This study uses qualitative research methods and a descriptive approach. According to Bogdan and Taylor (1975), qualitative research is a research process that produces descriptive data in the form of written or oral data from the subjects and objects studied [4]. According to Sugiyono (2007), qualitative research methods are used to examine natural things where the researcher is the key instrument, and the research results are more on meaning than generalization [5]. Meanwhile, according to Sevilla (1993), a descriptive approach is designed to collect information about the current actual situation. Researchers choose to use quantitative methods to describe and summarize the various phenomena that are the object of this research. So that the results of this study produce an

overview of the current state of public health in Indonesia and illustrate how dangerous diabetes mellitus is to human health [6].

The data collection technique used is literature study, in the sense that the data obtained by the researcher comes from scientific journals, books, and so on. In addition, the researcher also studied references from previous studies related to this title. The research technique was carried out online using the internet. The internet is useful for researchers to obtain information about the types and benefits of herbal medicine in Indonesia.

3. RESULTS AND DISCUSSION

The cultural principles of Ayurvedic medicine in curing a disease must be based on the relationship between Tri-Dosha and Panca Maha Bhuta i.e. a disease whether it is Vata, Pitta, or Kapha. In study literature, diabetic foot ulcers are hot, so they must be treated with a plant that cools the wound.

Table 1.

MEDICINE CULTURE	TREATMENT NAME/ORIGIN OF TREATMENT	TYPE OF PLANT USED (LATIN NAME)	TYPE OF PLANT USED (INDONESIAN NAME)	HOW TO PREPARE MATERIALS	HOW TO USE
Indonesian Traditional	Ramuan (Mixed Herb)/Batak karo, North Sumatra	<i>Villebrunea rubescens</i>	Nderasi (Leaf)	All ingredients are chopped and dried. The number of ingredients is 1 in 1. Every handful of the mixture is cooked with 3 liters of water	Drink 2 times a day until healed [7].
		<i>Pteridophyta</i>	Paku-paku (Leaf)		
		<i>Centella asiatica</i>	Pegagan (Stem)		
	Param/ Batak karo, North Sumatra	<i>Oriza glutinosa</i>	Beras Ketan	All the ingredients are mixed together and then ground and to soften the ingredients can be added with <i>hibiscus rosa-sinensis</i> flower. The medicinal material is shaped like a ball (round) then dried directly in the sun	Applied to the wound 3 times a day with chicken feathers [7].
		<i>Curcuma heyneana</i>	Temugiring (Rhizome)		
		<i>Curcuma domestica</i>	Kunyit (Rhizome)		
		<i>Areca catechu</i>	Pinang (Root)		
		<i>Cocos nucifera</i> L.	Kelapa (Root)		
		<i>Hibiscus rosa-sinensis</i>	Kembang Sepatu (Flower)		

Karo Oil/Batak Karo, North Sumatra	<i>Cocos nucifera</i> L.	Kelapa (Oil)	All ingredients are distilled and extracted to produce oil	Applied to the wound 1 to 3 times a day then covered with betel leaf that has been heated over coals until half wilted and wrapped with a clean cloth [7].
	<i>Curcuma domestica</i>	Kunyit (Rhizome)		
	<i>Zingiber officinale</i>	Jahe (Rhizome)		
	<i>Eucalyptus</i> sp.	Eucalyptus		
	<i>Myristica fragrans</i> houtt	Pala (Fruit)		
	<i>Piper nigrum</i> L.	Lada (Leaf)		
	<i>Piper betle</i>	Sirih (Leaf)		
	<i>Habatussauda/Nigella sativa</i>	Jintan Hitam		
	And other materials that reach 100 ingredients			
Indonesian Traditional/Indramayu	<i>Syzigium cumini</i>	Duwet (Seed)	Seeds are converted into powder	The powder is then mixed with water and drunk [8].
Indonesian Traditional/West Sumatra	<i>Cocos nucifera</i> L.	Kelapa (Oil)	Made in the form of pure oil (VCO)	The wound is cleaned using VCO as much as 10-30 cc (according to the size of the wound) [9].
Indonesian Traditional/ Jepara	<i>Aloe Vera</i>	Lidah Buaya	Made in gel dosage form	Aloe Vera gel is applied evenly to the wound area, then the wound is closed using sterile gauze, then covered with 1 rolled gauze then coated with 4 padding [10].

	Indonesian Traditional/Bali	<i>Anredera cordifolia</i> (Tenore) S.	Binahong (Leaf)	Made in gel dosage form	Gel is applied evenly to the wound area [11].
Ayurveda	Jaloukavacarana /India	<i>Pterocarpus marsupium</i> Roxb.	Kino India (Tree Bark)	The bark is soaked with water for 8-10 hours until the water color turns brown	Take 5-10 mL in the morning on an empty stomach [12].
	Ashtanga Hridaya /India	<i>Cissampelos pareira</i> Linn.	Genjer (Root)	Made in powder form	Drink 3-6 grams [13].
	Amruthotharam kashayam/India	<i>Zingiber officinale</i>	Jahe (Rhizome)	Made in the form of mixed herbs with a ratio of ginger : bratawali : terminalia (1:3:2)	Taken 3 times a day 1 hour before meals as much as 60 mL [14].
		<i>Tinospora cordofolia</i>	Bratawali		
		<i>Terminalia chebula</i>	Terminalia		
	Kalka/India	<i>Eclipta prostrata</i>	Urang-aring	Made in the form of pasta	Applied to the wound area [15].
<i>Jasminum</i>		Melati			
<i>Aloe vera</i>		Lidah Buaya			
Karanjadhya Ghrita/India	<i>Millettia pinnata</i>	Malapari (Leaf and Fruit)	Made in the form of pasta	Applied to the wound area [16].	

From several journal articles reviewed, there are approximately 19 types of herbal plants used in Indonesian traditional medicine culture and 10 types of herbal plants in Ayurvedic medicine culture in treating diabetic foot ulcers (DFUs). The following are the results of a literature study :

a. Indonesian Traditional Medicine Culture

1. Traditional Medicine by the Karo Batak Tribe, North Sumatra (Herb, Param, Karo Oil) The

ingredients used by the Karo tribe consist of Nderasi plants (Nderasi leaves), Gotu kola (stems and leaves), Paku-paku roots (Paku-paku veins). Gotu kola plant functions to lower blood sugar, as an antiseptic, and antikeloid. Based on the results of research on gotu kola plants contain active compounds, among others : asiaticoside, brahmoside, madecassic acid, acetic acid, beta sterol, beta elemene, beta farsenen, beta carotene,

and brahminoside. Gotu kola is able to increase immunity and increase antioxidant enzymes, such as superoxide dismutase (SOD), catalase, glution peroxide, and reduce oxidative stress [7]. Param consists of glutinous rice flour, various types of roots such as Pinang root, Coconut, Temugiring, Turmeric. Glutinous rice (*Oriza glutinosa*) contains B vitamins which function to improve smoothness and cleanse the skin. The material needed is flour in the manufacture of yellow (param). Another ingredient is Temugiring (*Curcuma heyneana*) which can be useful for nourishing the skin, rejuvenating, and smoothing the skin. Other mixed ingredients such as turmeric (*Curcuma domestica*) contain the active ingredient curcumin which can be efficacious as antibacterial, antiseptic, and anti-inflammatory [7].

Karo oil consists of roots and leaves, one of which is betel leaf and lancing leaf. Then spices such as Ginger, Turmeric, Black Cumin, and others. All the ingredients when added together reach more than 100 spices that must be prepared. Several studies state that black cumin (*habatussauda/nigella sativa*) contains 40% constant oil, 1.5% essential oil, 15 amino acids, protein, calcium ions (Ca²⁺), iron (Fe²⁺), sodium ions (Na⁺), and potassium (K⁺). The turmeric plant (*Curcuma domestica*) functions as an antiseptic. Betel plant (*Piper betle*) functions as an antiseptic. Ginger plant (*Zingiber officinale*) functions as an analgesic, antipyretic, and anti-inflammatory. Nutmeg (*Myristica fragrans* Houtt). The benefits of nutmeg seeds in the management of DM is due to their activity as an antihyperglycemic and antidyslipidemic and can reduce the risk of complications caused by inflammation, endothelial dysfunction, and atherosclerosis through their activities as antioxidants and anti-inflammatory [7].

2. Traditional Medicine from the Indramayu Region
Using the Duwet plant (*Syzigium cumini*) which contains tannins, chromium, gallic acid, phytomelin glucosides, alpha phytosterols, saponins, flavonoids, and phenols. The content of tannins and chromium in duwet seeds after being converted into powder dosage forms can be absorbed into the bloodstream, helping to lower glucose, thereby minimizing the occurrence of infections due to bacterial contamination and excess glucose. This is reinforced by chromium and tannins that work to increase insulin receptor sensitivity so that insulin circulating in the circulation can be easily associated with insulin receptors. Furthermore, there will be glucose mobilization and transport to the surface of the cell membrane to transport glucose into the cells so that glucose in the blood will be reduced. The content of saponins in

duwet seed powder also helps in the mechanism of wound healing by stimulating the formation of collagen. Flavonoids are anti-inflammatory so they can reduce inflammation and help reduce pain if there is bleeding or swelling in the wound [8].

3. Traditional Medicine from West Sumatra
Using Coconut (*Cocos nucifera* L.)
plant which is converted into pure oil (VCO). VCO can improve wound healing because it can stimulate angiogenesis and suppress inflammatory markers that can inhibit bacterial growth. VCO can increase the formation of new blood vessels in the wound. A good flow of nutrients and oxygen can accelerate wound healing. In addition, VCO also has a high antioxidant content that can help the wound healing process. An in vitro study proved that lauric acid contained in VCO can reduce the colonization of staphylococcus aureus bacteria. In addition, lauric acid can also stimulate collagen growth so that it can repair wounds more quickly [9].
4. Traditional Medicine from the Jepara Region
Using the Aloe Vera plant (*Aloe vera*). The use of aloe vera as a medicinal ingredient and has been widely used as a complementary therapy because of the antimicrobial content in Aloe Vera gel which is able to fight microorganisms such as gram-positive and negative bacteria, and *Candida albicans*. Extraction of Aloe vera in gel and antibiofilm activity, in general, can reduce bacterial biomass and increase tolerance against microbes/bacteria. The ability of antimicrobial activity and antibiofilm of Aloe Vera has the potential to be used in treating bacterial infections. Aloe vera contains several substances such as auxin, gibber-raline, anthraquinone, vitamins A, C, E which have proven properties as anti-inflammatory, antipyretic, antioxidant, antiseptic, antimicrobial, as well as antiviruses. Aloe Vera is able to penetrate and absorb and diffuse well so that it is able to withstand the loss of body fluids from the skin surface so that it is maintained [17].
5. Traditional Medicine from Bali
Using the Binahong plant (*Anredera cordifolia*) which contains saponin compounds. This saponin compound has the ability as a cleanser and is able to stimulate the formation of collagen I which is a protein that plays a role in the wound healing process. In addition, the ethanolic extract can also accelerate the wound closure process [11].
- b. Ayurvedic Medicine Culture
In the culture of Ayurvedic medicine originating from India diabetic foot ulcers (DFUs) are known in the local language as Dushta Vrana. Vrana is an entity of tissue damage and discoloration, where

permanent scar tissue is left in the body in healing and remains until the body survives [12]. The selection of herbal medicines for the treatment of DFUs depends on the following treatment principles such as Vrana shodhana (cleansing wounds), Vrana ropana (wound healing purposes), and blood purifiers [13].

1. Jaloukavacarana Treatment from India
Acharya Susruta who is the father of surgery in India said that Jaloukavacarana can be used as a treatment for Dushta Vrana. In this treatment, the Vijaysar or Indian Kino plant is used to treat DFUs. This plant has the characteristics of Lakhu (Light), Ruksha (Coarse), and Sheeta (cold). Kino India is useful for rejuvenating every cell of the body, cleansing the blood, and removing all toxins from the body [12].
2. Ashtanga Hridaya Treatment from India
In Ashtanga Hridaya it is mentioned that the treatment for DFUs is found in the Vrana Paratishedha Adhyaya section of Ashtanga Hridaya. In this treatment, the roots of the Patha (Genjer) plant are used which contain pelosine or 0.5% berberine. This plant has benefits as a blood purifier (Khare), anti-inflammatory, and antimicrobial [13].
3. Amruthotharam Kashayam Treatment from India
Amruthotharam Kashayam is an oral medication that has anti-inflammatory action and increases blood supply in the body. This treatment uses plants Nagara (Ginger), Amrutha (Bratawali), and Haritaki (Terminalia). In reference journals, it is known that this treatment was carried out for 3 months [14].
4. Kalka treatment from India
Kalka is a method of Ayurvedic medicine that utilizes herbs that are applied in the form of a paste. This treatment utilizes the Bhringraj (Urangaring), Chameli (Jasmine), and Ghritkumari (Aloe vera) plants for local wound application [15].
5. Karanjadhya Ghrita Treatment from India
This treatment uses Malapari plants (leaves and fruit) and Gambas/Oyong (leaves). The plant used in the treatment of Karanjadhya Ghrita has the action of increasing the rate of contraction resulting in healthier granulation tissue and faster healing time [16].

From several literature studies, every medicinal plant contains different compounds. Even one plant can be said to have more than one compound or secondary metabolite possessed by the plant. Some compounds or secondary metabolites found in plants It has a pharmacological activity that is used to treat DFUs (diabetic foot ulcers). Such as antibacterial, anti-inflammatory, antifungals, and so on. Alternative medicine that can be used is wrong the

other is a traditional medicine that is currently widely used because the side effects that occur are smaller than the use of synthetic drugs. Thus, it can minimize complications that occur.

Based on the journal that the author used as a reference, it is known that the principle of Indonesian traditional medicine culture in curing a disease is to find out in advance the nature of the disease belonging to a disease that is hot or cold. According to sources, diabetic foot ulcers are classified as hot diseases, therefore they must be treated with ingredients that cool the wound [7]. This is also in line with and explained in the culture of Ayurvedic medicine that Dushta Vrana (diabetic foot ulcers) can be treated with sheeta (cold) medicinal ingredients [12].

4. CONCLUSION

The culture of ayurvedic medicine and traditional Indonesian medicine have many similarities, namely that there are several plants that we can easily find both in Indonesia and in India. And, how to use it can also be said to be easy and convenient simple.

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