Original Article

Potential Of Moringa Leaf Extract (Moringa Oleifera Lam) As Wound Medicine In Livestock

Syarifah Nurul Waqiah[1], Ratmawati Malaka[2], Ambo Ako[3]

[1]Graduate Student of Animal Science and Technology, Faculty of Animal Science, Hasanuddin University Jl. Perintis Kemerdekaan Km. 10, Tamalanrea Indah, Makassar, Indonesia 90245, assagafsyarifah22@gmail.com
[2]Department of Animal Production, Faculty of Animal Science, Hasanuddin University Jl. Perintis Kemerdekaan Km. 10, Tamalanrea Indah, Makassar, Indonesia 90245 ,584002 Fax. 585188, corresponding author: malaka_ag39@yahoo.co.id
[3]Department of Animal Production, Faculty of Animal Science, Hasanuddin University Jl. Perintis Kemerdekaan Km. 10, Tamalanrea Indah, Makassar, Indonesia 90245, 584002 Fax. 585188
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Abstract

Wounds are the loss or destruction of part of the body's tissue, if the wound is not treated it will lead to infection and may interfere with livestock production. The faster the healing process occurs, the less likely secondary infections are to develop and become more severe. Clinically, various treatments and medicines, mainly those of chemical origin, have been introduced to facilitate and accelerate the wound healing process, but their use is limited due to side effects or low efficiency. Some substances and active substances are used to accelerate the process, but in this case herbal or medicinal plants can be used as an alternative in treating wounds in livestock, these plants have long been used as herbal medicines for humans and livestock. Moringa leaves contain phytochemicals that have antioxidant, anti-inflammatory and antimicrobial activities that can help the wound healing process. Compounds in Moringa leaves that play a role in wound healing include flavonoids, saponins, tannins, antibacterial, antiseptic, antimicrobial, and polyphenolic compounds. This review discusses and explains Moringa leaves on their medicinal function in livestock. Wound healing is the most important property for organisms and is the process of cell recovery because poor wound healing can cause physical pain, discomfort, and also bring a series of psychological problems to livestock. In addition, wounds that are difficult to heal can cause a further decline in the quality of life of livestock and result in a heavy economic burden.

Keywords: Healing, Livestock, Moringa Leaves, Treatment, Wounds

INTRODUCTION

Indonesian medicinal plants or herbs have good potential in treating various diseases. Different plant species have been used universally in the manufacture of traditional medicines for the cure of several diseases and for other plant bioproducts (Popoola & Obembe, 2013). Treatment using the latest therapies or based on traditional can treat wounds about 80% of the world population uses traditional medicine to treat various skin diseases (Hashary, 2022). The application of medicinal plants in the treatment of diseases has been accepted globally (Liew and Yong, 2016;Khdhir et al., 2019). Along with the development of modern medicine, herbal materials have become an alternative to chemical drugs. Wound healing agents that are effective, fresh and economical (Boakye et al., 2018). Wound healing can delay livestock recovery that may increase the cost of maintenance (Proios et al., 2021). Poor livestock health is an important factor that inhibits the reach of optimal productivity. In addition to various infectious diseases, an equally important livestock health problem is wounds (Soyelu & Masika, 2009). One of the actions in treating wounds is that many people use traditional medicine that comes from nature, this is one of the reasons people use traditional medicine because it is easily accesible, can be made in-house and can also be grown by the users (Balqis, 2016). Wound care aims to prevent infection, reduce pain, accelerate epithelialisation and cover the skin surface of the wound (Sjamsuhidajat & Jong, 2010). Because small wounds that go untreated for days can turn into severe microbial infections that cause septicaemia, and can even be fatal to livestock (Basha K et al., 2019).

Several studies began to be developed for the treatment of wounds from natural materials, one of the plants that has the potential as a traditional medicinal plant is the Moringa plant (Abdul Latif, 2012). In addition, Moringa (Moringa oleifera Lam) is native to the Indian subcontinent and has been naturalised in tropical and subtropical regions around

the world. The tree is known by local names such as Benzolive, Drumstick tree, Horseradish tree, Moringa, Marango, Mlonge, Mulangay, Saijihan and Sajna (Fahey, 2005).

Since ancient times, Moringa plants have been known as traditional medicinal plants that have many benefits. Compounds in Moringa leaves (Moringa oleifera Lam) that play a role in wound healing include flavonoids, saponins, tannins, antibacterial, antiseptic, antimicrobial, and polyphenolic compounds. The largest organ of the body is the skin, which acts as a barrier against external factors. Loss of skin tissue integrity, such as when a wound occurs, can lead to damage or disease. Tissue cell damage and anatomical progression are defined as wounds with or without microbial infection due to sharp or accidental wounds (Sabale et al., 2012). Wounds can be described as a disruption in cell continuity, which has a variety of effects that can occur such as loss of some organ function, sympathetic stress response, bleeding and clotting, bacterial contamination and cell death. The incidence of bacterial wound infections is increasing worldwide (Achmad & Putri., 2021). Adaptation strategies, survival mechanisms and the development of antibiotic resistance mechanisms in pathogenic bacteria complicate the treatment of infections (Peterson and Kaur, 2018). Wound infections caused by multidrug-resistant bacteria can exacerbate skin damage and reduce the effectiveness of antibiotics, leading to medication failure and recurring infections (Ekom et al., 2022).

Clinically, various treatments and medicines, mainly those of chemical origin, have been introduced to facilitate and accelerate the wound healing process, but their use is limited due to side effects or low efficiency. Generally, wound healing in livestock is carried out by administering chemical drugs in the form of ointments, sprays, powders, tablets, pastes, and drops, but in this case extracts from Moringa plants will be used as the main ingredient for wound healing in livestock. The application of medicinal plant products that have the potential to heal wounds with antimicrobial effects is beneficial to humans clinically and economically (Hemmati et al., 2018). Poor wound healing can cause physical pain, discomfort, and also bring a series of psychological problems to livestock. In addition, wounds that are difficult to cure can lead to further deterioration of livestock's quality of life and bring heavy economic burdens (Li et al., 2021). Attempts to overcome the problem of wound healing in livestock require preparations that have good penetrating power and long contact time. Moringa leaf extract has advantages such as easy application on the skin, can be used on wet skin and even wounds, easy to wash after application compared to ointments, gels or pastes (Wijaya & Putri, 2013).

How Wounds Occur

Wounds are the loss or destruction of a portion of body tissue. A wound comes from a disruption in the cellular, anatomical, and functional continuity of living tissue, due to external action, with or without loss of the underlying connective tissue (Wayal & Gurav, 2021). These conditions can be caused by sharp or blunt force trauma, temperature changes, chemicals, explosions, electric shock or animal bites. Wounds can be suffered by anyone and anything, including animals, both large and small. Wounds expose the inner part of the animal body to the outside which when left untreated can lead to infection and inhibit wound healing (Sjamsuhidajat & De Jong, 2017). Wounds result in loss of skin epithelial integrity with or without loss of connective tissue (Nagori & Solandi, 2011). Skin trauma especially in severe wounds is a common clinical problem, and more difficult to cure (Chen et al., 2019). Wound healing is the process of trying to repair damage that occurs to the skin (Gunanti et al., 2021). The wound healing process begins with the restoration of damaged tissue as close to its original state as possible and wound contraction is the process of shrinkage of the wound area (Begashaw et al., 2017). Wound curement continues to evolve with advances in medicine, yet wounds are still significant health problem worldwide, and can lead to severe complications (Achmad & Putri, 2021). Therefore, alternatives that do not cause toxicity are needed. Natural products have been an important source for the maintenance of life for a long time, natural products are becoming increasingly important as alternative medicine.

A schematic of cattle wounds can be seen in Figure 1 below:

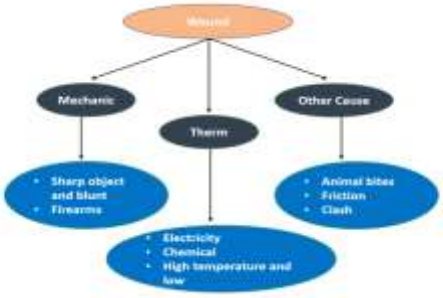

Figure 1: Schematic of livestock wounds

Wounds can occur for several reasons, including intentional and unintentional factors. Intentional wounds include surgery and unintentional wounds include accidents, sharp objects, or scratches. Wound healing means that there is a bodily response to the wound and helps in the restoration of skin structure by various mechanisms including inflammatory response and proliferative activity involving different cells (Van de Velde et al., 2014).

There are generally two types of wounds: closed and open wounds. Closed wounds cannot bring the body into contact with the external environment. Open wounds can come into contact with the external environment of the body (Purwasih & Safitri, 2018). Closed wounds are wounds without tears in the skin. These wounds can be caused by body parts being hit by blunt objects, twisting, sprains, decelaration of body direction such as fractures, tears in internal organs.

The next type of wound is an open wound, which is a tear in the skin or mucous membrane that breaks the continuity of tissue. These wounds can be caused by sharp or blunt objects (surgical incisions, venous functions, gunshot wounds). Skin tears facilitate the entry of microorganisms, and the release of blood and body fluids through the wound (Kartika et al., 2015).

Burns are tissue loss due to contact with heat sources such as hot water, fire, chemicals, electricity, and radiation that cause disruption of body function, that might disrupt daily activities (Hartati Yuliani et al., 2012). The difference between burns and other traumatic wounds is that they are characterised by fundamental damage to vital tissues, which complicates the normal wound healing response, as cells and blood vessels are often destroyed, leading to areas of coagulative necrosis (Huebner et al., 2017).

Benefits of Moringa Leaf Extract

Moringa oleifera Lam is the most widely cultivated species of the Moringaceae family. Native to India, Pakistan, Bangladesh, and Afghanistan, it was used by the ancient Romans, Greeks, and Egyptians; it is now distributed in many tropical and subtropical countries (Biswas et al., 2012). The speed of wound healing can be influenced by the substances contained in the medicine administered, where the medicine has the ability to promote healing by stimulating the growth of new cells in the skin more quickly (Febram et al., 2010). Moringa leaves contain amino acids such as aspartic acid, glutamic acid, alanine, valine, leucine, isoleucine, histidine, lysine, arginine, venylalanine, tryptophan, cysteine and methionine. Likewise, moringa leaf extract has properties in accelerating the wound healing process. The chemical content of Moringa leaves per 100 g can be seen in Table 1. Moringa roots, stems and bark contain saponins and polyphenols. In addition, moringa also contains alkaloids, tannins, steroids, flavonoids, reducing sugars and essential oils.

Table 1. Moringa Leaf Content Per 100g

Component	Composition
Water	94 g
Energy	92 Cal
Protein	22.7 g
Fat	4.65 g
Carbohydrate	51 g
Fibre	7.92 g
Calcium	440 mg
Potassium	259 mg
Phosphor	70 mg
Iron	7 mg
Zinc	0.16 mg
β-carotene	6.78 mg
Thiamine (vitamin B1)	0.06 mg
Riboflavin (vitamin B2)	0.05 mg
Niacin (vitamin B3)	0.8 mg
Vitamin C	220 mg

Source: (Melo et al., 2013)

The results of the phytochemical study of moringa leaves (Moringa oleifera Lam) state that moringa leaves contain several contents such as flavonoid secondary metabolites, alkaloids, and phenols that can block bacterial activity. An overview of Moringa leaves can be seen in Figure 2:

Figure 2: Moringa leaves

Based on previous research carried out by Wahyudi and Agustina (2018) using moringa leaf extract ointment level 10% can cure topical burns on rabbits (Oryctolagus cuniculus). In addition, research conducted by Cahyani (2020) found that the use of ethyl acetate fraction ointment of moringa leaf ethanol extract at 8% level can accelerate the wound healing process in Wistar rats. Furthermore, research conducted by Syarifah (2021) using 50 ml moringa leaf herbal spray and 30 ml betel leaf can accelerate the wound healing process in native chickens. This is also because Moringa leaves contain active substances such as saponins, tannins, and flavonoids that can accelerate wound healing (Handoko & Andriani, 2015). Saponins have the role as a cleanser and antiseptic that functions to kill germs or prevent the growth of microorganisms that usually occur in wounds so that the wound does not experience severe infection (Wijaya et al., 2014).

Tannins act as astringents that can cause skin pores to shrink, stop exudates and minor bleeding. Tannins and alkaloids have antimicrobial and antioxidant properties that help the wound healing process by preventing and protecting the wound area from free radical damage and inhibiting the growth of pathogenic bacteria in the wound (Hanafiah et al., 2019). So that when a wound occurs, tannins will help stop bleeding so that blood does not come out (Irmaneisa et al., 2019).

Flavonoids play a role as antibacterials, where flavonoids denature proteins that cause the metabolic activity of bacterial cells to stop because all metabolic activities of bacterial cells are catalysed. The halt of metabolic activity will cause the death of bacterial cells, results in wound healing acceleration. The work mechanism of flavanoids is to improve blood circulation throughout the body and prevent blockages in blood vessels, contain anti-inflammatory properties, function as antioxidants, and help reduce pain in case of bleeding or swelling (Isnaeni et al., 2022).

The wound healing process in livestock can be seen in Figure 3 below:

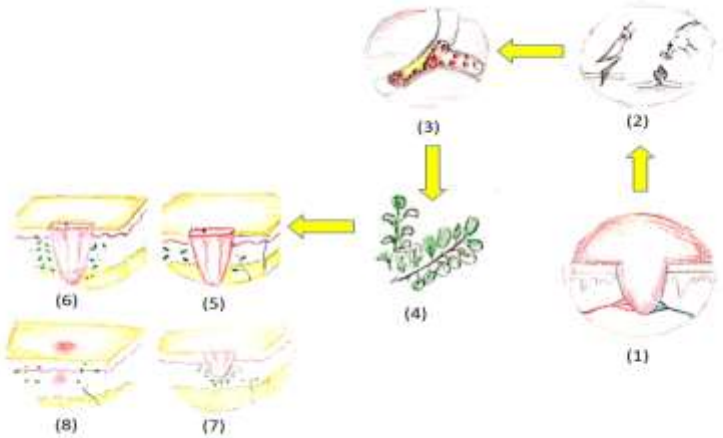

Figure 3: Wounding process in livestock that occurs on the skin layer (1) Wounds due to trauma from sharp or blunt objects (2) Wounds that result in rupture of blood vessels (3) Wounds can be cured with alternative medicine using extracts from moringa leaves (4) Wound healing is divided into several phases, the first is haemostasis, which is the process of stopping bleeding spontaneously from damaged blood vessels, in this case the function of tannins in moringa

leaves can accelerate the stopping of bleeding in wounds (5) The next phase is inflammation, which is the body's natural immune reaction to fight various diseases or bad microorganisms. In this case, the function of saponins in moringa leaves can fight microorganisms in the wound (6). The next phase is proliferation, when the wound is rebuilt with new tissue consisting of collagen and extracellular matrix. In the proliferative phase, the wound contracts as new tissue is formed (7). The final stage of wound healing is the strengthening of the newly formed tissue or the maturation process. In this phase, the scar is completely covered by a new layer of skin (8).

Application of Moringa Leaf Extract

Application of Moringa leaf extract to treat wounds in livestock can be done by washing moringa leaves then mashed, once becoming smooth, moringa leaves are soaked in water for extraction, after the moringa leaf soaking process, filtering is carried for extraction, then the extract can be used to treat wounds in livestock by attaching the extract to the wounds in livestock and making sure the moringa leaf extract can cover the surface of livestock wounds. The use of moringa leaves as an ingredient to heal wounds in livestock is done because the leaves are the most widely used due to the process is easier when compared to other plant parts and has better material content. Using leaves as medicine will not damage the plant because it is easy to grow back and leaves are part of the plant that is widely used as traditional medicine because leaves usually have a soft texture and high water content (70%-80%). In addition to the application of moringa leaves in the form of extracts, some researchers have modified the treatment of livestock wounds using moringa leaves by making it in the form of ointments or herbal sprays. The type of applications can be seen in Table 2 below:

Table 2. Moringa Leaf Application

No.	Moringa Leaf Application	Reference
1	Moringa leaf extract ointment 10% most potent in healing burns in rabbits	Wahyudi and Hanna Agustina in the year 2018
2	Ethyl fraction ointment ethanol extract Moringa leaves 8% can accelerate the process wound healing in wistar rats	Ari Dwi Cahyani in 2020
3	Application of Moringa leaf herbal spray as much as 50 ml can accelerate wound healing process in native chickens	Syarifah Nurul Waqiah in 2021
4	Moringa leaf extract 15% showed wound repair recovery rate was higher than the other treatment	Herdiani in 2022
5	The 15% concentration extract was able to cure The fastest wounding was for 5 days.	Padmono Citroreksoko, Sofyan Ramani, Putut Prasetyana Putra, in 2017
6	The reduction in wound area in the group applied with moringa leaf ethanol extract gel was higher than the control group, with the highest wound closure in group II (2% moringa leaf ethanol extract gel concentration).	Agus Susanto, Regina Kumala Muhaimina, Amaliya Amaliya, and Afifah Bambang Sutjiatmo, 2018
7	Based on the experimental findings, it can be concluded that topical application of Shigru Patra Ghana on open wounds induces significant wound contraction and accelerates epithelialisation, tissue alignment and tissue strength at later stages of wound healing. Thus, Moringa leaf herbal aqueous extract can be a promising remedy as a wound curer for various types of wounds.	Sunil Kumar, Subash Sah, Ritu and Sanjaya KS in 2016
8	The results showed that increasing the concentration of moringa leaf extract affected the healing properties of the material. In the wound bandaging experiment on days 1, 4, and 7, the highest % wound closure in mice was in nanofibres containing 0.5 g moringa leaf extract.	Omolola Esther Fayemi, et al in 2018
9	From the results obtained, it can be concluded that M. oleifera water extract has significant wound healing properties.	BS Rathi, SL Bodhankar and AM Baheti in 2004
10	The results showed that Moringa oleifera aqueous extract significantly promoted wound healing and was able to cure wound by suppressing the action of dexamethasone.	Lambole Vijay, and Upendra Kumar in 2012

11	M. oleifera is more effective in the treatment of MRSA-infected wounds in diabetic rats.	Abdullah A. Al-Ghanayem, Mohammed Sanad Alhussaini, Mohammed Asad and Babu Joseph in 2022

Prospects of Moringa

Although there have been many studies on the use of moringa leaf extract, there are still few studies on its application for wound healing in livestock. Treatment of livestock wounds from moringa leaf extract is an alternative in conducting treatment in order to avoid using chemicals because if treatment in livestock is carried out using chemicals, there will be negative impacts as side effects in the use of these medicine, besides moringa leaves are plants that are commonly found around residential so they are easy to apply and have economic value, farmers do not need to incur high costs for the treatment of wounds in livestock. Wounds on livestock have the potential to economic loss (Lipinski et al., 2012). Further research on the use of natural materials in the treatment of livestock wounds is worth doing considering that there are still many medicinal plants that contain antibacterial, anti-inflammatory, saponins, tannins and flavonoids that function to treat wounds in livestock.

The utilisation of moringa leaf extract as a wound medicine in livestock has a wide opportunity to be developed and applied by the community, especially farmers, seen from the content in moringa leaves and ingredients that are easy to find and easy to apply, which is an advantage for them to be proud of. In this case, the use of moringa leaf extract can be used as a solution in the treatment of wounds in livestock. Further research on the use of natural ingredients in the treatment of livestock wounds is expected to be a solution for livestock health today and in the future (Taufik et al., 2021).

Conclusion

Moringa leaf extract in this case is an alternative natural wound treatment in livestock because of its chemical content such as antibacterial, anti-inflammatory, antiseptic, saponins, tannins, and flavonoids that can accelerate the wound healing process in livestock.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Author's Contribution

All authors contributed equally in conducting and writing the manuscript.

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