



## Efficacy test of *Aloe Vera* ethanol extract ointment (*Aloe Barbadensis* Milleer) On healing grade II Burns in Wistar Rats

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### Abstract

Since ancient times, Indonesian people have known and used medicinal plants, including aloe vera, as a solution to health problems. Aloe vera proves effective in healing various wounds, including burns, due to its essential nutritional content and ability to stimulate the growth of skin tissue. The development of aloe vera gel as a stable and practical pharmaceutical preparation became an important step in the effective treatment of wounds. This study aimed to test the phytochemical content and effectiveness of Aloe Vera Extract (*Aloe Barbadensis* Miller) in healing grade II burns in wistar rats (*Rattus norvegicus*). Conducted with a pre-post-test control group design approach in January 2024. Samples of aloe vera plants were obtained from a traditional market in Medan City, North Sumatra. In this study, 20 Wistar rats were divided into 4 treatment groups. Variables observed included topical formulations and wound healing processes in mice. The results showed a significant difference in wound healing period between the treatment group (Aloe Vera Ointment 25% and 50%) compared to the Control group, with a value of  $p = 0.003$ . These findings support aloe vera's potential as an effective therapeutic thanks to the anti-inflammatory and antioxidant properties of compounds such as flavonoids and saponins. Therefore, Aloe Vera Ointment can be considered as an effective option to improve the healing process of burns.

**Keywords:** *Aloe Vera* (*Aloe Barbadensis* Miller), Burn treatment, Effectiveness of Aloe Vera Ointment, Aloe vera phytochemicals, Wistar rat (*Rattus norvegicus*)

### Introduction

Indonesian people have known and used medicinal plants since ancient times as an effort to overcome health problems faced, long before formal health services with modern medicines <sup>[1]</sup>. The maintenance and development of traditional medicine as the nation's cultural heritage continues to be improved and encouraged its development through excavation, testing, and discovery of new drugs, including the cultivation of plants that are medically accountable <sup>[2]</sup>.

One of the efficacious plants to heal wounds is aloe vera, this is because aloe vera plants have the ability to close the entire surface of the leaves tightly to prevent the release of valuable gels <sup>[3]</sup>. If injured, aloe vera quickly closes the wound so that gel evaporation does not occur <sup>[4]</sup>. These characteristics inspired people in ancient times to use aloe vera as a wound healer in the hope that the wound immediately closes like on aloe vera leaves. The efficacy of aloe vera is due to this plant having sufficient nutritional content for the human body <sup>[5]</sup>. Of the about 200 types of aloe vera plants that are good to use for treatment is the type of *Aloevera Barbadensis miller*. This type of aloe vera contains 72 substances needed by the body. Among the 72 substances needed by the body there are 18 kinds of amino acids, carbohydrates, fats, water, vitamins, minerals, enzymes, hormones, and drug class substances. These include antibiotics, antiseptics, antibacterials, anticancer, antivirals, antifungals, anti-infectives, anti-inflammatory, anti-inflammation, antiparkinsonian, antiatherosclerosis, and antivirals resistant to antibiotics <sup>[6]</sup>.

Aloe vera is also beneficial for healing in burns. This is

based on the results of human studies showing that giving aloe vera is safe to use in burn patients and can speed up the healing process because it can accelerate the process of forming new epithelial tissue <sup>[7]</sup>. Aloe vera stimulates growth in new cells on the skin. In aloe vera mucus contained lignin substances that are able to penetrate and seep into the skin. This mucus will hold body fluids from the surface of the skin. Aloe vera will also stimulate epidermal growth factors and will improve fibroblast cell function. This causes aloe vera can be used to treat wounds due to burns, scratches, and other skin wounds <sup>[8]</sup>.

The use of aloe vera as a wound medicine has traditionally been done by the community by cutting the base of aloe vera, then washed and peeled to get a gel or liquid that is clear greenish, after that the gel is attached to the injured part. The gel preparation is a suitable preparation for aloe vera because the gel base can increase stability and is also comfortable to use by patients. In addition, the gel is an interesting preparation, odorless, durable and practical in use <sup>[9]</sup>. Based on the background, researchers are interested in researching the phytochemical content and effectiveness of Aloe Vera Extract (*Aloe Barbadensis* Miller) in healing II degree burns in wistar rats (*Rattus norvegicus*)

### Research Methods

This research is an experimental study with a *pre-post-test control group design approach*, January 2024. The research sample is the Aloe Vera plant (*Aloe Barbadensis* Miller) obtained from one of the traditional markets in the city of Medan, North Sumatra. The sample of experimental animals in this study was wistar strain rats, while the number of

mice used in this study was as many as 20 male wistar rats (*Rattus norvegicus*) divided into 4 treatment groups, so that each group consisted of 5 mice. The variables in this study were independent variables in the form of giving several topical formulations (ointment base, nebacetin® ointment, Aloe Vera ointment (Aloe Barbadensis Miller) 25% and Aloe Vera ointment (Aloe Barbadensis Miller) 50%, as well as independent variables which include *wound contraction* and epithelialization period.

**Table 1:** Aspects of Variance Variation-Research Variables

Group	Treatment
Control	In this group only ointment base is given
Standard	In this group used Nebacetin® ointment which is generally used in the treatment of burns.
Aloe Vera Extract (Aloe Barbadensis Miller) 5%	In this group given Aloe Vera Extract Ointment (Aloe arbadensis Miller) 25%
Aloe Vera Extract (Aloe Barbadensis Miller) 25%	In this group, 50% Aloe Vera Extract Ointment (Aloe arbadensis Miller) was given.

Each treatment of each group of rats was carried out on the day when wounds were carried out on the rats until the release of *eschar*. *Wound contraction* is measured by measuring the diameter of the wound using a ruler. The epithelialization period is measured by calculating the length of time it takes *eschar* to detach, where the epithelialization period is calculated in days. The statistical analysis used in this study was the One-Way Anova difference test, which was followed by a post-hoc test. Before the different tests were carried out, descriptive analysis of *wound contraction* and epithelialization periods was carried out. If the data in this study is abnormally distributed, it will be transformed to the data so that the data is normally distributed.

**Table 4:** Results of One Way Anova and Kruskal-Wallis analysis with *Wound Contraction* as Wound Healing Parameters in the Treatment Group

Observation Time	Control	Standard	Aloe Vera (Aloe Barbadensis Miller)	Aloe Vera (Aloe Barbadensis Miller)	P Value
			25%	50%	
Day 3	5.72 (8.11)	0.02 (8.70)	22.55 (25.92)	20.62 (25.92)	0.002**
Day 6	9.56 ± 5.22	8:22 ± 20:55	10.26 ± 7.88	55.67 ± 7.58	0.002*
Day 9	7.62 ± 7.92	3:22 ± 8.05	55.55 ± 6.55	52.52 ± 8.92	0.002*
Day 12	9.55 (29.27)	55.56 (20.72)	65.65 (22.75)	56.67 (8.96)	0.005**
Day 14	27.21 (17.50)	82.72 (52.56)	76.27 (21.65)	89.29 (1.65)	0.002**

Table 4. presents the results of One-Way ANOVA and Kruskal-Wallis analysis on wound healing parameters, with *Wound Contraction* as the focus on the treatment group. Data are presented for observation time (Day 3, Day 6, Day 9, Day 12, and Day 14) with mean or median values (if any) and standard deviation in parentheses. The treatment group involved Control, Standard, and two concentrations of Aloe Vera (Aloe Barbadensis Miller) namely 25% and 50%. The

**Research Results**

From Table 2. the results of phytochemical screening on fresh samples of Aloe Vera (Aloe Barbadensis Miller) found phytochemical content in the form of alkaloids, flavonoids, and tannins.

**Table 2:** Screening Results of Aloe Vera Phytochemicals (Aloe Barbadensis Miller)

Phytochemicals	Test Method	Result
Alkaloids	Dragendorff	+
	Maeyer	+
Steroids	Salkowsky	-
	Aquadest	-
Saponins	Aquadest + Alcohol 96%	-
	FeCl3 5%	+s
Flavonoids	NaOH 25%	-
	FeCl3	+

**Table 3:** Results of Data Normality Analysis on Healing Parameters Second Degree Burns

Wound healing parameters	P Value
<i>Wound Contraction</i> on Day 3	0.015
<i>Wound Contraction</i> on Day 6	0.422
<i>Wound Contraction</i> on Day 9	0.076
<i>Wound Contraction</i> on Day 12	0.021
<i>Wound Contraction</i> on Day 14	0.008
Epithelialization Period	0.014

From the table data above, it can be seen that the wound contraction parameter data on day 6 and day 9 showed a normal distribution of data, so the data analysis used for the difference test was One Way Anova followed by Post Hoc Test Tukey HSD. Meanwhile, other parameters show abnormal data distribution so that the other tests used are the kruskal-wallis and mann-whitney tests.

**Table 5:** Comparison Results of Epithelialization Period on Individual treatment groups

Treatment Group	Epithelialization Period*	P Value
Control	20 (2)a	0.003
Standard Aloe Vera Ointment (Aloe Barbadensis Miller) 25%	17 (2)b	
	21 (2)b	
Aloe Vera Ointment (Aloe Barbadensis Miller) 50%	21 (2)b	

\*Data is presented in Median (Range). Different lowercase letters in the same column indicate a significant difference in P values < 0.05

Table 5. presents comparative results of epithelialization periods in each treatment group, including Control, Standard (25% Aloe Vera Ointment), and 50% Aloe Vera Ointment. Epithelialization period data are presented in the form of medians along with a range of values. Comparative analysis showed a significant difference between the treatment groups, with a p value of 0.003. Different lowercase letters in the same column (a, b) indicate a significant difference at a significance level of 0.05. Therefore, it can be concluded that 25% Aloe Vera Ointment and 50% Aloe Vera Ointment have significantly different influences on the epithelialization period compared to the Control group.

### Discussion

Aloe vera has benefits topically towards healing perineal wounds more practically. The content of aloe vera can help speed up wound healing time because aloe vera contains flavonoid compounds that function as antioxidants to protect the body's cell structure. Flavonoids and saponins are also active substances and function as anti-inflammatory and antioxidants for wound healing. When injury occurs, flavonoid compounds can remove reactive oxygen species (ROS) and detoxify hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) so that lipid peroxide levels decrease and the inflammatory phase is shorter. Flavonoids are also able to accelerate the migration of fibroblasts, smooth muscle cells and endothelial cells by stimulating an increase.<sup>20</sup> Aloe vera has healing properties in the presence of glucomannan compounds, mannose-rich polysaccharides, and gibberellin, a growth hormone, interacting with growth factor receptors on fibroblasts, thereby stimulating their activity and proliferation, which in turn significantly increases collagen synthesis after topical administration. Aloe vera contains 75 Potentially active ingredients include vitamins, enzymes, flavonoids, saponins, amino acids and so on<sup>[10]</sup>.

These results showed that 25% Aloe Vera Ointment and 50% Aloe Vera Ointment had significantly different influences on the epithelialization period compared to the Control group. The results of this study are supported by the research of Riris Wahyu Anggraini, Lenni Saragih, Ni Luhputu Eka, 2019, in his research there were four groups: two treatment groups with aloe vera extract concentrations of 10% and 20%, and two control groups with SSD 1% and NaCl 0.95%. The data collection method was carried out through observations carried out every day and documented chest days 4, 8, and 12, observation of the inflammatory phase and wound proliferation by taking photos to see the color of the wound and the presence of exudate. The area of the wound is measured using a ruler. He states that Aloe vera helps in healing burns and the formation of new blood vessels, improves tissue oxygenation, and speeds up the epithelialization process. This can increase wound contraction, making it a relatively inexpensive alternative to burn treatment for humans<sup>[11]</sup>.

The benefits of aloe vera are used for the treatment and various pathological conditions, one of which is to reduce pain and wound healing. Aloe vera has benefits topically towards healing perineal wounds more practically. The content of aloe vera can help speed up wound healing time because aloe vera contains flavonoid compounds that function as antioxidants to protect the body's cell structure. Flavonoids and saponins are also active substances and function as anti-inflammatory and antioxidants for wound healing<sup>[12]</sup>. When injury occurs, flavonoid compounds can

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### Conclusion

Based on the results of the study it can be concluded that there is a significant difference in epithelialization period between treatment groups, including Control, Standard (Aloe Vera Ointment 25%), and Aloe Vera Ointment 50%, with a p value of 0.003. These results showed that 25% Aloe Vera Ointment and 50% Aloe Vera Ointment had significantly different influences on the epithelialization period compared to the Control group. The study supports previous findings showing aloe vera's potential in speeding up burn healing through its anti-inflammatory and antioxidant properties of compounds such as flavonoids and saponins. Therefore, Aloe Vera Ointment can be considered as an effective therapeutic option to improve the healing process of burns and accelerate the epithelialization period.

### References

1. Randani EG, Kundera IN, Bint G, Shamdas N, Studi P, Biology P, *et al.* The Effectiveness of Guava Leaf Extract (*Psidium guajava* L.) to Inhibit the Growth of *Vibrio cholera* Bacteria and Its Utilization as a Biology Learning Media, 2020;8(1):602–9.
2. Weka VM. Comparison of Consumer Preferences in Choosing Traditional Medicine and Synthetic Medicine at Apotek Kasih Kupang. Univ Citra Bangsa, 2019:8–9.
3. Marhaeni LS. The potential of aloe vera (*Aloe vera* Linn) as a medicine and food source. *AGRISIA J Agriculture Sciences*, 2020;13(1):32–9.
4. Erika E, Fridayana Fitri R, Sumiati A. Effect of wound treatment using aloe vera gel on decubitus healing. *J Beautiful Science and Clin*, 2022;2(3):40–51.
5. Atik N, Iwan A. R. J. differences in the effect of topical administration of aloe vera gel (*Aloe vera* L.) With Povidone Iodine Solution Against Healing Incision Wounds On The Skin Of Mice (*Mus musculus*). *Maj Kedokt Bandung*, 2009;41(2):29–36.
6. Suarni E, Prameswarie T. Comparison of Aloe Vera Gel (*Aloe vera* L.) and Povidone Iodine on the Healing Time of Iris Wounds (*Vulnus scissum*) in Mice (*Mus musculus*) Wistar Strain. *Shifa' Med J Masks and Health*, 2015;5(2):82.
7. Alepandi M, Wahyudi JT, Tiranda Y. The effectiveness of aloe vera administration on the healing process of burns: literature review. *JKM J Independent Nursing*, 2022;2(1):15–29.
8. Budiyanto MAK. Effects of aloe vera extract.
9. Novyana RM, Susanti. Aloe Vera (*Aloe vera*) for Wound Healing. *J Cover Univ Lampung*, 2016;5:149–53.
10. Maternity D. The effectiveness of the use of aloe vera (*Aloevera*) on healing perineal wounds in postpartum mothers in the working area of the South Lampung

- Anyar Coral Puskemas in 2021. *J Ilm Midwife*,2022;6(2):25–32.
11. Riris Wahyu Anggraini, Lenni Saragih NLE. Effect of extra topical aloe vera gel aloevera concentration of 10%, and 20% on macroscopic features of grade II burns in rats *Rattus norvergicus* Wistar strain. *A: "FLYWHEEL."* 2019;10:56–65.
  12. Ria Ranti S, Sari Lubis M, Munandar Nasution H, Yuniarti R. Antibacterial Activity Of Leaf Bark, Exudate, And Leaf Fleshaloe Vera (*Aloe Vera* (L.) *Burm.F.*) Against Bacteria *Staphylococcus epidermidis*. *August*,2023;3(1):22–8.