

THE EFFECT OF ALOE VERA EXTRACT GEL (*Aloe vera* sp) ON THE CLOSURE ON INCISION WOUND LENGTH IN *SWISS WEBSTER* STRAIN MICE (*Mus musculus*)

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Abstract

Background: Indonesia is rich in plant biodiversity, particularly species with potential medicinal uses. One such plant is Aloe vera, which contains over 75 active chemical compounds beneficial to the medical field. *Aloe vera* contains bioactive compounds such as saponins, flavonoids, tannins, and polyphenols that play crucial roles in the wound healing process. Saponins possess antimicrobial properties and aid in cleansing wounds; flavonoids and polyphenols act as antioxidants and anti-inflammatory agents that accelerate cell regeneration; while tannins exhibit astringent effects that help stop bleeding and form a protective barrier. The synergistic action of these four compounds creates an environment conducive to natural and effective tissue recovery.

Objective: This study aims to determine the effect of *Aloe vera* gel extract on the closure of incision wound length in Swiss Webster strain mice (*Mus musculus*). **Methods:** This research employed a true experimental design with a post-test only control group approach. A total of 24 male white mice (*Mus musculus*) were divided into three treatment groups. Group K served as the control group with no treatment. Group P1 was treated with 50% *Aloe vera* gel extract, while Group P2 received 100% *Aloe vera* gel extract. **Results:** The analysis of the effect of *Aloe vera* gel extract on incision wound length closure in Swiss Webster mice across all treatment groups, using standard deviation, showed statistically significant results. The average wound length in the 100% *Aloe vera* group was 0.33 cm, in the 50% group was 0.56 cm, and in the control group was 0.22 cm. These findings indicate that the 100% *Aloe vera* gel extract was the most effective, consistent, and stable in accelerating wound closure.

Conclusion: The application of *Aloe vera* gel extract had a significant effect on the closure of incision wound length in Swiss Webster mice. The 100% *Aloe vera* extract demonstrated the fastest, most consistent, and most stable wound healing effect. From day 11, wound size began to significantly decrease, and by day 14, the average wound length was 0.78 cm, indicating near-complete closure. The 50% *Aloe vera* group also showed relatively fast wound closure, with an average wound length of 0.21 cm on day 12; however, healing was less stable and more fluctuating compared to the 100% group. Meanwhile, the untreated control group exhibited the slowest healing process, with an average wound length of 1.38 cm remaining open on day 14. These results affirm that 100% *Aloe vera* gel is more effective in accelerating wound closure and promoting natural tissue regeneration.

Keywords: *Aloe vera* sp., Extract, Wound Closure, Incision Healing, Swiss Webster.

INTRODUCTION

Indonesia is a country endowed with remarkable biodiversity, particularly in terms of plant diversity, many of which have the potential to be developed as medicinal plants. Out of approximately 20,000 known medicinal plant species in Indonesia, only about 1,000 have been documented, and around 300 of these have been used in traditional medicine practices. Aloe vera is one such medicinal plant with recognized therapeutic properties.¹

Aloe vera extract is believed to possess the ability to inhibit the growth of Gram-negative bacteria such as *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, and *Proteus vulgaris*, as well as Gram-positive bacteria such as *Enterococcus bovis* and *Staphylococcus aureus*. Because of this, Aloe vera is classified as a bacteriostatic agent. Compared to Gram-negative bacteria, Aloe vera demonstrates a broader and more effective inhibitory zone against Gram-positive bacteria. With a maximum inhibition zone of 1.6 mm, leaf extract of Aloe vera at 25%, 30%, and 35% concentrations has been shown to inhibit the growth of *Staphylococcus aureus*. The antibacterial properties of Aloe vera may be attributed to the bioactive compounds present in its extract.²

A wound is specifically defined as an injury to tissue components or units that results in the loss or damage of tissue structures. Wounds typically lead to bleeding and blood coagulation, bacterial infection, cell death, partial or complete loss of organ function, sympathetic stress responses, and other effects.³

An injury where the skin and underlying tissue are no longer connected is referred to as a wound. Almost every routine activity carries the risk of physical harm to the body. Among various types of wounds, an incised wound is a common one. Incised wounds (*Vulnus scissum*) are defined as wounds caused by sharp-force trauma.⁴

A study conducted by Jane Wuisan, Christi Mambo, and Christian A. Sewta (2015) found that the application of Aloe vera gel extract accelerated the healing of incised wounds on the skin layer of mice. On the third day of the healing process, the incised wounds on mice began to dry up and no longer appeared wet. Mice treated with Aloe vera gel extract had irregular wound edges, measuring approximately three centimeters in length, with a blackened appearance due to the residue of dried Aloe vera leaf extract. In contrast, mice that did not receive the extract had uneven, reddish wound edges, with a circular length of approximately 3.8 cm.⁵

These findings support the theory of inflammation, which suggests that within 24 hours of tissue damage, endothelial and fibroblast cells within blood vessels begin to develop and produce granulation tissue. On the right dorsal side of mice treated with Aloe vera gel extract, the wound area dried out more rapidly, indicating faster healing.⁶

RESEARCH METHODS

The scope of this research combines biochemistry, traditional medicine, and histology. This study employed an experimental research design using a post-test only control group design. The sample consisted of 30 Swiss Webster mice that met the inclusion and exclusion criteria of the study. Sampling was conducted using Simple Random Sampling. The independent variable in this research was the Aloe vera (*Aloe Vera sp*) gel extract applied to the incised wounds of Swiss Webster mice. The dependent variable was the wound closure time of the incised wounds in *Mus musculus* (*Swiss Webster*).

RESULTS



Figure 1



Figure 2



Figure 3

This research encompasses a combination of biochemistry, traditional medicine, and histology. The study utilized an experimental approach with a post-test only control group design. The sample consisted of 30 Swiss Webster mice selected based on specific inclusion and exclusion criteria. Simple Random Sampling was used to select the subjects. The independent variable in this study was the application of Aloe vera (*Aloe Vera sp*) gel extract on the incised wounds of the Swiss Webster mice. The dependent variable was the wound closure time in *Mus musculus* (Swiss Webster).

Tabel 1. Phytochemical Test Results

No.	Test Type	Positive Indicator	Test Result
1.	Saponin	Formation of stable foam after shaking	+
2.	Polyphenol	Greenish color after reagent addition, brownish green color and presence of mucus	+++
3.	Tanin	Formation of precipitate after reagent addition	+
4.	Flavonoid	Color change to brown or formation of brown precipitate	+

Tabel 2. Mean of the treatment results

Hari	Lidah Buaya 100%	Lidah Buaya 50%	Tanpa Perlakuan
0	2.00 cm	2.00 cm	2.00 cm
1	1.80 cm	1.71 cm	2.00 cm
2	1.72 cm	1.70 cm	1.50 cm
3	1.75 cm	1.37 cm	1.77 cm
4	1.52 cm	1.28 cm	1.67 cm
5	1.48 cm	1.32 cm	1.61 cm
6	1.48 cm	1.32 cm	1.61 cm
7	1.48 cm	1.06 cm	1.58 cm
8	1.30 cm	1.36 cm	1.48 cm
9	1.21 cm	1.23 cm	1.26 cm
10	1.16 cm	1.20 cm	1.22 cm
11	1.03 cm	1.22 cm	1.38 cm
12	1.15 cm	0.21 cm	1.66 cm
13	1.11 cm	0.21 cm	1.51 cm
14	0.78 cm	0.08 cm	1.38 cm
Std. Dev	0.33	0.56	0.22

Based on the table, the group treated with 100% Aloe vera demonstrated a faster and more consistent wound closure process. From day 11, the wound size began to significantly decrease, followed by noticeable closure from day 12 to day 13, during which most of the wounds were nearly closed. By day 14, almost all wounds had achieved complete closure, with an average wound length of 0.78 cm. These results indicate that 100% Aloe vera concentration effectively accelerates tissue regeneration and enhances skin repair. In the group treated with 50% Aloe vera, the wound healing process progressed more slowly compared to the 100% Aloe vera group. By day 12, wounds remained relatively large, with an average size of 0.21 cm. From day 13 to day 14, the wounds began to show more significant signs of closure. Although the wounds in the 50% Aloe vera group appeared more closed by the end of the observation period, the size fluctuations were greater than those observed in the 100% Aloe vera group. Meanwhile, in the untreated control group, the wound healing process was significantly slower and showed no substantial improvement. By day 14, the average wound size remained relatively large at 1.38 cm, indicating that most wounds were still open and had not closed completely.

In conclusion, the administration of 100% Aloe vera gel extract proved to be more effective in accelerating incision wound closure in mice. This group not only exhibited faster healing but also demonstrated greater consistency and stability in the wound closure process compared to both the 50% Aloe vera group and the untreated control group. Although the 50% Aloe vera group showed relatively tight wound closure at the end of the observation, the healing process was less consistent. Therefore, high-concentration Aloe vera is more recommended as a natural agent for promoting effective wound healing.

Tabel 3. Data Normality Test

Treatment	<i>p</i> -value
Control (K)	0,20
Treatment 50% (P1)	0,20
Treatment 100% (P2)	0,15

Based on the table above, the normality test used was the Shapiro-Wilk test. This test was chosen because the sample size in this study was less than 50 (24 samples). The decision for this test is based on the significance value (Sig.). In Table 2, all data in each sample group show *p*-values greater than 0.05 (*p*-values = 0.200, 0.200, and 0.150). These values indicate that the data in each group are normally distributed.

Tabel 4. ANOVA Test

Group	<i>p</i> -value
Control (K)	0,001
Treatment 50% (P1)	0,001
Treatment 100% (P2)	0,001

Based on the table above, the ANOVA test results show *p*-values less than 0.05 (*p*-value < 0.001). This means the null hypothesis (Ho) is rejected, indicating that Aloe vera extract has a significant effect on the wound closure time of incised wounds.

Tabel 5. Uji *PostHoc*

Treatment 1	Treatment 2	<i>p</i> -value
Control	Treatment 50%	0,001
	Treatment 100%	0,001
Treatment 50%	Control	0,001
	Treatment 100%	0,001
Treatment 100%	Control	0,001
	Treatment 50%	0,001

Based on the table above, the Post Hoc Bonferroni test shows *p*-values less than 0.05 for all pairwise comparisons. This indicates rejection of the null hypothesis (Ho), meaning that the Aloe vera gel extract significantly affects wound closure time across all groups.

Comparison between the control group and the 50% treatment group (P1) showed a *p*-value of 0.001, indicating a statistically significant difference between the two groups. Likewise, the comparison between the control group and the 100% treatment group (P2) also showed a significant difference (*p*-value = 0.001). Finally, the comparison between the 50% and 100% treatment groups (P1 and P2) showed a significant difference as well (*p*-value = 0.001).

DISCUSSION

The results of this study show that the phytochemical test was conducted to identify the secondary metabolite compounds in the Aloe vera plant flesh extract. The saponin test showed the formation of stable foam after shaking, indicating a positive result for the presence of saponin compounds. This result is marked with a positive one symbol (+), which means saponin is present in relatively low but detectable amounts.

In the polyphenol test, the extract exhibited a color change to greenish after reagent addition, as well as a brownish-green color in the plant flesh extract. Additionally, mucus was observed in the sample. These three indicators demonstrate a strong positive result (+++) for the presence of polyphenol compounds, categorizing the test as strongly positive.

The tannin test resulted in a precipitate formation after reagent addition, indicating the presence of tannin compounds in the extract. The precipitate is a common indicator for tannin identification, so the result was considered positive one (+), or mild positive. Meanwhile, the flavonoid test showed a color change to brown or the formation of brown precipitate after treatment with certain reagents. This change indicates the presence of flavonoid compounds, and the result was classified as positive one (+), or mild positive.

The analysis of the effect of Aloe vera gel extract on the closure of incision wound length in Swiss Webster strain *Mus musculus* across all treatment groups, using standard deviation, yielded statistically significant results. It was found that the group treated with 100% Aloe vera gel had an average wound length of 0.33 cm, the 50% Aloe vera group had 0.56 cm, and the untreated control group had 0.22 cm. These results indicate that the 100% Aloe vera gel is more effective, consistent, and stable in accelerating wound closure.

Based on the results of the ANOVA test conducted, a significant difference between treatment groups was found. The ANOVA test yielded a significance value (p-value) of 0.001 for each group: the control group (K), the 50% treatment group (P1), and the 100% treatment group (P2). This indicates statistically significant differences among the means of the three groups. In other words, treatment administration (both 50% and 100%) had a significantly different effect compared to the control group. The significance value of 0.001 in all comparisons indicates that the treatments significantly affected the observed variable. This means that both 50% and 100% concentrations of Aloe vera extract had different effects compared to the control (no treatment), and there was also a significant difference between the two treatment concentrations.

Based on the Post Hoc test results, p-values of 0.001 were found for all pairwise group comparisons. Since all p-values were below the significance threshold of 0.05, it can be concluded that all group comparisons showed statistically significant differences. The 50% treatment group had significantly different results compared to the control group. The 100% treatment group also differed significantly from the control. Furthermore, a significant difference existed between the 50% and 100% treatment groups as well. These results reinforce the ANOVA findings that the treatment had a real effect on the tested variable. According to the study, decision-making for this test is based on the significance values (Sig.), all of which were below 0.05. This means the null hypothesis (Ho) was rejected, confirming differences in wound size among all groups. Additionally, the test results can also be seen from the mean difference values, which ranged from 0.2 to 0.4 between groups.

Moreover, research by Harumi Ananda stated that Aloe vera extract has potential wound healing effects. Aloe vera contains mannose-6-phosphate and polysaccharides that promote fibroblast proliferation, which is important in the wound healing process. Ethanol extracts of Aloe vera can accelerate the healing of incised wounds in male white mice. Differences in dose and concentration significantly affect the wound healing process in Swiss Webster mice. The differences in dosage and concentration used had a statistically significant impact on the healing process of incision wounds in Swiss Webster mice. The group treated with 100% Aloe vera showed a faster, more consistent, and stable reduction in wound length, with wounds nearly completely closed by day 14. In contrast, the 50% Aloe vera group exhibited tighter wound closure but with greater fluctuations. Meanwhile, the untreated control group showed no significant changes, and the wounds remained incompletely closed by the end of the observation period.

CONCLUSION

Based on the research results, it can be concluded that: The group treated with 50% Aloe vera showed a slower wound healing process compared to the 100% Aloe vera group. Based on standard deviation analysis, the average remaining wound length was 0.56 cm, with a wound size of 0.21 cm still open on day 12 and higher fluctuations observed throughout the healing period. Although wound closure appeared tighter at the end of the observation period, the consistency and stability of the healing process were inferior to those observed in the 100% Aloe vera group. The group treated with 100% Aloe vera showed faster and more consistent wound healing, with an average wound length of 0.33 cm based on standard deviation analysis. From day 11, the wound size began to decrease significantly; by days 12 and 13, most wounds were nearly closed, and by day 14, nearly all wounds had completely closed, with an average wound length of 0.78 cm. This indicates that 100% Aloe vera gel effectively accelerates tissue regeneration and skin repair compared to both the 50% Aloe vera group and the untreated control group. The untreated control group exhibited the slowest wound healing, with an average wound length of 1.38 cm remaining open on day 14, indicating incomplete closure by the end of the observation period. Based on the ANOVA test results, a significance value (p-value) of 0.001 was obtained for each group: the control group (K), the 50% treatment group (P1), and the 100% treatment group (P2). This demonstrates a statistically significant difference in the average results among the three treatment groups. Therefore, the application of 100% high-concentration Aloe vera gel is more strongly recommended as a natural agent to accelerate incision wound closure and promote more consistent and stable tissue regeneration.

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