

Effect of Aloe Vera Gel Extract (Aloe Vera sp) on Collagen Thickness in Incision Wounds of Swiss Webster Mice

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ABSTRACT

Background: *Aloe vera (Aloe vera sp.) is known to have various benefits in wound healing, one of which is increasing the number of fibroblasts that play an important role in tissue regeneration. Collagen has the main function of forming the extracellular matrix to balance between scar tissue formation and tissue regeneration, which helps accelerate wound healing.* **Objective:** *To determine the effect of aloe vera gel extract on the increase in collagen levels in the healing of incision wounds in Swiss Webster mice.* **Methods:** *Experimental study with a post-test only control group design. Four male Swiss Webster mice aged 2–3 months were used. Observations were made by counting collagen levels using a microscope with Hematoxylin-Eosin (HE) staining.* **Results:** *This study involved less than 50 samples (24 samples). The decision for this test was based on the significance value (Sig.), where the significance values were found to be > 0.05 (Sig = 0.593; 0.546; and 0.610). These values indicate that all data after the treatment were normally distributed.* **Conclusion:** *The 100% Aloe vera gel extract treatment group performed better than the 50% treatment group in influencing collagen thickness, but there was no significant difference.*

Keywords: *Aloe vera, collagen, wound healing, Swiss Webster mice*

INTRODUCTION

These materials can come from plants that grow wild or from plants cultivated by the community. Aloe vera is one of the most commonly used medicinal plants.¹ A plant from the Liliaceae family, Aloe vera originates from Africa and grows easily in tropical areas with sandy soil and little water. This plant is also easy to cultivate and grows quickly. It has been present in Indonesia since the 17th century. There are more than 350 varieties of Aloe vera resulting from crossbreeding.

Aloe vera sp. helps heal many diseases, such as arthritis, asthma, gastrointestinal disorders, and skin problems like burns and wounds. Its antibacterial, antifungal, antiviral, anti-inflammatory, and antitumor properties make it beneficial for healing various diseases.²

Aloe vera is excellent for the skin because it helps restore skin balance through its pH content by promoting epidermal tissue growth and assisting in cell regeneration. Its vitamins can moisturize, eliminate acne, and reduce inflammation.³

Aloe vera leaves contain many antibiotics and water, which help restore skin health by maintaining moisture and eliminating bacteria in eschar tissue. It contains vitamins, enzymes, proteins, amino acids, carbohydrates, minerals, as well as anti-inflammatory, antibiotic, and pain-relieving properties.⁴ Because Aloe vera skin contains many secondary metabolite compounds, its waste can be converted into an extract that has the potential to function as a natural antimicrobial.⁵

A wound occurs when the continuity of tissue is damaged by sharp or blunt objects, temperature changes, chemicals, electricity, radiation, or animal bites. The body performs a wound healing mechanism to repair the damaged tissue.⁶

The wound on the skin of the mice began to dry on the third day of the study, which used the incision wound healing method. After the mice were given Aloe vera leaf extract, their wounds appeared reddish with uneven edges measuring 3.8 cm in length. In contrast, the mice that were given the extract appeared darker with dried extract residue and regular edges measuring 3 cm in length. This is consistent with the theory of inflammation, which states that the inflammatory phase occurs 24 hours after injury, when the endothelial cells and fibroblasts begin to develop and form granulation tissue. Aloe vera leaf extract dried the wound on the right side of the back faster than the wound on the left side.⁷

RESEARCH METHODS

This study is an experimental study with a post-test only control group design. A total of 24 male Swiss Webster mice aged 2–3 months were divided into three groups: the control group with no treatment, the treatment group with a 50% Aloe vera gel extract concentration, and the treatment group with a 100% Aloe vera gel extract concentration. Observations were made by counting the amount of collagen using a microscope with Hematoxylin-Eosin (HE) staining, it show in Figure 1.

DISCUSSION

This study used subjects in the form of Swiss Webster mice, totaling 24 individuals with a body weight range of 20–40 grams. All the mice were divided into 3 post-treatment groups, with 24 mice in total. Each group received different treatments as follows: Group I received no treatment, Group II received a 50% Aloe vera concentration, and Group III received a 100% Aloe vera concentration.

The termination of the Swiss Webster mice was performed on day 3 to collect skin tissue for anatomical pathology examination using HE staining. The samples were then observed under a microscope with 400x magnification, and collagen thickness was measured in 5 fields of view.

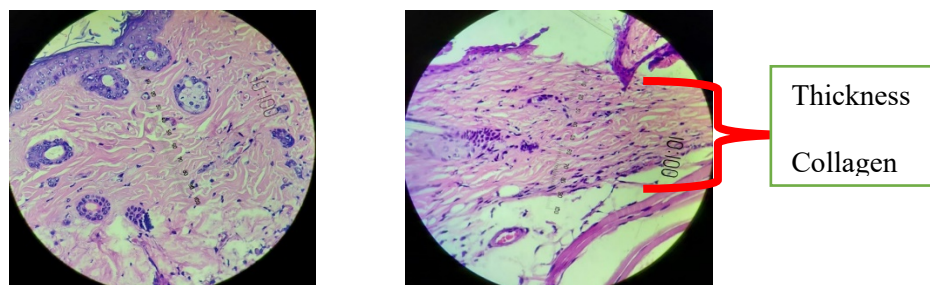


Figure 1. Observation of collagen tissue (a) K1; (b) P1; (c) P2

The descriptive analysis results of collagen levels in each group are as follows Table 1.

Table 1. Post-treatment univariate test.

Perlakuan	Mean+SD	Median	Min	Max
Without treatment (K1)	0,55+0,24	0,56	0,19	1,02
Treatment 50% (P1)	0,42+0,30	0,36	0	0,82
Treatment 100% (P2)	0,61+0,19	0,61	0,34	0,86

After the treatment, the highest average (mean) collagen level was observed in the 100% treatment group (P2), which was 0.61. The highest median value was also in the 100% treatment group (P2), at 0.61. The largest standard deviation was found in the 50% treatment group (P1), with a value of 0.30. The lowest average minimum value was in the 100% treatment group (P2) at 0.34, while the highest maximum average value was in the untreated group (K1), which was 1.02.

Table 2. Post-treatment normality test using the Shapiro-Wilk test

Treatment	Statistic	df	Sig
Without treatment	0,938	8	0,593
Treatment 50%	0,933	8	0,546
Treatment 100%	0,940	8	0,610

This test was chosen based on the number of samples used in this study, which totaled <50 samples (24 samples), it shown in table 2. The decision for this test was based on the significance value (Sig.) obtained. In the table above, data from all sample groups show significance values greater than 0.05 (Sig = 0.593; 0.546; and 0.610). This value indicates that all the data, after treatment, have been normally distributed.

Table 3. Levene's test.

Levene Statistic	df 1	df 2	Sig
1,072	2	21	0,360

The results of the Levene's homogeneity test for the Collagen variable showed a Levene Statistic value of 1.072 with degrees of freedom (df1) 2 and (df2) 21. The significance value (Sig.) obtained was 0.360. It is concluded that the variances between groups are homogeneous. This result show in table 3 and 4. Therefore, there is no significant difference in variance between the data groups, and the assumption of homogeneity has been met.

Table 4. Post-treatment test using ANOVA.

K1 N=8 Avg+SD	P1 N=8 Avg+SD	P2 N=8 Avg+SD	df	F	Sig
0,55+0,24	0,42+0,30	0,61+0,19	2	1,208	0,319

This value means that the null hypothesis (Ho) is accepted, or Aloe vera gel extract does not have a significant effect on collagen levels.

CONCLUSION

This study aims to test the increase in collagen levels in incision wounds of mice treated with Aloe vera gel extract. The Aloe vera extract is obtained from the peeled Aloe vera, then blended into a pulp, filtered, and stored in a freezer for 24 hours. Next, an infusion is performed, and the mixture is placed in an Erlenmayer

flask, then stored in the freezer for 24 hours. The final phase involves drying the Aloe vera using a rotary evaporator until it becomes thick.

This study found that the highest average (mean) collagen level was in the 100% treatment group (P2), which was 0.61. The highest median value was also in the 100% treatment group (P2), which was 0.61. This indicates that Aloe vera gel extract has an effect on increasing collagen thickness.

Flavonoids can increase collagen, and this study shows results that suggest Aloe vera groups, which may be related to other studies explaining IL-6 and IL-10 as factors in wound healing. Aloe vera can modulate the release of cytokines TNF- α and IL-10. High levels of IL-10 and low levels of IL-6, influenced by the administration of honey, can reduce the inflammatory phase and enhance the proliferative phase.

What is interesting about this proliferative phase is that at a certain point, the entire process described above must be stopped. Fibroblasts will quickly disappear once the collagen matrix fills the wound cavity, and neovascularization will decrease through the process of apoptosis. The failure of regulation at this stage is what is currently considered the cause of fibrosis abnormalities such as hypertrophic scars.

According to previous studies, Aloe vera gel extract has been shown to have a positive effect on the synthesis and thickness of collagen tissue, particularly in the wound healing and skin regeneration processes. Active compounds in Aloe vera, such as aloin, acemannan, and polysaccharides, play a role in enhancing fibroblast proliferation and stimulating the synthesis of type I and III collagen, which contributes to increased collagen tissue thickness. Experimental studies have shown that Aloe vera extract can increase the expression of growth factors, such as transforming growth factor-beta (TGF- β) and vascular endothelial growth factor (VEGF), which are involved in fibroblast activation and collagen production. Additionally, the antioxidant and anti-inflammatory properties of Aloe vera help protect collagen from degradation caused by oxidative stress and inflammation, which are often key factors in the decline of collagen tissue quality. Thus, the application of Aloe vera gel extract holds potential as a natural therapeutic agent for improving collagen tissue thickness and quality for clinical purposes.⁸

ADVICE

The 100% Aloe vera gel extract treatment group is more effective than the 50% treatment group in influencing collagen thickness, resulting in no significant difference.

REFERENCES

1. Mustofa, Yuniastuti A, Marianti A. Efek Pemberian Jus Lidah Buaya Terhadap Kadar Glukosa Darah Tikus Putih. *Unnes J Life Sci.* 2012;1(1):36–40.
2. Puteri T, Milanda T. Uji Daya Hambat Ekstrak Daun Lidah Buaya (Aloe vera L.) Terhadap Bakteri *Escherichia coli* dan *Staphylococcus aureus*: Review. *Farmaka.* 2016;14:9–17.
3. Widiawati W. Perbedaan Hasil Penyembuhan Kulit Wajah Berjerawat antara Masker Lidah Buaya dengan Masker Non Lidah Buaya. *e-Jurnal.* 2014;03(01):217–25.
4. Primasari M. Efek Terapi Gel Lidah Buaya (Aloe vera) dalam Penyembuhan Luka. *Medicinus.* 2019;32(3):46–51.

5. Mulyanita, Djali M, Setiasih IS. Total Fenol, Flavonoid dan Aktivitas Antimikroba Ekstrak Limbah Kulit Lidah Buaya (*Aloe chinensis baker*). *J Vokasi Kesehat*. 2019;5(2):100.
6. Ariani S. Khasiat Daun Binahong (*Anredera Cordifolia* (Ten.) Steenis) Terhadap Pembentukan Jaringan Granulasi Dan Reepitelisasi Penyembuhan Luka Terbuka Kulit Kelinci. *J E-Biomedik*. 2014;1(2):914–9.
7. Sewta Ca, Mambo C, Wuisan J. Uji Efek Ekstrak Daun Lidah Buaya (*Aloe Vera L.*) Terhadap Penyembuhan Luka Insisi Kulit Kelinci (*Oryctolagus Cuniculus*). *J E-Biomedik*. 2015;3(1):1–7.
8. Terapan JI, Hamman JH. molekul Komposisi dan Aplikasi Gel Daun Aloe Vera. 2021;1599–616.