



## THE USE OF ALOE VERA GEL ON SCAR COLLAGEN

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### ABSTRACT

**Introduction:** *Aloe vera* have active chemicals substances including saponins, tannins, flavonoides, and polyphenols. Saponin takes a role as a disinfectant, so it is normally effective for healing any open wounds, while tannins have ability to be an antiseptic. This study aims to see how the effect of the *Aloe vera* gel on wound collagen, and too inspect which is the most effective concentration of the *Aloe vera* gel in the formation of wound collagen in wistar strains (*Rattus novergicus*) rats.

**Methods:** This study uses a post-test only method with control group design. The subjects of this study were 28 male Wistar rats (*Rattus novergicus*). The subjects were divided into 4 groups consisting of 1 negative control group and 3 treated groups, the control group was not given any treatment, while the treated group was given the *Aloe vera* gel with each concentrations of 12.5%, 25%, and 50% respectively. The experiment was started by making a wound on the back of the rat which then be followed by applying the gel to the wound for 14 days.

**Results:** The results showed the group with the 50% *Aloe vera* gel treatment had the best collagen formation, followed by a concentration of 25%, 12.5%, and the control group. Therefore, the used of *Aloe vera* has given good change in scar collagen, and the best scar collagen can be viewed in the group with 50% concentrate of *Aloe vera*.

**Conclusion:** Increasing the concentration of applied *Aloe vera* gel led to the development of thicker collagen tissue in wounds on male white rats (*Rattus novergicus* strain Wistar). This suggests that *Aloe vera* may serve as a viable alternative treatment for wounds in our daily lives.

### Highlights:

1. The active chemical compounds present in *Aloe vera* are known to be efficacious in the process of healing open wounds.
2. The use of *Aloe vera* can significantly improve scar collagen, with the highest improvement observed in the group treated with 50% *Aloe vera* gel.

### INTRODUCTION

The definition of a wound is the loss of tissue continuity.<sup>1</sup> Wounds are the damaged parts of some of the bodies tissues that can occur in our daily lives. Some of the causes of wound can be divided into wound because of chemical substances, thermal wounds, and mechanics. Mechanic wounds usually happen varying/depending on the object

that made ouches it.<sup>2</sup> Wound is a common case that happens to humans. The top three injuries that Indonesians suffers are excoriation/ contusion amounting to about 70.9% and vulnus laceratum around 23.2%.<sup>3</sup> Since old times, Indonesians have known and took advantages of medicinal plants as one of the effort to resolve health problems, precisely for wound treatment by using herbal ingredients. Maintenance and

development of traditional plants continued and its developments are pushed through extractions, experiments and productions of herbal medicines using modern equipments.<sup>6</sup> Some of the previous research showed the effect of *Aloe vera* on wound healing. There are substances that are capable of helping wound heals founded in *Aloe vera* leaves.<sup>4</sup>

*Aloe vera* plants, both the leaves and roots contains substances such as saponin, tannin, flavonoid, and polyphenol. Saponin takes a role as a disinfectant, so it is normally effective for healing any open wounds, while tannins have ability to be an antiseptic.<sup>4</sup> Flavonoid and polyphenol have the ability as antiseptic as well. In some countries *Aloe vera* is commonly used as firstaid step on wound. *Aloe vera* contains a lot of active substances that can be helpful on wound recovery because it has glucomannan, lignin, vitamin A, vitamin C, enzymes, and amino acids that has roles in cell regenerations.<sup>1</sup>

One previous study showed that there is a connection between the application of *Aloe vera* gel to the formation of wound fibrotic tissue. It is also mentioned that *Aloe vera* has very profound effect for the proliferation phase in which it provides the effects of wound reduction and size of the wound.<sup>4</sup> Because there hasn't been any research done about the effect of *Aloe vera* gel on scar collagen, the we are interested to study the effect of *Aloe vera* gel on scar collagen.

## METHODS

This type of research is a laboratory experimental research using complete randomized design with posttest only control group design. This research used 28 animal tester which are the male white rats (*Rattus novergicus* strain wistar). The experimental animals are divided into 4 simple randomized group that consists

of 3 behavior group and 1 control group. For the upkeep and handling/treatment of the experimental animals and also histopathological examination will be done in the pharmalogy laboratory of the veterinary medicine faculty of syiah kuala university. Herbarium laboratory of the biology major of the math and science faculty (FMIPA) syiah kuala university for the herbarium test and chemistry laboratory of the math and science faculty (FMIPA) Syiah Kuala University for the phytochemical test. The research is done in April-November 2018. The data will be collected in September-October 2018.

The study is done on experimental animals which are the 28 male white rats (*Rattus novergicus* strain wistar). The tools used for the research are: rats nest, rats feeding and drinking place, experimental animal analytical scales, fur shaver, gloves, mask, rulers, blenders, vacuum rotary evaporator, erlemeyer, Buchner funnel, sterilized gloves, aluminium foil, filter paper, cotton buds, digital camera, measuring glass, minor surgery tools/equipment, and microtechnics tools to make the histology preparations (object glass, cover glass, paraffin mold, oven, and microscope). The materials used for this research are the *Aloe vera* meats that came from the *Aloe vera* plants that are obtained through, 70% ethanol, alcohol, aquades, tools to make the histology preparations, 10% ormalin solution, paraffin, xylitol solution, hematoxylin-eosin, rats food such as pellet 529 and its drinks which is aquades.

## RESULT

Herbarium study is done to determine the plant being used and to establish the validity. According to the determined result, the plant being used in this research is *Aloe vera*. Phytochemical test results of leaf ethanol extract contains substances such as alkaloids, steroids, flavonoids, saponins, and

phenolics/tannins.

Table 1. Phytochemical Test Result

Phytochemical Test	Ethanol Extract of Binahong Leaves
Alkaloid	+
Steroid	+
Terpenoid	-
Saponin	+
Flavonoid	+
Phenolic/ Tannin	+

Based on the results of the research conducted within the span of 14 day it obtained the macroscopic examination data and microsophic wound slices of the experimental animals on day 14<sup>th</sup> can be seen below.

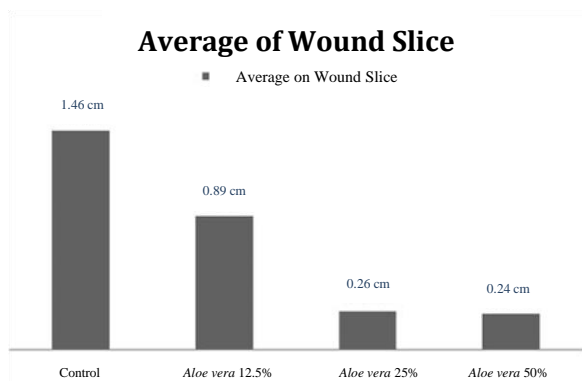


Figure 1. Average of Wound Slice Length

According to the two tables below it can be seen that *Aloe vera* gels with 50% concentration is the most effective concentration in wound healing, it is identified by the average wound length and the biggest average collagen thickness.

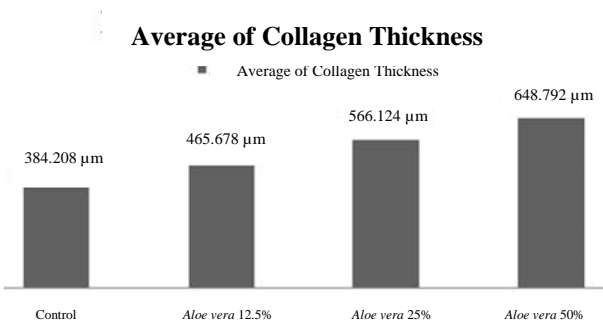


Figure 2. Average of Collagen Thickness

One way test ANOVA is a test to determine whether there are any major effect to ward the treatment. Hypothesis (Ho) is accepted if there's any significant numbers/ value, which is a sign that there is no major/meaningful effect towards the treatment. On the contrary, if theres significant numbers  $\leq 0.05$  ( $p \leq 0.05$ ) then Ho is denied, which signify a significant effect towards the treatment. If from the calculation result there is smaller F value calculated than F table then the hypothesis (Ho) is accepted.

Table 2. Wound Alterations/Changes From The ANOVA Test Result Day 0-14

	Sum of Squares	Degrees of Freedom (df)	Mean Square	F value	p value
Between Groups	7.134	3	2.378	12.049	0.000
Within Groups	4.736	24	0.197		
Total	11.870	27			

However, if from the calculation result there is bigger F value calculated than F table then hypothesis (Ho) is denied. The result from one way ANOVA test method that is listed in table 2 as follows. According to the result of table 4.3 it is obtained that p value = 0.000 ( $p \leq 0.05$ ). Then the conclusion can be drawn that the result of one way ANOVA has major/ significant effect to every research group. Next, a differentiation test was performed using Duncan method. According to table 3 it canbe concluded that there is a significant relation between wound length examination (macroscopic) and collagen thickness (microscopic). Subsequently in 4 showed the comparison of contolled group to each treatment.

Table 3. The Connection Between Collagen Thickness in Sliced Wounds with Wound Length Alteration.

	N	Average ± SD	P Value
Change of Day (Cm)	28	0.7911 ± 0.66305	0.000
Collagen Thickness (μm)	28	516.19 ± 105.564	



Table 4. The Comparison of Wound Length Between Control and Each Treatment

	Group	Change (cm)
Control Group	<i>Aloe vera</i> 12.5%	-0.57
	<i>Aloe vera</i> 25%	-1.20
	<i>Aloe vera</i> 50%	-1.22

Table 5. The Result of The Duncan Test About Sliced Wound Length Alteration (Cm) Day 0-14

Treatment	N	Alpha=0.05		
		1	2	3
Control Negative	7	-0.0429		
<i>Aloe vera</i> 12.5%	7		-0.6143	
<i>Aloe vera</i> 25%	7			-1.2429
<i>Aloe vera</i> 50%	7			-1.2643
p-value		1.000	1.000	0.92

Table 6. The Result of The Duncan Test about Collagen Thickness (µm) in Sliced Wounds Day 14

Treatment	N	Alpha=0.05			
		1	2	3	4
Control Negative	7	384.208			
<i>Aloe vera</i> 12.5%	7		465.678		
<i>Aloe vera</i> 25%	7			566.124	
<i>Aloe vera</i> 50%	7				648.792
p-value		1.000	1.000	1.000	1.000

Next, using the Duncan method which is a differentiation test that aims to see and compare treated group which have major differences. Hypothesis (Ho) is accepted if the significance value 0.05 (p 0.05) which means there is no major differences between treated groups. However, hypothesis is denied if the significance value  $\leq 0.05$  ( $p \leq 0.05$ ), in which case there According to table 4 and 5 above we found changes to the wounds length and collagen thickness are the best using *Aloe vera* gel 50% treatment and

then followed by 25%, 12.5%, and the last is negative control. Therefore, it can be concluded that *Aloe vera* gel with 50% concentration is the most efficient in healing sliced wound on male white rats (*Rattus novergicus* strain wistar).

### DISCUSSION

The use of *Aloe vera* gel with an increased concentration on experimental animals demonstrated notable variances, particularly at the maximum concentration of 50%. Findings from the 14-day study indicated that as the concentration of *Aloe vera* gel applied to the experimental animals increased, there was a corresponding increase in the thickness of the collagen connective tissue. Additionally, the phytochemical analysis revealed that *Aloe vera gel* consists of a variety of chemical compounds, including alkaloids, steroids, saponins, flavonoids, and phenolics/tannins.

Collagen, a group of extracellular proteins, plays a pivotal role as the primary constituent of connective tissue. Collagen contributes to both strength and flexibility and is characterized by its triple helix structure. On day 14 of the study, in each group, we observed the occurrence of the second phase of wound healing. This phase is identified by a reduced wound distance and the appearance of collagen fibers when examined under a microscope.

Based on the findings of our phytochemical analysis, *Aloe vera* gel comprises a range of chemical compounds, including alkaloids, steroids, terpenoids, saponins, tannins, and flavonoids, all of which contribute positively to the wound healing process in the experimental animals. Furthermore, our research aligns with prior studies, such as the work of Napanggala et al. (2014), which reported that saponins found in *Aloe vera* can stimulate the growth of collagen during the healing process and facilitate the formation of new cells<sup>18</sup>.



According to research conducted by Nycho Alva Chindo in 2015, outlined in a paper titled "Benefits of Aloe vera Compounds in the Treatment of Stomatitis," Aloe vera plays a multifaceted role in the process of wound healing.<sup>19</sup> Aloe vera contains amino acids such as tryptophan and phenylalanine, both of which exhibit anti-inflammatory properties. Additionally, Aloe vera contains salicylic acid, which serves as a deterrent to the biosynthesis of prostaglandin and arachidonic acid. Consequently, it can be inferred that Aloe vera possesses analgesic effects and aids in mitigating inflammation, thereby contributing to the overall quality of wound healing.

The proliferation phase is characterized by evidence of angiogenesis, the deposition of collagen tissue, the maturation of the epidermis, and the reduction in wound size. In this phase, also referred to as the epithelialization phase, there is the development of granulation tissue, which gives the wound a fresh, shiny, reddish appearance, hence its name, the granulation phase. This granulated tissue is comprised of a combination of fibroblasts, inflammatory cells, newly formed blood vessels, fibronectin, and hyaluronic acid. The proliferation phase is also commonly known as the collagenization phase.

This study's strengths lie in its exploration of the effects of varying concentrations of Aloe vera gel on wound healing, presenting clear findings regarding its influence on collagen tissue formation. Additionally, the inclusion of information about the phytochemical composition of Aloe vera gel enhances the credibility of the results. The study's robustness is further bolstered by references to other research studies that support its claims, showcasing a well-researched and informed approach. Furthermore, the study offers a

comprehensive understanding of the wound healing process by discussing its various phases and their interconnection. However, a notable limitation is the absence of specific quantitative data, such as measurements of collagen thickness or statistical values, which hinders the assessment of the significance of the observed differences.

## CONCLUSION

*Aloe vera* gel is in fact effective towards the formation of wound collagen on male white rats (*Rattus novergicus* strain wistar). The higher the concentration of the *Aloe vera* gel that was applied, the thicker the collagen tissue found on male white rats (*Rattus novergicus* strain wistar) wound, and it is expected that *Aloe vera* can be used as an alternative medicine to treat wound in our daily live.

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## CONFLICT OF INTEREST

The authors declare that they have no personal relationships with any individuals or organizations that could inappropriately influence or bias the content of this article.

## FUNDING DISCLOSURE

The authors declare that they have no financial relationships with any individuals or organizations that could inappropriately influence or bias the content of this article.

## AUTHORS CONTRIBUTION

All authors contributed to the conceptualization, study design, data curation, formal analysis, data interpretation, methodology, manuscript writing, conceptualization, investigation, project administration, and content revision.

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