# Effectiveness Of A Combination Of Lady's Tea Extract (*Aloe Vera* L.) And Celedri Leaf Extract (*Apium Graveolens* L.) In Healing Wounds In Rats (*Rattus Norvegicus*)

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**Abstract:** Incision wounds are tissue injuries caused by sharp objects that require rapid and effective healing. Aloe vera and celery leaves are known to contain secondary metabolites such as flavonoids, tannins, and saponins, which are believed to accelerate wound healing. This study aims to determine the effectiveness of combining both extracts in promoting the healing of incision wounds in male rats and to identify their secondary metabolite content. This experimental study used a Post-test Only Control Group Design. Male rats were divided into five groups: negative control (lanolin ointment), positive control (gentamicin ointment), and three treatment groups receiving combinations of aloe vera and celery extracts at ratios of 24.8%:72.5%, 48.6%:48.6%, and 72.5%:24.8%. A 2 cm incision wound was made on each rat and observed macroscopically on days 3, 6, and 9. Wound healing percentage was calculated based on wound length. Phytochemical screening was conducted to identify the secondary metabolites in both extracts. The combination of aloe vera and celery extracts at a ratio of 48,6%:48,6% showed the highest healing percentage, with 40% on day 3, 85% on day 6, and 89% on day 9. Phytochemical tests confirmed the presence of flavonoids, tannins, and saponins in both extracts, which contribute to the wound healing process. Aloe Vera extract and Celery leaf extract were proven to contain secondary metabolite compounds in the form of flavonoids, tannins, and saponins. The combination of Aloe Vera extract and Celery leaf extract can heal cuts in mice. The optimal concentration can be in a ratio of 48,6%: aloe vera and 48,6% celery leaves.

**Keywords:** Celery leaf, Concentration, Incision wound, Aloe vera, Phytochemical Screening

## INTRODUCTION

Indonesians still believe traditional medicine can treat various diseases and injuries. Traditional medicine is also referred to as herbal medicine because the ingredients used come from natural ingredients. Traditional medicine is an ingredient or combination of ingredients in the form of plant materials, animal materials, mineral materials, preparations of sarian (galenik), or a mixture of these materials that have been used for generations for treatment and can be applied in accordance with the norms prevailing in the community (BPOM RI, 2019). Based on Basic Health Research (RISKESDAS) data in 2018, the prevalence of cut or slashed wounds in Indonesia reached 20.1%. The highest rate was found in the Papua region with a percentage of 7.74%, while in the Jambi region, the prevalence of cuts was recorded at 4.76%.

A wound is the destruction of part of the body's tissue caused by sharp or blunt trauma, temperature changes, chemicals, explosions, electric shock, or animal bites. A cut is a wound caused by a sharp object, such as in surgery. The characteristics of a cut wound are pain, open wounds, and the length of the wound being greater than its depth (Muliyah *et al*., 2020). The wound healing process is a complex process consisting of 4 phases, namely, the hemostasis phase, the inflammation phase, the proliferation phase, and the maturation phase (Primadina *et al*., 2019).In recent years, there has been an increasing interest in the use of herbal medicine as an alternative or complement to conventional medicine. Aloe vera and celery leaves (*Apium graveolens*) are known to have various beneficial therapeutic properties, such as anti-inflammatory, antimicrobial, and stimulant of tissue healing.

Aloe vera contains a large number of bioactive compounds, such as flavonoids, terpenoids, lectins, fatty acids, anthraquinones, mono and polysaccharides (pectin, hemicellulose, glucomannan), tannins, sterols (campesterol, β -sitosterol), enzymes, salicylic acid, minerals (calcium, chromium, copper, iron, magnesium, manganese, potassium, phosphorus, sodium and zinc) and vitamins (A, C, E, β-carotene, B1, B2, B3, B6, choline, B12, folic acid) (Gupta, 2017). Celery (*Apium graveolens* L.), a plant of the Apiaceae family, is a leaf vegetable distributed worldwide. Celery originated in the Mediterranean and the Middle East. Due to its high vitamin and nutrient content, celery is becoming increasingly popular for consumption. Celery can be beneficial for suppressing inflammation caused by various diseases (Hedayati *et al*., 2019). Chemical content differences among different parts of celery, especially leaves

and stems, have been previously reported, which may have an impact on its anti-inflammatory properties (Ingallina *et al*., 2020; Lau *et al.*, 2021).

Based on this background, researchers are interested in examining the effects of a combination of aloe vera and celery leaf extracts. Although the benefits of each of these plants have been proven, there is still very little research on their combination. Aloe vera is rich in flavonoids and polysaccharides, while celery leaves contain apiin or flavonoids. The combination of the two is thought to work effectively together to speed up the wound healing process.

## METHODS

Tools that will be used in this study include: Rat cage, rat drinking water bottle, aquadest, scalpel, ruler, analytical balance (Ohaus), erlenmeyer, measuring cup, pipette, beaker glass, mask, gloves, tweezers, filter paper, blender, stirring rod, dropper, steam cup, test tube, test tube container, bunsen, spatula, water bath, flannel cloth, rotary evaporator, occlusive bandage. While for materials, aloe vera extract, celery leaf extract, rats, 70% ethanol, ketamine, cream veet (hair loss), distilled water, Mg (magnesium), concentrated HCl, concentrated hydrochloric acid, hydrochloric acid, Ethyl Acetate, concentrated sulfuric acid, FeCl_3, HCl 2 N.

This study used an experimental research design with Post Test Only Control Group Design using male white rats as experimental animals. The treatment was divided into 5 groups, each group consisting of 5 male white rats that had been adapted to the environment for 7 days.

**Simplification and Extraction Process**

1. Preparation of Aloe Vera simplisia
   Fresh aloe vera leaves weighing 16.2 kg were sorted, washed with running water, then chopped ± 1 cm. After that, the leaves were dried in an oven at 44°C for 12 hours. The dried leaves were then ground using a diskmill with a 60 mesh sieve, resulting in 1,088 g of simplisia powder. This powder was extracted using 10 L of 70% ethanol in an extractor container. Extraction was carried out with Ultra Turrax (1,000 rpm, 2 hours), then continued with maceration for 48 hours. Filtrate filtered using Buchner funnel with vacuum machine was evaporated using rotary evaporator at 50°C with vacuum pressure. The remaining solvent was evaporated with a waterbath to dry, resulting in a final extract weighing 108.2 g. The ratio of fresh material to the final extract was 1:150, while the simplisia powder to the final extract had a ratio of 1:10. In addition, each 1 L of ethanol was used to extract about 108.8 g of simplisia powder, ensuring optimal extraction.
2. Preparation of simplisia Celery leaves
   Fresh aloe vera leaves weighing 6.09 kg were sorted and dried in an oven at 40°C for 6 hours. After drying, the leaves were ground using a diskmill with a 60 mesh sieve to produce 712.9 g of simplisia powder. The powder was then extracted using 9.5 liters of 70% ethanol in an extractor container using the Ultra Turrax method at 1,000 rpm for 2 hours, followed by maceration for 48 hours. The filtrate from maceration was filtered using a Buchner funnel and vacuum machine, while the residue was re-extracted using the same method. Filtrates from the first and second extractions were then evaporated with a rotary evaporator at 50°C and vacuum pressure. The extract obtained was then evaporated again with a waterbath to dry, resulting in a final extract weighing 115.7 g. The ratio of ethanol to simplisia powder used was 9.5 L:712.9 g, or about 1:0.075. This means that every 1 L of ethanol is used to extract about 75 g of simplisia powder.

**Phytochemical Screening Flavonoid Identification**

Add 1g of extract into 100mL of hot water and boil for 5 minutes, then filter. Take 5ml of the filtrate, add 0.05g of magnesium (Mg) powder and 1mL of concentrated HCl, then shake vigorously. This test is positive if a red, yellow, or orange color appears (Safriana *et al*., 2021).

**Identification of Saponins**

Add 1g of extract into a test tube and add 10mL of hot water. Cool the mixture, then shake vigorously for 10 seconds until foam appears. This test is positive for saponins if the foam formed as high as 1-10 cm does not disappear within 10 minutes, and the foam remains after adding 1 drop of 2N HCl (Sulistyarini *et al.*, 2016).

**Identification of Tannins**
Add 0.5g of extract into a test tube, then add 10mL of hot water. Simmer the mixture for 15 minutes, then filter. Add 2-4 drops of FeCl_3 to the filtrate. If a blue green (green-black) color is formed, this indicates the presence of positive tannin (Syahadat & Siregar, 2020).

**Preparation of ointment**
Preparation of the preparation begins with preparing ointment stock from each extract, namely aloe vera extract and celery leaf extract. Each stock was made as much as 50 grams with a composition of 95% thick extract and 5% lanolin (Widnyana et al., 2021), then stirred until homogeneous. After both ointment stocks were ready, mixing was carried out to make a combination preparation of 35 grams according to the predetermined ratio. There are three variations of the combination ratio, namely 24.8% aloe vera and 72.5% celery leaves; 48.6% aloe vera and 48.6% celery leaves; and 72.5% aloe vera and 24.8% celery leaves. Each combination was weighed based on the specified ratio, then mixed evenly to form a homogeneous ointment and ready to be used for the testing process.

**Incision Making**
Rat hair was removed using Veet cream, then the rat's back was cleaned with 70% alcohol before anesthesia. Mice were given ketamine before making the incision wound to reduce pain. The incision wound was made with a scalpel 2 cm long on the back with a depth of 1 mm. The process of making the wound is done by removing the rat's skin using tweezers, then making a wound with a scalpel that has been sterilized with 70% alcohol, until it reaches the subcutaneous part of the rat's skin.

**Data Analysis**
Data analysis using parametric tests. The first step was normality test and then data homogeneity test using Test of Homogeneity of Variances. After fulfilling the requirements of the parametric test, the One Way Anova test was carried out to determine whether there were significantly different data variances or not. This test is meaningful if the p value is <0.05.

## RESULTS AND DISCUSSION

The research was conducted after obtaining Ethical Clearance approval from the Health Research Ethics Commission of Muhammadiyah Purwokerto University. The purpose of the permit is to protect research subjects from physical, practical, social and legal consequences of participating in a study. The results of the Research Ethics Permit with registration number KEPK/UMP/40/V/2025.

**The Results of Organoleptic Examination of Viscous Extract**
The results of the examination show that Aloe Vera extract (Aloe vera L.) has a viscous extract form with a distinctive odor, has a bitter taste and a blackish green color. The results of the organoleptic examination show that the characteristics of the extract meet the specifications of the Indonesian Herbal Pharmacopoeia, including shape, color, odor, and taste (Ministry of Health, 2017).

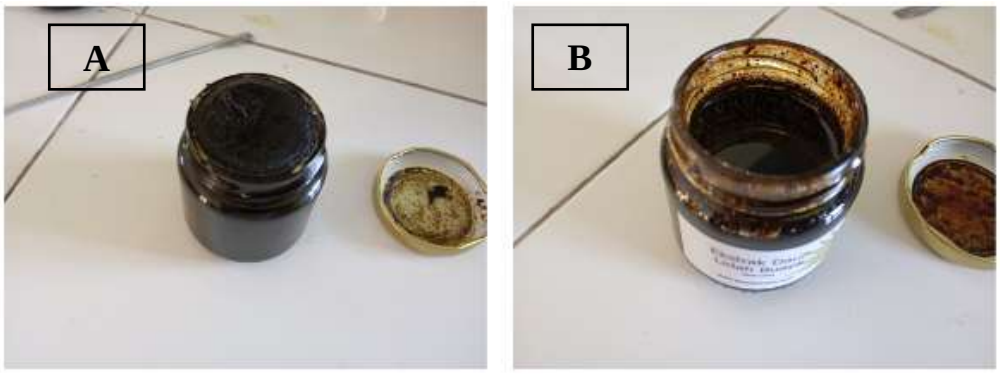


**Figure 1.** Macroscopic Appearance of Thick Extracts of Aloe Vera (A) and Celery Leaf (B)

The results of the examination show that Celery Leaf Extract (Apium graveolens L.) has a thick

extract form with a distinctive odor, has a distinctive taste and dark green color. The results of the organoleptic examination show that the characteristics of the extract meet the specifications of the Indonesian Herbal Pharmacopoeia, including shape, color, odor, and taste (Ministry of Health, 2017). Organoleptic evaluation, also known as sensory testing, uses human sensory abilities as the main method in assessing and identifying the visual aspects, aroma, taste, and color of an extract (Gusnadi et al., 2021).

**The results of the examination of water content**

The results of the examination of the water content of thick aloe vera extract (Aloe vera L.) using a moisture balance tool with 3 replications. The results of determining the water content of celery leaf extract. Determination of water content in the extract aims to determine the water content in celery herb extract. Based on the results of the analysis, the water content obtained in celery herb simplisia (Apium graveolens L.) is 1.93%, which is within the specified limit, which is not more than 10%. As for the thick extract of celery leaves itself, it has a set limit of no more than 10% (Ministry of Health of the Republic of Indonesia, 2017). The higher the percentage of water content in an extract, the more susceptible the extract is to damage and spoilage due to microbial growth. Excess water content above 10% can also trigger the decomposition of active compounds due to enzymatic reactions, which in turn has an impact on reducing the stability of the extract (Nazar, 2023).

Based on the results of the analysis, the water content obtained in Aloe vera (Aloe vera L.) simplisia is 6.94%, which is within the limit set by (Ministry of Health RI, 2017) which is not more than 12.5%. Determination of water content is also related to the purity of the extract because the greater the percentage of water content in a material, the easier it is for an extract to experience damage and decay caused by microbes (Table I).

**Table 1**. Phytochemical Screening of Aloe Vera and Celery Leaf Extracts

| No | Group of compounds | Method | Interpretation | results |
|---|---|---|---|---|
| 1. | Flavonoid | Shinoda | Yellow | (+) |
| 2. | Saponin | Foam | Stable foam that presists | (+) |
| 3. | Tanin | Ferric Chloride | Dark green | (+) |

Description:
(+) : Indicates a positive reaction

**a. Flavonoids**

Phytochemical screening results on aloe vera extract (Aloe vera L.) and celery leaf extract (Apium graveolens L.). Indicates the presence of flavonoid compounds, which are characterized by the appearance of yellow color. Flavonoid compounds themselves can produce red, orange or orange colors when reduced with Mg and concentrated HCl. The flavonoid test uses a reagent in the form of concentrated HCl and Mg powder. The addition of Mg powder plays a role in allowing the flavonoid carbonyl group to bind to Mg, while HCl functions to form flavylium salts that produce an orange-red color (Afriani *et al.*, 2016).

Gustia *et al*. (2017) Flavonoids are phenolic compounds found in plants and function as antioxidants. Flavonoids are polyphenolic compounds that function as antibacterials by forming complex compounds against an extracellular protein that can disrupt the integrity of bacterial cell membranes (Novitasari & Putri, 2016). The mechanism of action of flavonoids as antibacterials by forming complexes with extracellular proteins, which then disrupt the stability of bacterial cell membranes.

**b. Saponin test**

The results of the saponin test on aloe vera extract (Aloe vera L.) and celery leaf extract (Aloe vera L.) proved positive for saponin compounds by showing the results of stable foam formation. Saponins act as antimicrobials with dual functions as cleansers and antiseptics. This compound is able to inhibit the growth of microorganisms in the wound, thus helping to prevent infection and support the healing process (Fahrezi & Sumarmin, 2021).

**c. Tannin test**

The results of the tannin test on aloe vera extract (Aloe vera L.) and celery leaf extract (Aloe vera L.) proved positive for tannins which were marked by the formation of a blackish green color. Tannins are phenol compounds with large molecular weights containing hydroxy groups and other groups, such as carboxyl. These compounds are able to form strong and effective complexes with proteins and various

macromolecules, which contribute to their astringent properties and their potential in various biological applications (Priamsari & Yuniawati, 2019).

**Macroscopic Observations of Wound Length**

Redness (erythema) is the first thing that is seen in the inflamed area. During the inflammatory reaction, there is a dilation of arterioles that supply blood to the area of inflammation (Qomariah *et al.*, 2015). There are 4 phases of wound healing: hemostasis, inflammation, proliferation or epithelialization and maturation or remodeling (Melanie *et al.*, 2019). The wound healing process is complex and dynamic, involving various cells and tissues. One indication of wound recovery is the formation of granulation tissue, which is young connective tissue that plays a role in filling the wound area and replacing damaged tissue (Hendler *et al.*, 2021). Granulation tissue begins to form on the third to fourth day after the wound occurs. This tissue formation is characterized by the process of angiogenesis, which is the formation of new capillaries, as well as the infiltration of inflammatory cells, especially macrophages and fibroblasts, which play a role in regenerating connective tissue in the wound area (Nolff *et al.*, 2018) (Table 2 and Figure 2).

**Figure 2.** Macroscopic Observation of Incision Wound Healing on Experimental Rats

**Table 2.** Macroscopic Observations Wound length**.**

| Group | Observation Macroscopic | H3 | H6 | H9 |
|---|---|---|---|---|
| K1 | Color | CM | CT | - |
| | Wound length | 1,6 cm | 0,5 cm | 0,1 cm |
| K2 | Color | CT | + | - |
| | Wound length | 1,5 cm | 0,5 cm | 0 cm |
| K3 | Color | CM | CT | CT |
| | Wound length | 1,5 cm | 0,4 cm | 0,1 cm |
| K4 | Color | CT | - | - |
| | Wound length | 1,4 cm | 0,4 cm | 0,1 cm |
| K5 | Color | CT | CT | + |
| | Wound length | 1,4 cm | 0,4 cm | 0,1 cm |

Description:
PL: Wound Length
CM : Reddish Brown CT : Dark Brown
+ : Available - : Absent
K1: Negative Control Group (lanolin)
K2: Positive Control Group (gentamicin)
K3 : LB:DS combination (24.8%:72.5%)
K4 : LB:DS combination (48.6%:48.6%)
K5 : LB:DS combination (72.5%:24.8%)

Macroscopic observations of the wound healing process were made on day 3 (H3), day 6 (H6), and day 9 (H9) in the five treatment groups. The wound color in the negative control group (K1) changed from reddish brown (CM) at H3 to dark brown (CT) at H6, indicating the progression of the healing process. The wound length in this group decreased gradually, from 1.6 cm at H3 to 0.5 cm at H6, and finally reached 0.1 cm at H9, indicating a fairly good healing effectiveness even though there were still residual wounds.

The positive control group (K2) was treated with gentamicin ointment, which maintained a dark brown wound color (CT) from H3 to H9, indicating stability in the healing process without noticeable discoloration. This treatment caused a gradual decrease in wound length, from 1.5 cm at H3 to 0.5 cm at H6, finally reaching 0 cm at H9. This reflects the progressive regeneration of tissues over time.

The LB:DS combination group (K3) with a ratio of 24.8%:72.5% showed a change in wound color from reddish brown (CM) at H3 to dark brown (CT) at H6 and remained CT at H9. Along with the reddish discoloration of the wound, it signifies the initial inflammatory phase in the healing process, where the immune response works to address the injury and initiate tissue regeneration. In addition to the color change, the wound length significantly decreased from 1.5 cm at H3 to 0.4 cm at H6 and 0.1 cm at H9, indicating good healing progress.

The LB:DS combination group (K4) with a ratio of 48.6%:48.6% had a dark brown wound color (CT) since H3 and remained unchanged until H6 and H9. This condition indicates that the wound is at an advanced stage in the healing process, most likely having passed the inflammatory phase and entered the proliferation or remodeling phase. The wound length in this group also decreased gradually from 1.4 cm at H3 to 0.4 cm at H6 and 0.1 cm at H9, indicating healing in line with the other groups.

While the LB:DS combination group (K5) with a ratio of 72.5%:24.8% showed a wound color that remained dark brown (CT) from H3 to H6, with a change at H9 marked by the presence of a healing sign (+). The wound length in this group decreased from 1.4 cm at H3 to 0.4 cm at H6 and 0.1 cm at H9. In general, all groups showed progressive healing with reduced wound length over time, with the positive control group (K2) experiencing the most rapid healing.

**The wound length measurement**

The results showed that all groups could reduce wound length. Aloe vera extract is known to increase fibroblast proliferation and collagen synthesis, which contribute to the acceleration of wound healing. This is in line with research by Hutabarat *et al.* (2023) showing that Aloe vera extract has a significant clinical effect in accelerating incision wound healing. The test results showed that the higher the level of Aloe vera extract given, the faster the wound recovery process compared to the negative control group. The results of research by Nikola et al., (2021) showed that celery leaves (Apium graveolens L.) have activity in accelerating wound healing.

Measurement of wound length from day 3 to day 9 aims to evaluate the effectiveness of incision wound healing and compare the effect of various treatments. The tested groups included the use of ointment base (K1), gentamicin ointment (K2), and LB:DS combination with the ratio of 24.8%:72.5% (K3), 48.6%:48.6% (K4), and 72.5%:24.8% (K5). The success of wound healing was measured based on the decrease in wound length and increase in recovery percentage in each group. The smaller the size of the remaining wound, the faster the healing process takes place (Table 1 and 4).

**Table 3.** Mean decrease in Incision Wound Length

| Group | Mean wound length on day (cm) | | | Mean ± SD |
|---|---|---|---|---|
| | Day 3 | Day 6 | Daya 9 | |
| K1 | 1,36 | 0,40 | 0,26 | 0,67 ± 0,59 |
| K2 | 1,20 | 0,32 | 0,34 | 0,62 ± 0,50 |
| K3 | 1,22 | 0,32 | 0,28 | 0,60 ± 0,53 |
| K4 | 1,20 | 0,30 | 0,22 | 0,57 ± 0,54 |
| K5 | 1,16 | 0,36 | 0,32 | 0,61 ± 0,47 |

**Table 4.** Percentage decrease in Incision Length

| Group | Day 0 (cm) | Day 3 (cm) | Day 6 (cm) | Day 9 (cm) | Decrease H3 (%) | Decrease H6 (%) | Decrease H9 (%) |
|---|---|---|---|---|---|---|---|
| K1 | 2,0 | 1,36 | 0,40 | 0,26 | 32% | 80% | 87% |
| K2 | 2,0 | 1,20 | 0,32 | 0,34 | 40% | 84% | 83% |
| K3 | 2,0 | 1,22 | 0,32 | 0,28 | 39% | 84% | 86% |
| K4 | 2,0 | 1,20 | 0,30 | 0,22 | 40% | 85% | 89% |
| K5 | 2,0 | 1,16 | 0,36 | 0,32 | 42% | 82% | 84% |

Description:
K1 : Negative Control Group (lanolin)
K2: Positive Control Group (gentamicin )
K3 : LB:DS combination (24.8%:72.5%)
K4 : LB:DS combination (48.6%:48.6%)
K5 : LB:DS combination (72.5%:24.8%)

**Effect of Treatment on Wound Healing.**

The wound healing test data obtained were then processed using One Way ANOVA. The requirement for data to use ANOVA analysis is that the observation data must be normally distributed and homogeneous. The results of the data normality test obtained a significant value of p>0.05, so the data was declared normally distributed and then continued with the homogeneity test. The results of the data homogeneity test on the Levene statistic test.

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Then proceed with the One Way ANOVA parametric test. Based on the results of normality and homogeneity, the observation data is normally distributed and homogeneous, so it can be continued to the One Way Anova test to determine whether there is a significantly different data variance or not. This test is meaningful if the p value > 0.05.

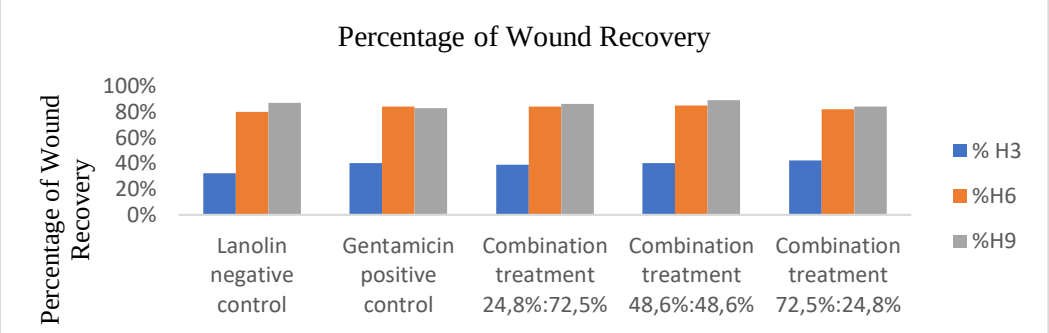


**Figure 3.** Graph of Percentage of Incision Wound Healing

The graph (Figure 3) shows the average percentage of wound healing in rats for three days of observation, namely day 3 (H-3), day 6 (H-6), and day 9 (H-9), in five different treatment groups: Lanolin control, Gentamicin control, and three different combinations of aloe vera and celery leaf extracts.

On day 3, the lanolin control group showed the lowest healing percentage of 32%, indicating that lanolin only provides a moisturizing effect without an active wound-healing agent. On the other hand, the aloe vera and celery leaf extract combination group with a composition of 72.5% : 24.8% showed the highest healing of 42%, indicating the effectiveness of aloe vera in the early phase of wound healing. The other combination groups as well as the gentamicin control showed percentages between 39-40%, which already showed healing progress.

Entering the 6th day, all groups experienced a significant increase in the percentage of wound healing. The combination of aloe vera extract and celery leaf with a balanced composition (48.6%:48.6%) achieved the highest healing percentage of 85%, indicating a synergistic effect between their active ingredients. The gentamicin group and the celery leaf dominant combination (24.8%:72.5%) were at 84% each, showing strong antibacterial effectiveness. Whereas in the aloe vera dominant

combination (72.5%:24.8%), the healing percentage was slightly lower at 82%, indicating the need for antimicrobial support from celery leaves.

By day 9, wound healing was close to complete, with the 48.6%:48.6% balanced combination remaining the highest at 89%. The lanolin group and the 24.8%:72.5% combination also showed good improvement, at 87% and 86% respectively.

The gentamicin group experienced a slight decrease to 83%, which may be due to the stagnation of the healing process in the tissue remodeling phase. The dominant combination of aloe vera also only reached 84%, reinforcing the indication that celery content is needed in the final phase of healing to support the antimicrobial effect. Overall, the balanced combination of aloe vera and celery leaf showed the most stable and optimal wound healing effect throughout the observation time.

From this graph (Figure 3), it can be concluded that the combination of aloe vera extract and celery leaf is more effective in accelerating wound healing than the control, especially in the LB:DS 72.5%:24.8% and LB:DS 48.6%:48.6% ratios, which showed the best results from day 3 to day 9. Meanwhile, the lanolin control consistently showed the slowest wound healing.

Visual wound assessment was also supported by macroscopic scoring based on parameters such as redness, exudate, and granulation tissue formation, as described by Okur *et al.* (2020). These observations reinforce the importance of macroscopic observation as the primary basis for assessing the effectiveness of extract combinations.

Of the three treatment groups, the combination with a ratio of 48.6% aloe vera and 48.6% celery leaves (K4) consistently produced the highest wound healing percentages, at 40% on day 3, 85% on day 6, and 89% on day 9. This combination also demonstrated rapid and stable healing progress from the beginning to the end of the observation period.

Although not statistically significant, the K4 combination was deemed clinically optimal because it demonstrated a faster and more consistent healing pattern than the other combinations and the control group. According to Koesdjojo *et al.* (2017), the combination of two herbal plants can exhibit a synergistic pharmacodynamic effect that is superior to their single use. This extract combination demonstrated the best efficacy in accelerating wound healing both macroscopically and statistically.

## CONCLUSION

Aloe vera extract and celery leaf extract contain secondary metabolite compounds flavonoids, tannins, and saponins. The combination of aloe vera extract and celery leaf extract proved to be effective in accelerating wound healing in male rats. This effectiveness can be seen from the faster healing time and significantly smaller wound size compared to the control group. Macroscopically, the incision wounds treated with the combination of extracts showed signs of better healing, such as decreased edema, reduced redness (inflammation), granulation tissue formation, and faster wound closure compared to the combination treatment and control groups.The optimal concentration was the combination of 48.6% aloe vera extract and 48.6% celery leaf extract. This group produced the highest percentage of wound healing compared to other groups, both statistically and clinically.

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