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Evaluation of the Effectiveness of Dragon Tail Leaf Extract (*Rhaphidophora pinnata* (Lf) Schott) on Incisional Wound Healing in White Rats *(Rattus norvegicus)*

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ABSTRAK

Rhaphidophora pinnata (daun ekor naga) secara tradisional telah digunakan sebagai tanaman obat untuk mengobati luka. Penelitian ini bertujuan untuk mengevaluasi efektivitas ekstrak daun ekor naga (*Rhaphidophora pinnata*) terhadap penyembuhan luka sayat pada tikus putih jantan (*Rattus norvegicus*). Penelitian ini menggunakan desain eksperimental laboratorium dengan 15 ekor tikus yang dibagi menjadi lima kelompok perlakuan, yaitu kontrol negatif (aquades), kontrol positif (povidone iodine), serta pemberian ekstrak secara topikal dengan konsentrasi 15%, 20%, dan 25%. Panjang luka diukur setiap hari selama 14 hari. Analisis statistik menggunakan uji *paired sample t-test* menunjukkan adanya perbedaan signifikan antara kondisi luka sebelum dan sesudah perlakuan ($p = 0{,}000 < 0{,}05$; $t = 5{,}391$). Hasil penelitian menunjukkan bahwa seluruh konsentrasi ekstrak mampu mempercepat penutupan luka, dengan konsentrasi 25% memberikan efek penyembuhan terbaik dan mencapai penutupan luka sempurna pada hari ke-14. Temuan ini menunjukkan bahwa ekstrak daun ekor naga efektif dalam mempercepat proses penyembuhan luka sayat, terutama pada konsentrasi 25%.

Kata kunci: *Rhaphidophora pinnata*, luka sayat, penyembuhan luka, ekstrak daun, *Rattus norvegicus*

ABSTRACT

Rhaphidophora pinnata (dragon tail leaf) has traditionally been used as a medicinal plant for treating wounds. This research aimed to evaluate the effectiveness of *Rhaphidophora pinnata* leaf extract on incision wound healing in male white rats (*Rattus norvegicus*). The study employed a laboratory experimental design using 15 rats divided into five treatment groups: negative control (aquades), positive control (povidone iodine), and topical extract concentrations of 15%, 20%, and 25%. Wound length was measured daily for 14 days. Statistical analysis using paired sample t-test showed a significant difference between pre-treatment and post-treatment wound conditions ($p = 0.000 < 0.05$; $t = 5.391$). The results demonstrated that all extract concentrations accelerated wound closure, with the 25% concentration showing the greatest healing effect and complete wound closure by day 14. These findings indicate that *Rhaphidophora pinnata* leaf extract is effective in promoting incision wound healing, particularly at a concentration of 25%.

Keywords: *Rhaphidophora pinnata*, incision wound, wound healing, leaf extract, *Rattus norvegicus*

1. INTRODUCTION

Indonesia is recognized as a country with extremely high biodiversity, providing great potential for the development of medicinal plants as sources of both traditional and modern therapies. The use of herbal medicine remains

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widespread, particularly in developing countries, where approximately 80% of the population still relies on herbal remedies for primary healthcare needs[1]. One plant with promising potential for further development is dragon tail leaf (*Rhaphidophora pinnata* (L.f) Schott).

Dragon tail leaves have various benefits and are commonly used by communities as traditional remedies for cancer, tumors, rheumatism, hypertension, stroke, diabetes mellitus, and blood detoxification. Numerous studies have confirmed the effectiveness of this plant, including its inhibitory activity against cancer cell growth[2], anthelmintic properties[3], antihyperuricemic activity[4], antihyperglycemic effects[5], anti-inflammatory potential[6], and its use in burn wound treatment[7].

Incisional wounds are tissue injuries caused by sharp objects and require appropriate management to prevent infection and accelerate tissue regeneration. The wound healing process involves inflammatory, proliferative, and remodeling phases, during which bioactive compounds derived from natural products may contribute to faster wound closure and tissue repair. Previous research has indicated that dragon tail leaf extract may enhance wound healing by promoting the formation of new tissue[8].

Therefore, this research was conducted to evaluate the effectiveness of dragon tail leaf extract (*Rhaphidophora pinnata* (L.f) Schott) on the healing process of incisional wounds in white rats (*Rattus norvegicus*) using different extract concentrations and comparing the results with both positive and negative controls.

2. RESEARCH METHODS

Type and Research Design

This research was a laboratory experimental research aimed at evaluating the effectiveness of dragon tail leaf extract (*Rhaphidophora pinnata* (L.f) Schott) on the healing process of incisional wounds in white rats (*Rattus norvegicus*). The research employed a Completely Randomized Design (CRD) consisting of five treatment groups: a negative control, a positive control, and three extract treatment groups with graded concentrations (15%, 20%, and 25%). Each group was replicated three times, resulting in a total of 15 experimental rats.

Research Location and Duration

This research was conducted at the Biology and Chemistry Laboratories, Faculty of Mathematics and Natural Sciences, Indonesian Christian University of Tomohon, from March to July 2025.

Tools and Materials

The equipment used included an analytical balance, rotary evaporator, maceration jars, beakers, Erlenmeyer flasks, funnels, filter paper, rat cages, scissors, sterile scalpels, rulers, sterile cotton buds, alcohol pads, and gloves.

The materials consisted of dragon tail leaves, 95% ethanol, distilled water, 10% povidone iodine, 75% alcohol, chloroform anesthesia, rat feed, and male white rats (*Rattus norvegicus*).

Research Procedures

1. Sample Collection
   Dragon tail leaf samples were collected from Pineleng District, Manado City, North Sulawesi. The leaves used were fresh young leaves harvested in the morning.
2. Preparation of Simplicia
   The collected leaves underwent wet sorting, washing with running water, slicing, and drying at room temperature without direct sunlight exposure. After drying, dry sorting, weighing, and grinding using a blender were performed to obtain simplicia powder.
3. Preparation of Dragon Tail Leaf Extract
   A total of 700 g of simplicia powder was macerated using 95% ethanol for 3 × 24 hours with stirring every 10 minutes. The filtrate was filtered and remacerated for an additional 2 × 24 hours. All filtrates were combined and evaporated using a rotary evaporator at 40°C until a thick greenish-brown extract was obtained. The maceration method was chosen as a cold extraction technique to prevent degradation of thermolabile active compounds[9].
4. Experimental Animals and Adaptation
   Fifteen male white rats aged 2–3 months with body weights of 150–200 g were used. The rats were acclimatized for 7 days prior to treatment.
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   Fifteen male white rats aged 2–3 months with body weights of 150–200 g were used. The rats were acclimatized for 7 days prior to treatment.

6. Incisional Wound Induction
   The dorsal area of each rat was shaved and cleaned using alcohol pads. The rats were anesthetized with chloroform (0.1 mL) via inhalation for approximately 3 minutes. A 1 cm incision wound was made using a sterile scalpel.
7. Treatment and Wound Healing Observation
   After wound induction, the rats were divided into five groups:
   a. Negative control: distilled water
   b. Positive control: 10% povidone iodine
   c. Dragon tail leaf extract 15%
   d. Dragon tail leaf extract 20%
   e. Dragon tail leaf extract 25%
   The extract was applied topically to the wound once daily, and wound length was observed and measured for 14 days.

Data Analysis

Wound length measurement data were analyzed using SPSS software with the Paired Sample T-Test method to determine differences in wound healing effectiveness among treatments. The results were presented in tables and graphs, with statistical significance defined as $p < 0.05$.

3. RESULTS AND DISCUSSION

The observation of incisional wound length diameter in white rats over a 14-day period demonstrated differences in healing rates among the treatment groups. Wound diameter data from day 1 to day 14 were averaged to obtain the mean value for each group.

Table 1. Average Incisional Wound Diameter in White Rats Over 14 Days

Treatment Group	Replication 1 (cm)	Replication 2 (cm)	Replication 3 (cm)	Treatment Mean
(1)	(2)	(3)	(4)	(5)
Negative Control (Distilled Water)	0,50	0,50	0,50	0,50%
Positive Control (Povidone iodine)	0,70	0,80	0,80	0,76%
Dragon Tail Leaf Extract 15%	0,80	0,80	0,70	0,76%
Dragon Tail Leaf Extract 20%	0,80	0,80	0,80	0,80%
Dragon Tail Leaf Extract 25%	100	100	100	100%

Based on Table 1, the extract concentration of 25% showed the fastest wound healing compared with the other groups. The negative control produced the lowest healing outcome, whereas the positive control and the 15% extract concentration exhibited similar results.

The percentage of wound healing was calculated to describe the wound closure rate in each treatment group. As shown in Figure 1, the percentage results indicate that higher extract concentrations led to greater wound healing rates.

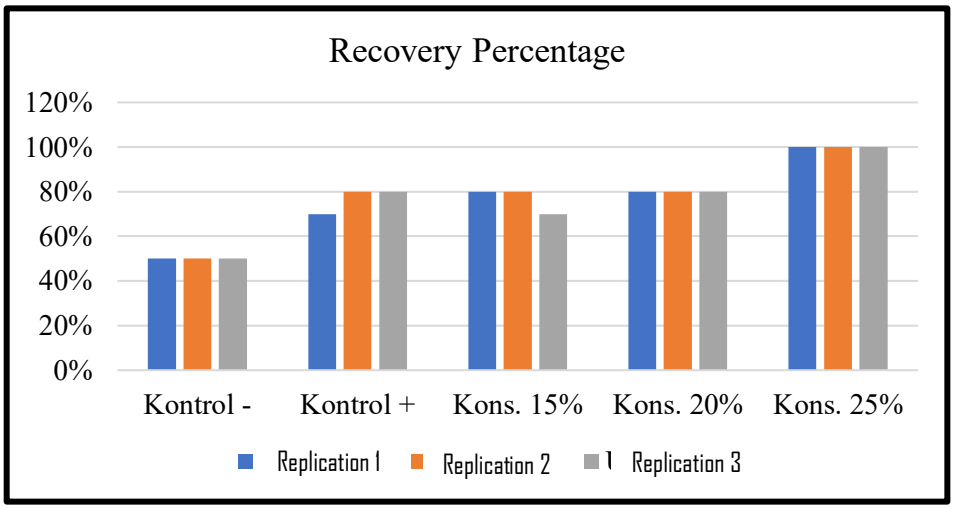

Figure 1. Percentage Reduction in Wound Length Over Time

Based on the wound healing percentage graph, the 25% extract group achieved complete healing (100%), followed by the 20% extract group with 80%. The 15% extract group showed a healing percentage of 0.76%, which was equivalent to the positive control group (povidone iodine). The negative control group demonstrated the lowest healing percentage at 0.50%.

These findings confirm that dragon tail leaf extract accelerates the wound healing process, with the 25% concentration being the most effective treatment.

The effectiveness of dragon tail leaf extract is presumed to be associated with the presence of bioactive compounds such as flavonoids, saponins, tannins, steroids, and phenols, which contribute to tissue regeneration, re-epithelialization, and collagen formation. Previous research[10] reported that these compounds possess antibacterial properties and enhance wound healing. In addition, steroids play a role in inhibiting inflammatory mediators through the arachidonic acid pathway[8].

Tannins act as astringents that promote pore closure and reduce exudate, while flavonoids exert antibacterial activity through protein denaturation mechanisms[11]. Saponins also function as growth factors that stimulate fibroblast activity and collagen synthesis[12,13].

The data were analyzed using SPSS software with the Paired Sample T-Test method. The results indicated a significant difference in wound length before and after treatment, with a p-value of 0.000 (< 0.05) and t-count > t-table (5.391 > 2.000). This suggests that there was a statistically significant improvement between the pre-incision wound condition and the post-healing condition, indicating substantial wound recovery.

Table 3. Statistical Test Results

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PRE_Wound – POST_Healing	.23333	.16762	.04328	.14051	.32616	5.391	14	.000

The wound healing process consists of three main phases: inflammation, proliferation, and remodeling. By day 14, the 20% and 25% extract groups had entered the remodeling phase. This final healing phase may continue for months or even years. Healing maturation varies depending on the formulation effects and the physiological conditions of the experimental animals. In this study, each extract concentration resulted in different healing durations, indicating variations in the length of each healing phase.

Overall, dragon tail leaf extract at a concentration of 25% demonstrated superior effectiveness compared with both negative and positive controls in promoting incisional wound healing in white rats (*Rattus norvegicus*). This is attributed to the extract's ability to accelerate tissue regeneration, re-epithelialization, fibroblast stimulation, collagen formation, and antimicrobial activity, which suppresses microorganisms that may delay wound recovery.

Tannins contribute to faster healing due to their astringent properties, which precipitate proteins on the cell surface, reduce permeability, close skin pores, harden tissue, and control mild bleeding and exudate.

Furthermore, saponins enhance epidermal re-epithelialization and inflammatory cell infiltration in the wound area. As growth factors, saponins stimulate endothelial cell proliferation, smooth muscle cell growth, and fibroblast activation, leading to cellular regeneration and repair of damaged blood vessels. They also increase macrophage migration to the wound site, enhancing cytokine production that activates fibroblasts and triggers collagen formation. Saponins may also help stop bleeding by precipitating and coagulating red blood cells, thereby supporting collagen growth during wound healing.

The results of this research confirm that dragon tail leaf extract at concentrations of 15%, 20%, and 25% significantly influenced wound healing, with the 25% concentration showing the greatest healing effect. At this concentration, the incisional wound healed completely by day 14,

as evidenced by full closure of the wound area on the rat's dorsal region.

4. CONCLUSION

Based on the research findings, it can be concluded that dragon tail leaf extract (*Rhaphidophora pinnata* (L.f) Schott) at concentrations of 15%, 20%, and 25% was able to accelerate the healing process of incisional wounds in male white rats. Among these, the 25% concentration exhibited the best effectiveness, as indicated by the fastest and most complete wound closure.

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