



The Effectiveness of Bajakah Ethanol Extract on Wound Length in The Proliferation Phase of White Rats Induced *Pseudomonas aeruginosa*

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Abstract. The incision is a wound that has taken the shape of a linear tear as a result of being sliced by a sharp object. Antibiotics are required to limit bacterial development during wound healing to prevent infection. Because improper antibiotic use might lead to resistance, there are other options for wound healing, such as Bajakah extract. The goal of this study is to determine the effectiveness of Bajakah ethanol extract in reducing wound length in rats during the proliferative phase of *P. aeruginosa*. This study is experimental, with a post-test-only control group design. The study divided into four groups: negative control (NC), positive control (PC), treatment with 2.5 mg/kgBW extract (T1), and treatment with 25mg/kgBB extract (T2). Every day for 14 days, wound length measurements were taken in each group. The results of measuring the length of the incision in all groups showed a decrease in the length of the wound every day, even indicating that the wound was closing. Wound closure in group T2 occurred on the 10th day, while for groups T1 and PC occurred on the 11th day. On day 14, NC still had a wound length of 1 mm. These findings reveal that Bajakah ethanol extract may reduce the length of incision wounds in rats during the induced proliferation phase of *P. aeruginosa*.

Keywords: Incision, bajakah ethanol extract, wound length, proliferation phase.

1. Introduction

A wound is a condition where part of the body's tissue is lost or damaged which is often experienced by the body. The part of the body that often experiences injuries is the skin. The skin is an elastic covering and is an organ located on the outermost part, which functions to protect the body from injury and pathogens, so the skin is susceptible to injury. Wounds are categorized into two types, namely open wounds and closed wounds. Open wounds are categorized based on the object, including incisional wounds, laceration

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wounds, abrasion wounds, stab wounds, penetration wounds, and gunshot wounds [1]. The most common open wounds on the body are cuts. Cut wounds are a form of damage or loss of body tissue caused by sharp objects and can cause bleeding involving a hemostasis role [2].

Incision wounds are characterized by linear tears in the skin and underlying tissue. If open wounds such as cuts are not treated immediately, they will hinder the wound-healing process. The healing process of tissue cuts can be divided into four phases, namely the hemostasis, the inflammatory, the proliferation, and the remodelling or maturation phase [3]. Open wounds can become the port d'entry of pathogenic microorganisms into the body so that wounds become non-sterile/infected [4]. The microorganisms that most often cause infections are *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Opportunistic pathogenic bacteria such as *P. aeruginosa*, the emergence of the disease begins with a disturbance or abnormality in the body's normal defense system [5]. These bacteria attach and form colonies on mucous membranes or skin, invade locally, and cause systemic disease [6]. Bacterial growth in cut wounds needs to be inhibited using broad spectrum systemic antibiotics [7].

Continuous use of inappropriate antibiotics at inappropriate doses can result in the emergence of resistance so that other alternatives are needed as substitutes for antibiotics that can be used for the wound healing process [8]. The wound healing process is a complex biological process that results in restoration of tissue integrity. Several parameters observed in the healing process of incision wounds are the length of the wound, the disappearance of redness in the wound area (erythema), and the disappearance of swelling (edema). When the length of the wound decreases, a contraction process can occur. The contraction process is a stage of narrowing the size of the wound towards the center to reduce the size of the wound. Wound contraction is movement centripetal from the edge of the wound toward the center of the wound. Maximum wound contraction continues in the proliferation phase. The wound moves towards the center at an average of 0.6 to 0.75 mm/day. Contractions also depend on the looseness of the surrounding skin tissue. Assessing the level of wound contraction is an indicator of wound healing [9].

One alternative for healing wounds is bajakah plant extract. The Bajakah (*Spatholobus littoralis* Hassk) is one of the plants that is empirically used by the people of Kalimantan (Borneo) as traditional medicine. Dayak people of Borneo have long used the bajakah plant as a medicine to restore stamina during activities in the forest, and it is also used to treat various diseases [10]. In previous research, the bajakah tempala plant contained phenolic compounds, flavonoids, tannins and saponins. These substances can theoretically shorten the wound healing process. In addition, not only helping flavonoids avoid oxidation events by halting chain reactions brought on by the appearance of free radicals, phenolic compounds also function as hydrogen donors [11].

Flavonoid substances have antibacterial properties through their inhibition of energy metabolism, cell membrane function, and nucleic acid production. Flavonoid compounds

are also efficacious as antioxidants which can accelerate wound healing and inflammation [12]. Through a number of biological processes, including the removal of reactive oxygen species and free radicals, an increase in wound healing, and an increase in capillary and fibroblast production, the tannin concentration can hasten wound healing. Tannins help hasten the closure of wounds by halting exudates and minor bleeding. In wound sites, tannins and saponins contribute to the migration and proliferation of fibroblasts [11]. The aim of this study was to measure the length of the wound in the proliferation phase in white mice (*Rattus norvegicus*) induced *P. aeruginosa* as an indicator of wound healing.

2. Methods

This type of experimental research uses a research design post test only control group design. Research samples of male white rats (*Rattus norvegicus*) with a body weight of 200-250 grams and 2-3 months old were obtained from the Experimental Animal Laboratory, Muhammadiyah University, Semarang in June 2023. Bajakah trunks were obtained from West Kalimantan, extracts were made using ethanol.

The research was carried out using 4 treatment groups, namely negative control (NC), positive control (PC), treatment with 2.5 mg/KgBB extract (T1), and treatment with extract 25mg/KgBW (T2). Each group used 5 mice, then the mice in each group were acclimated for 1 week. Groups NC, PC, T1, and T2 were given an incision on their back with a wound length of 2 cm, and depth of 2 mm and were given a bacterial suspension. *Pseudomonas aeruginosa* as much as 20 μ L. *P. aeruginosa* was cultured on MC media, then suspended in 0.9% Physiological NaCl solution and equalized to the standard Mc Farland turbidity of 0.5. Oral administration of pirated ethanol extract was 2.5 mg/KgBW in group T1 and 25 mg/KgBW in group T2.

3. Result

Data from measurements of the length of wounds on the backs of induced white mice *P. aeruginosa* in the treatment groups NC, PC, T1, and T2 every day from day 1 to day 14 are presented in Table 1.

Based on the observation results (Table 2), it can be seen that the P2 group showed the fastest wound closure than the P1 group, namely on the 10th day. Meanwhile, in the P1 group, wound closure occurred on the 11th day, the same as in the K+ group. These results indicate that administration of Bajakah ethanol extract with a higher concentration indicates an acceleration of wound closure.

Based on observations of cut wounds in male white mice during 14 consecutive days of treatment in the K-, K+, P1 and P2 treatment groups (figure 1), day 1 showed that the wounds were red (erythrema), wet and open. On the 4th day, the wound was still red (erythrema), wet, swollen and open. Day 8 showed that the condition of the P2 treatment

group's wounds had begun to close, dry and had a little scabbing. In the P1 treatment group, the cut wounds were still red but starting to close. Day 11 showed that the wounds in groups P1 and P2 were completely closed, like in the K+ group.

4. Discussion

The results of research on measuring the length of incision wounds from day 1 to day 14 in all research groups showed a decrease in wound length every day (table 1). The results of the study also showed that there was wound closure before the 14th day. Wound closure in the P2 group occurred on the 10th day, while for the P1 group it occurred on the 11th day, the same as in the K+ group. These results show that Bajakah ethanol extract is able to reduce the length of incision wounds in the induced proliferation phase of white rats *P. aeruginosa*.

Bajakah tampala stem extract on average contains phenolic levels of 12.33mg GAE/g. Bajakah tampala has also been proven to be able to speed up the wound healing process [11]. The role of flavonoids as anti-inflammatories and protecting cells damaged by free radicals can help speed up the wound healing process. Flavonoids can accelerate the production of new epithelial cells to assist the epithelialization process, which shortens the time it takes for wounds to heal, as seen by a decrease in their wound size [13]. Because of their antioxidant properties, flavonoids help lessen the effects of free radicals. Free radicals can slow down the healing process of wounds by preventing cell division, inflammatory responses, and the contraction of newly created collagen tissue [14][15]. Along with tannins, which may have antiviral and antibacterial properties, saponins, flavonoids, and other compounds function as anti-oxidants and anti-inflammatory agents. Cell hemolysis is a result of increased membrane permeability, which is facilitated by saponin. Bacteria will lyse if saponin comes into contact with them. Bajakah extract's tannin concentration has the ability to speed up wound healing through multiple cellular wound creation. fibroblasts and capillaries. Tannins have an astringent effect that can halt minor bleeding and exudate, hastening the healing process [11].

5. Conclusion

Based on the research results, it was concluded that Bajakah ethanol extract was able to reduce the length of incision wounds in the induced proliferation phase of white rats *P. Aeruginosa* as an indicator of wound healing.

Authors' Contributions. All authors contributed equally to this work.

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