

Efficacy of red betel (*Piper ornatum*) in accelerating perineal wound healing in postpartum women

Riana Pascawati, Desi Hidayanti, Lola Noviani Fadilah

Midwifery Department, Politeknik Kesehatan Kemenkes Bandung, Bandung, Indonesia

Abstract

The incidence of second-degree perineal lacerations, which involve injury to the vaginal tissue and perineal muscles, ranges from 35.1% to 78.3% among primiparous women and 34.8% to 39.6% among multiparous women. Red betel (*Piper ornatum*) is well known for its disinfectant and antifungal properties, making it an effective option for wound care. This study aimed to evaluate the effectiveness of red betel leaf extract in accelerating perineal wound healing in postpartum women. A quasi-experimental design with a non-randomized pretest-posttest control group approach was employed, involving 39 participants divided into the

intervention and control groups. The intervention group received red betel leaf extract twice daily for seven days, while the control group received conventional care. Wound healing was assessed by using the REEDA score. The results showed a significant reduction in REEDA scores in the intervention group, with an average decrease from 10.7 to 2.1, compared to a reduction from 7.2 to 3.5 in the control group ($p < 0.05$). This represents an 8.6-point improvement in the intervention group versus a 3.6 points in the control group. The bioactive compounds in red betel leaves, including flavonoids, tannins, and saponins, contribute to their antimicrobial, anti-inflammatory, and antioxidant properties that accelerate wound healing. These findings highlight the potential of red betel leaf extract as a natural, non-pharmacological therapy for postpartum wound care. Broader implementation could improve maternal health outcomes, particularly in settings with limited access to conventional treatment.

Correspondence: Riana Pascawati, Lecturer of Midwifery Department, Politeknik Kesehatan Kemenkes Bandung, Bandung, Indonesia
E-mail: rianapascawati@staff.poltekkesbandung.ac.id

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Introduction

Perineal lacerations are a common outcome of vaginal childbirth and affect approximately 80% of women. Primiparous women are more frequently affected by these tears than are multiparous women. The incidence of second-degree perineal lacerations, which involve injury to the vaginal tissue and perineal muscles, ranges from 35.1% to 78.3% among primiparous women and 34.8% to 39.6% among multiparous women. A recent comprehensive review on perineal lacerations highlights global variations in prevalence, management, and outcomes, emphasizing the need for context-specific care strategies.¹ More severe third- and fourth-degree lacerations, which extend to the anal sphincter, occur in 5.1% to 8.3% of primiparous women and in 1.8% to 2.8% of multiparous women.²⁻⁴

Standard perineal care follows the “clean and dry” principle, which involves cleaning the wound with clean water (without any additives) and thoroughly drying it after each instance of discharge.⁵ Adhering this typically allows perineal suture wounds to heal within ten days, although healing may take up to 14 days in some cases. Proper perineal wound care is essential for postpartum women, as it helps prevent infection, accelerates the healing process, and reduces discomfort associated with perineal lacerations.⁴

Perineal infections are common postpartum complications that affect many women after childbirth.^{6,7} Studies have reported that 16% of women experience prolonged perineal infections, often accompanied by significant perineal pain.⁵ Given the potential complications of these infections, herbal remedies have gained attention as preferred option for wound healing, due to their minimal side effects and cost-effectiveness compared to conventional medications. One such herbal remedy is the red betel plant (*Piper ornatum*), which is well-known for its therapeutic properties.⁸

Although evidence-based perineal wound care often empha-

sizes the use of clean water without additives, traditional practices in Indonesia continue to incorporate the use of plants as natural remedies for wound care. These plants, frequently used for their antiseptics and antimicrobial properties, play a significant role in postpartum healing. One such plant is the red betel (*Piper ornatum*), valued for its potent antiseptic and antibacterial effects. The extract of red betel leaves contains essential oils and various phytochemicals, which are known to accelerate the healing process of perineal wounds.^{4,9,10}

Red betel (*Piper ornatum*) is well known for its disinfectant and antifungal properties, making it an effective option for wound care. Studies have shown that the average healing time of perineal wounds treated with red betel leaves is 3–4 days faster than that of wounds treated with iodine.^{11,12} Considering these promising findings, the present study aimed to further analyze the effectiveness of red betel extract rinse (*Piper ornatum*) on perineal wound healing in postpartum women.

Materials and Methods

Research design

This study employed a quantitative approach using a quasi-experimental method with a non-randomized post-test control group design. This study was conducted in collaboration with private midwives in the Bandung area to facilitate a controlled assessment of the effectiveness of red betel extract in promoting perineal wound healing among postpartum women.

Study participants

The population for this study consisted of postpartum women with perineal suture wounds who gave birth at Private Midwife Practices “I” and “N” in Bandung over the past three months. A quasi-experimental design was chosen because of limitations in implementing full randomization in the field, especially considering the collaboration with private midwifery practices that required the allocation of research subjects.

Respondents were selected through consecutive sampling based on the specific inclusion and exclusion criteria. The inclusion criteria were as follows: women on the first day postpartum aged 20–35 years; those with second-degree perineal lacerations involving the vaginal mucosa, perineal skin, and perineal muscle; women who experienced a term and spontaneous labour; literate women who were willing to participate as respondents.¹³ Exclusion criteria included women with diabetes mellitus or anemia and those who had experienced labor complications.

Variables, instruments, and data collection

This study was preceded by the preparation of red betel leaf extract, conducted in May 2022 through collaboration between the Laboratory of the Medical Laboratory Technology Study Program at Bandung Polytechnic and the ITB Laboratory. The extraction process involved sequential steps of maceration, evaporation, and lyophilization. Subsequently, phytochemical analyses were performed to identify secondary metabolites present in the extract using 70% ethanol as the solvent. This stage aimed to evaluate the active compound content in the crude extract of red betel leaves through a series of phytochemical tests, adapted and modified from standard procedures, including tests for alkaloids, flavonoids, steroids/triterpenoids, saponins, and tannins. The extract was prepared at two concentration levels, specifically 0.125% and 0.25%. Phytochemical screening revealed that the red betel leaf extract at

a concentration of 0.25% contained alkaloids, flavonoids, terpenoids, saponins, and tannins, whereas the extract at 0.125% concentration positively identified the presence of saponins, tannins, and steroids/triterpenoids only.

Data collection

This study utilized both primary and secondary data. Primary data were gathered to assess perineal suture wound healing and to capture participant characteristics, including age, parity (number of previous births), and labor history. Secondary data included information on the number of postpartum women was collected from Private Midwife Practices “I” and “N” in Bandung. For the intervention group in this study, there was a detailed counselling guide on using red betel leaf extract for perineal wound care.

The following procedures detail the systematic steps for applying red betel leaf extract as part of a perineal hygiene routine. Each step is carefully designed to ensure proper hygiene, effective application, and consistent monitoring throughout the intervention period: i) hand hygiene: begin by thoroughly washing your hands with clean water and soap to ensure they are free from any contaminants; ii) preparation: take the bottle of red betel leaf extract and carefully open the lid. a sufficient amount of the extract was poured into a clean container or directly onto a clean cotton ball or pad; iii) application: position yourself comfortably, ensuring that the perineal area can be easily reached. using a clean cotton ball or pad, red betel leaf extract was gently applied to the outside of genitalia to ensure cleaning from front to back (towards the anus) to prevent contamination; iv) duration: the extract was allowed to remain in the perineal area for three minutes. this allows the extract to exert antiseptic and healing effects; v) drying: after three minutes, the perineal area was gently dried using clean tissue or pad; vi) post-application: wash your hands thoroughly with clean water and soap to maintain hygiene; vii) record keeping: the amount of red betel leaf extract used and the time of application (morning and evening) each day were recorded on provided record form; viii) frequency: this routine was performed twice a day for a total of seven days, once in the morning and once in the evening. This protocol ensures that the intervention is administered consistently and effectively, while maintaining proper hygiene and monitoring the application process.

The research procedures for both the intervention and control groups involved specific care and monitoring protocols. In the intervention group, respondents applied Red Betel Leaf Extract twice daily for seven consecutive days. Researchers ensured adherence through reminders via WhatsApp or SMS and monitored respondents' health conditions every two days. Additionally, home visits were conducted on days 1, 3, and 7 postpartum by researchers and students to assess wound conditions using the REEDA table and an observation sheet. Meanwhile, the control group received conventional perineal wound care based on clean and dry principles. Similar to the intervention group, researchers conducted home visits on days 1, 3, and 7 postpartum to monitor wound healing using the REEDA table and an observation sheet. Both of groups allowed for a comparative analysis of the effectiveness of red betel leaf extract against conventional wound care practices. Regular monitoring and consistent assessment using the REEDA scale ensured that any changes in wound healing were accurately recorded and analysed.

In this study, an observation sheet was utilized to assess and document the healing of perineal suture wounds. The observation sheet was designed based on the REEDA scale, which evaluates wound healing using the following five criteria: redness, edema, ecchymosis, discharge, and approximation. For the intervention,

tools and material for the red betel extract were used as the primary treatment to promote wound healing. Additionally, a healing rate observation sheet was employed to track and record the progress of wound healing throughout the intervention period. These instruments provide a comprehensive and systematic approach to evaluating the effectiveness of red betel leaf extracts in promoting perineal wound healing. The REEDA scale is a quantitative assessment method for assessing wound healing based on five main components: redness, edema, ecchymosis, exudation, and approximation. Each component is scored from 0 (no symptoms) to 3 (most severe symptoms), with a maximum total score of 15. The lower the REEDA score, the better the wound healing.¹⁴

Data analysis

Data collected from the observation sheets were coded and processed using statistical software to evaluate and compare the effectiveness of red betel leaf extract (*Piper ornatum*) and conventional treatments for perineal suture wound healing. The primary aim of this study was to assess the effectiveness of red betel leaf extract comparison with conventional treatments in promoting perineal suture wound healing. To determine which method was more effective in accelerating wound healing, we compared the outcomes of the two groups: those receiving red betel leaf extract and those receiving conventional treatments. For statistical analysis, an independent sample Wilcoxon test was employed to assess differences between the two groups. Statistical significance was set at $p < 0.05$, indicating that results with p -values less than 0.05 are considered statistically significant.

Ethical clearance

This study was approved by the Health Research Ethics Commission (KEPK) of Poltekkes Kemenkes Bandung (09/KEPK//EC/IX/2020). Several ethical considerations were implemented to ensure the protection of respondents right. All respondents provided their approval to participate through informed consent, ensuring that they were fully aware of the study's purpose and procedures. The study guaranteed anonymity and confidentiality of respondents' information. Respondents had the right to withdraw from the study at any time, without any consequences. These measures ensured that the study adhered to ethical standards and protected the rights and privacy of respondents.

Results

Samples characteristics

In the study, there were initially 42 respondents, with 21 in the intervention group and 21 in the control group. However, during the research, the following changes occurred: one participant withdrew from the intervention group, and two respondents withdrew from the control group. The final number of respondents was 39, 20 in the intervention group and 19 in the control group. To ensure comparability between the intervention and control groups, the characteristics of respondents at the beginning of the study including age, parity, education, and knowledge of personal hygiene, were presented and analysed.

There were no significant differences ($p > 0.05$) between the two groups in terms of age, parity, educational level, or knowledge level (Table 1). This lack of a significant difference indicates that the characteristics of the research respondents were homogeneous between the two groups. The homogeneity of the groups is crucial, as it ensures that any observed effects of the intervention can be

attributed to the treatment itself rather than differences in participant characteristics. Table 1 provides detailed data on these characteristics for each group, supporting the claim of equivalence and offering a clear basis for comparing the effectiveness of red betel leaf extract with conventional treatments. The preparation of red betel leaf extract (*Piper ornatum*) followed a systematic process, conducted in collaboration with the Medical Laboratory Bandung Ministry of Health Polytechnic and Laboratory Technology Study Program at Institut Teknologi Bandung. Fresh red betel leaves were carefully selected, thoroughly washed under running water, and then dried through aeration, ensuring they were shielded from direct sunlight to prevent the degradation of active compounds. Once dried, the leaves were ground into a fine powder using a blender and sieved with a 20-mesh sieve. The powdered leaves were then extracted using the maceration method, employing a solvent mixture of 70% ethanol and ethyl acetate. The resulting extract underwent phytochemical screening, which confirmed the presence of key bioactive compounds alkaloids, flavonoids, saponins, tannins, triterpenoids, and steroids. This meticulous process ensured that the red betel leaf extract was prepared with its bioactive compounds intact, making it suitable for application in perineal wound healing.

Table 2 illustrates that the intervention group, treated with red betel leaf extract, demonstrated a more significant reduction in

Table 1. Characteristics of research subjects.

Characteristics	Group		p
	Treatment (n=20)	Control (n=19)	
Age (Year)			0.67*
20-30	14 (70)	15 (75)	
31-35	6 (30)	4 (25)	
Education			0.12*
Elementary School	2 (10)	7 (35)	
Junior High School	15 (75)	10 (55)	
High School Bachelor	3 (15)	1 (5)	
Parity			0.52*
Prim	13 (65)	10 (53)	
Multi	7 (35)	9 (47)	
Knowledge level			0.16**
Low	0	1 (5)	
Moderate	13	7 (37)	
High	7	11 (58)	

Description * Chi-Square test.

Table 2. Overview of first, third and seventh day REEDA score on research group.

Characteristics	Group	
	Treatment (n=20)	Control (n=19)
Day one		
x (SD)	10.7 (2.8)	7.2 (1.7)
Median	10	7
Range	6-15	5-10
Day three		
x (SD)	6.6 (1.4)	5.6 (1.7)
Median	7	5
Range	4-9	3-9
Seventh day		
x (SD)	2.1 (0.8)	3.5 (1)
Median	2	3.5
Range	1-3	2-6

Reeda scores compared to the control group by day seven. Despite initially having more severe wounds, the intervention group's scores improved more rapidly, reflecting the extract's efficacy in accelerating wound healing. Table 3 highlights a statistically significant difference ($p=0.05$) was observed between the intervention and control groups' Reeda scores from day one to day seven. The intervention group's average score decreased from 10.7 to 2.1, compared to the control group's decrease from 7.2 to 3.5. This highlights the clinical relevance of red betel leaf extract in enhancing perineal wound healing.

Discussion

This study involved 39 respondents, with no significant differences in age, education, parity, or personal hygiene knowledge between the intervention and control groups, ensuring homogeneity at baseline. The red betel leaf extract (*Piper ornatum*) was prepared through a systematic process, retaining key bioactive compounds suitable for wound healing. The analysis of Reeda scores revealed that the intervention group, which received the red betel leaf extract, showed significant improvement in wound healing, with a marked reduction in Reeda scores from day one to day seven compared to the control group. The results indicate that red betel leaf extract significantly enhances perineal wound healing compared to conventional treatments. The wound healing process involves several stages: inflammation, proliferation, epithelialization, angiogenesis, remodeling, and scarring.¹⁵ Each of these stages is essential for the restoration of tissue integrity, with inflammation and proliferation being particularly critical in the initial phases. According to the theory of wound healing, the inflammatory response is necessary to clear debris and initiate tissue repair, while proliferation involves the formation of new tissue, including blood vessels and extracellular matrix. In this study, red betel leaf extract was shown to positively impact perineal wound healing in postpartum women, as indicated by the significant reduction in the Reeda score. The REEDA score is a commonly used indicator for assessing perineal wound healing, which evaluates redness, edema, ecchymosis, discharge, and approximation of the wound edges.¹⁴ The results showed that there was a significant difference in the Reeda score, which is an indicator of perineal wound healing, in the intervention and control groups ($p<0.05$), with an average decrease in the Reeda score in the intervention group and 8.6, whereas in the control group, it was 3.6. The significant decrease in the REEDA score in the intervention group compared to that in the control group suggests that red betel leaf extract has a more pronounced effect on improving perineal wound healing. These findings emphasize the potential of red betel leaf extract as an effective alternative or complementary treatment for improving perineal wound healing in postpartum women. In light of these findings, it can be argued that red betel leaf extract offers a promising alternative or complementary treatment for improving perineal wound healing in postpartum women. While traditional methods for wound care,¹⁶⁻¹⁸ such as antiseptics and basic hygiene, remain essential, the incorporation of plant-based treatments like red betel leaf extract may provide additional benefits, such as reducing inflammation and promoting faster tissue regeneration. Given the promising results of this study, it is important to further investigate the specific mechanisms by which red betel leaf extract contributes to wound healing, as well as its potential integration into clinical practices for postpartum care. The evidence from this study highlights the potential role of red betel leaf extract in enhancing the

wound healing process, offering a natural and effective option for managing perineal wounds. REEDA score includes redness, edema, ecchymosis, discharge, and approximation, with the highest score for each aspect being three and the lowest score being zero. The higher the score, the higher the level of tissue trauma, and the perineal wound healed when the REEDA score was zero.¹⁴ The decrease in Reeda's score in the intervention group (10.7) was greater on the seventh day than that in the control group (7.2). Therefore, daily perineal wound healing in the group administered a wash basin solution containing red betel extract was better than that in the control group, which received clean and dry care. The effectiveness of red betel leaf extract in healing perineal wounds is due to the content of specific compounds in red betel leaves, including polyphenols, saponins, flavonoids, alkaloids, and tannins, which accelerate wound epithelialization.¹⁹ This was evident from the test results of the chemical compound content in the red betel leaf extract conducted at the Laboratory of the Medical Laboratory Technology Study Program of the Polytechnic of the Ministry of Health Bandung. Phytochemical analysis of the red betel extract used in this study showed the presence of saponins, flavonoids, and tannins. The alkaloid and terpenoid contents were negative in laboratory phytochemical tests.²⁰ Flavonoids have antibiotic properties that can interfere with the function of microorganisms and cause their death to prevent infection.²¹ Therefore, these compounds accelerated the final stage of the inflammatory phase during the recovery phase. Alkaloids act as antibacterial agents by disrupting the peptidoglycans of bacterial cells.^{22,23} Alkaloids possess antibacterial properties that disrupt the peptidoglycan layer of bacterial cells, contributing to the reduction of bacterial infections in wound.⁹ Therefore, intervention group with red betel had better average redness and edema scores than the control group. Flavonoids can also accelerate wound epithelialization during proliferation phase.^{24,25} Polyphenols and saponins can stimulate collagen formation during the proliferation phase.²⁶ Tannins have antibacterial properties and promote the regeneration of new tissues, further aiding wound healing.²⁷ Owing to these properties, the intervention group receiving red betel leaf extract showed better average redness and edema scores than the control group. This indicates more effective management of inflammation and better overall wound healing.

Based on the above theoretical information, it can be concluded that red betel leaf extract significantly accelerates perineal wound healing in postpartum women. This conclusion was supported by the presence of effective antiseptic and antimicrobial compounds in the extract. Red betel leaf extract solution serves as a viable alternative to conventional treatments for accelerating perineal wound healing. It can be effectively used to prevent infections, reduce discomfort, and enhance wound recovery. Midwives

Table 3. Overview of *pre* and *post* reeda scores in the research group.

Characteristics	Group		p
	Treatment (n=20)	Control (n=19)	
<i>Pre</i>			0.00*
x (SD)	10.7 (2.8)	7.2 (1.6)	
Median	10	7	
Range	6-15	5-10	
<i>Post</i>			0.00*
(SD)	2.1 (0.8)	3.5 (1.0)	
Median	2	3.5	
Range	1-3	2-6	

Description: *Wilcoxon test.

should educate postpartum women on the benefits and applications of red betel leaf extract. They can recommend using the extract to wash perineal wounds and integrate this practice into postpartum care. Utilizing red betel leaf extract allows midwives to play a proactive role in maternal recovery during the postpartum period, ensuring better management of perineal wounds, and overall maternal health. This approach not only provides a natural remedy with minimal side effects, but also supports midwifery practice in promoting effective postpartum care. Despite these promising findings, the study's non-randomized design and limited sample size are notable limitations. These factors may restrict the generalizability of the results. Future studies should employ randomized controlled trials with larger sample sizes to validate these findings and explore the broader applicability of red betel extract in diverse wound-care contexts. Investigating its effects on other types of wounds and varying patient demographics would further substantiate its clinical utility.

Conclusions

Red betel extract (*Piper ornatum*) significantly accelerates perineal wound healing in postpartum women, offering a natural, non-pharmacological alternative to conventional treatments. Future studies with larger, more diverse populations are needed to validate these findings and explore additional factors influencing wound healing, such as lifestyle and nutritional status. Expanding research to other wound types could further demonstrate its therapeutic potential. Clinically, integrating red betel leaf extract into postpartum care may enhance maternal recovery and improve overall patient outcomes.

References

- Okeahialam NA, Wong KW, Sultan RTAH. The incidence of wound complications following primary repair of obstetric anal sphincter injury: a systematic review and meta-analysis. *Am J Obstet Gynecol* 2022;22:182–91.
- Jansson MH, Franzén K, Hiyoshi A, et al. Risk factors for perineal and vaginal tears in primiparous women – the prospective POPRACT-cohort study. *BMC Pregn Childbirth* 2020;20:1–14.
- Nurmaliza L, Lubis RC, Muryani M. The relationship between knowledge and attitudes of postpartum mothers regarding vulva hygiene and prevention of perineal wound infections at the Sulastris Clinic. *Int J Public Heal Excell* 2023;3:460–70.
- Fikria SH, Indrayani T, Dinengsih S. The effect of red betel leaves (*Piper Crocatum*) boiled water on the perineal wounds healing in public health center of Karangpawitan of Garut Regency In 2021. *J Nurs Pract* 2021;5:204–9.
- Queensland Clinical Guidelines. Maternity and neonatal clinical guideline. Queensland Health. 2017. 1–39 p.
- Cakwira H, Mukengere M, Lucien B, et al. The clinical characteristics of perineal tears: A study carried out on 14 pregnant women in a tertiary center: Case series. *Ann Med Surg* 2022; 82:104432.
- Gommessen D, Nohr EA, Drue HC, et al. Obstetric perineal tears: risk factors, wound infection and dehiscence: a prospective cohort study. *Arch Gynecol Obstet* 2019;300:67–77.
- Hadizadeh-Talasaz F, Mardani F, Bahri N, Rakhshandeh H, Khajavian N, Taghieh M. Effect of rosemary cream on episiotomy wound healing in primiparous women: a randomized clinical Trial. *BMC Complement Med Ther* 2022;22:1–10.
- Siregar Y, Lubis R, Irianti E. Gel Daun Sirih Merah (*Piper crocatum* Ruiz & Pav) 15% Efektif dalam Mempercepat Penyembuhan Luka Perineum pada Tikus Putih Betina (*Rattusnorvegicus*) Galur Wistar. *J Penelit Kesehat Suara Forikes* 2022;13:835–8.
- Rohmin A, Octariani B, Jania M. Faktor Risiko yang Mempengaruhi Lama Penyembuhan Luka Perineum pada Ibu Post Partum. *J Kesehat* 2017;8:449.
- Molan PC, Betts JA. Clinical usage of honey as a wound dressing: an update. *J Wound Care* 2004;13:353–6.
- Karpelowsky J, Rode H, Allsopp M. Wound healing with honey - a randomised controlled trial. *South African Med J* 2007;97:9–13.
- Goh R, Goh D, Ellepola H. Perineal tears. *R Aust Coll Gen Pract* 2018;47:35–8.
- Alvarenga MB, Francisco AA, Maria S, et al. Episiotomy healing assessment: Redness, Oedema, Ecchymosis. *Rev Lat Am Enfermagem* 2015;23:162–8.
- Sorg H, Tilkorn DJ, Hager S, et al. Skin wound healing: an update on the current knowledge and concepts. *Eur Surg Res* 2017;58:81–94.
- Fitriani H, Setyowati S, Afyanti Y, et al. Traditional treatment for diastasis rectus abdominis in postpartum mothers: A phenomenological study. *Br J Midwifery* 2024;32:474–82.
- Agustina ZA, Fitrianti Y. Utilization of jamu in puerperal mother in Sumatera and Java Island (literature review of health ethnographic research 2012-2016). *Indones J Public Heal* 2020;15:93–102.
- Gunawan F, Sandhika W, Wiqoyah N. Effectiveness of black honey as an antiinflammatory substance in rat's wound infected by *Staphylococcus aureus*. *Berk Ilmu Kesehat Kulit dan Kelamin* 2021;33:13.
- Bidan PP, Kesehatan I, Utara S, Ginting JJ, Tuntungan M. The effect of red betel infusion perineal care on the healing time of grade ii perineal wounds after delivery. *Jurnal EduHealth* 2024;15:725–30.
- Amini RA, Suwondo A, Ta'adi T. Potential red leaves extract on improving the effectiveness of antibiotic in postpartum (study experiment of perineum wound healing process). *J Kebidanan* 2022;11:167.
- Selawa W, Max Revolta John Runtuwene GC. Kandungan Flavonoid Dan Kapasitas Antioksidan Total Ekstrak Etanol Daun Binahong [*Anredera Cordifolia*(Ten.)Steenis.]. *J Bios Logos* 2013;3:18–23.
- Lisnanti EF, Lokapimasari WP, Hestianah EP, et al. Antibacterial alternatives using the potential of the ant nest plant (*Myrmecodia* spp.). *Int J One Heal* 2024;10:148–52.
- Irmawati A, Yuliantoro R, Sidarningsih, et al. The difference of Antibacterial properties extract seeds Papaya and Papaya leaves (*Carica papaya* L) against *Streptococcus mutans*. *Res J Pharm Technol* 2024;17:4353–62.
- Indriyanti A. The effect of giving gel combination of binahong leaf extract and turmeric rhizome extract on histopathological epithelial thickness in II B degree burn of *Rattus norvegicus*. *J Basic Med Vet* 2023;12:45–52.
- Luthfi M, Juliastuti WS, Asyhari NPO. The effect of giving okra (*Abelmoschus Esculentus*) extract on the increase of vascular endothelial growth factor (Vegf). *Indones J Dent Med* 2019;2:35.
- Partafi N, Windono T. Red betel (*Piper crocatum* Ruiz & Pav) literature review. *Media Pharm Indones* 2016;1:106–15.
- Nisa GK, Nugroho WA, Hendrawan Y. Ekstraksi Daun Sirih Merah (*Piper Crocatum*) Dengan Metode Microwave Assisted Extraction (MAE). *J Bioproses Komod Trop* 2014;2:72–8.