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RESEARCH **Open Access**

Development of Spray Made From Kelakai Leaves (*Stenochlaena palustris*) and Effectiveness in the Healing of Perineal Wounds

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Abstract
The prognosis or possible diagnosis in postpartum mothers with perineal suture wounds is the possibility of infection of perenium suture wounds. Kelakai leaf plants are plants that contain flavonoids, tannins, saponins, alkaloids, and tripenoids. This study aims to innovate and develop perineal wound medicine using kelakai leaf spray and analyze its effectiveness based on REEDA scale indicators (redness,edema, ecchymosis, discharge, approximation). This study uses a quantitative method with a Reseach and development approach. The sampling technique uses non-probability sampling with a type of purposive sampling selecting 34 respondents, who are divided directly between the two groups. The intervention group received treatment of perineal wounds for 7 days with kelakai leaf spray and education on how to treat perineal wounds, while the control group received treatment with placebo spray and education on how to treat perineal wounds. The spray is administered four times a day with a dose of four sprays. Wound healing was measured by the REEDA Scale on days 3, 5, and 7. A tool to measure hb levels with digital hb, to measure protein intake, calorie intake, and fe intake using food recall. Data analysis includes Friedman and Mann Whitney as well as Stratification. The results showed that there was a difference in the average healing of perineal wounds at the observation time between the intervention group and the control group (p=0.000). On average, the difference in perineal wound healing using the REEDA scale showed a significant difference between the intervention group and the control group (p=0.000). A value of 3.2 is considered a relatively large measure of effect. The irritation test obtained results that did not cause irritation, In conclusion, the developed Kelakai leaf spray was effective in helping to accelerate the healing of perineal wounds, as evidenced by the difference in the mean healing time of perineal wounds with the SIGINFIC REEDA scale in postpartum mothers in the intervention group compared to the control group (p=0.000).

Keywords: Kelakai, Spray, Perineal Wound, Irritation Test.

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1. INTRODUCTION

A perineal injury is an injury that occurs during childbirth in the perineum. The perineum often causes perineal tearing in both primigravida and multigravida with a stiff perineum. A perineal tear occurs during childbirth and its treatment is a midwifery problem. It can occur spontaneously or with an episiotomy (Alim, 2021). The World Health Organization (WHO) said that there were 2.7 million cases of perineal rupture in women giving birth by 2050. This number is expected to increase to 6.3 million. The incidence of perineal rupture in Indonesia is under the age of 30 years 24% and between the ages of 32 and 39 years. According to the Indonesian Ministry of Health mothers who undergo perineal sutures and experience perenium injuries are 57% (28% due to episiotomy and 29% due to natural tears) (Ministry of Health of the Republic of Indonesia, 2021). The prevalence of perenium rupture based on the results of research conducted by Ketut Remaniasih in primipara is 34.5%, while in multipara it is 21.7%. This prevalence suggests that perineal tears tend to be higher in primipara compared to multipara (Resmanisih & Rusmini, 2023). Treating perineal wounds in mothers after childbirth can help reduce discomfort, maintain hygiene, prevent infections and speed up healing. Perineal treatment is usually done in conjunction with vulva treatment. The main points are to avoid contamination of the rectum, treat wound tissue gently, and clean the blood which is a source of infection and bacteria (Rostika et al., 2020). Perineal care is the fulfillment of the need to nourish the area between the thighs that are limited by the vulva and the anus in the period between the birth of the placenta and the return of the genetic organs as in the time before pregnancy . This risks causing postpartum infection due to the presence of wounds. Postpartum infections are infections in and through the reproductive tract after childbirth. Body temperature of 380 c or higher between 2 and 10 days after the baby is born, measured orally at least four times a day (Kasmiati, 2023).

Non-pharmacological therapy is treatment therapy without the use of drugs (Fajri et al., 2022). Kelakai is a type of fern plant and grows freely in large numbers on the island of Kalimantan. Kelakai plants are able to live in peat soils that contain high acidity. The leaf shoots are whiter in color, slightly yellow to dark red and contain mucus (Fadhila et al., 2023). Kelakai is reported to have antibacterial properties, improves blood circulation, and is effective on open wounds, as well as burns. The use of natural herbal ingredients, namely Kelakai leaves (*Stenochlaena palustris*) can be used as a natural antibacterial and chemical-free, so it does not have a negative impact on health. In the article "Antioxidant Activity in Kelakai (*S. palustris*)" the active compounds that act as antioxidants in kelakai are flavonoids and phenols, which act as free radical antibodies to prevent various diseases. Discuss results including the addition of hemoglobin, cytotoxicity in MCF-7 breast cancer cells, as well as the role of antihyperlipidemia. It shows that kelakai has high antioxidant activity in various parts of the plant, such as roots, stems, and leaves. In the context of wound healing, antioxidant activity in the healing process can help in the healing process (Oksal et al., 2023). In addition, the flavonoids and phenols in kelakai can also help in reducing inflammation and promoting tissue regeneration, which is an important factor in wound healing. Thus, based on its antioxidant properties and cytotoxic potential, kelakai has effectiveness in supporting the wound healing process. However, further research is needed to validate its effectiveness clinically in the context of wound healing (Oksal et al., 2023). Sprays can be applied easily, are more evenly distributed, and have a low risk of contamination. This makes it an effective and practical option in wound care. Thus, spray preparations can provide ease of use to speed up the wound healing process (Astuti & Muslihin, 2020).

The previous study showed that The Effect of Giving Ointment Preparation of Kelakai Stem Leaf Extract (*stenochlaena palustris* (*burm.f*)*Bedd*) on the Healing of Cut Wounds on the Skin of White Rats with the results of the effect of giving ointment of leaves and stems of kelakai (Stenochlaena palustris (burm.f)Bedd) on the healing of cut wounds on the skin of white rats (Jamilah et al., 2022). Kelakai positive contains flavonoid compounds and has very strong

antioxidant abilities with an IC50 value of 6.4035 ppm (Hakim et al., 2021). The importance of treating perineal wounds in postpartum mothers is to reduce discomfort and prevent complications that may occur if perineal wounds are not treated properly. The development of research that utilizes local potential is one of the things that is carried out. This study aims to innovate and develop perineal wound medicine using kelakai leaf spray and analyze its effectiveness based on REEDA scale indicators (redness, edema, ecchymosis, discharge, approximation). Based on the above background, research related to "Development of Spray Made from Kelakai Leaves (Stenochlaena palustris) and Effectiveness in Healing Perineal Wounds" is needed.

2. RESEARCH METHOD

The type and design of the research used is with the R&D (Research and Development) approach in developing Kelakai leaf-based spray for perineal wounds in postpartum mothers. The R&D (research and development) method in this study uses 6 steps where research and development are carried out with steps including potential and problems, data collection, product design design, design validation and revision, use trial, product test, product results (Sugiyono, 2020). Product design and design are carried out in the pharmacy laboratory of Wahid Hasyim University Semarang. Meanwhile, the validity was carried out by six expert validators consisting of general practitioners, pharmaceutical laboratory experts, pharmacists, pharmaceutical technical personnel, and midwives. The trial use of the product was carried out on postpartum mothers with perineal wounds from the first day to the seventh day.

The sampling technique in this study uses non-probability sampling, with a type of purposive sampling, namely postpartum mothers from day 1 to day 7 with perineal suture wounds. The implementation in this study used all existing samples, namely as many as 34 postpartum mothers from the 1st to the 7th day who received second-degree perineal wound sutures, divided into 17 intervention groups given the intervention of Kelakai leaf spray for 7 days, and 17 control groups given a placebo spray for 7 days. The independent variable in this study was Spray made from Kelakai leaves (*stenochlaena palustritis*) using a compliance sheet measuring device spray Kelakai leaves on Perineum developed by researchers, and the dependent variable was the effectiveness of healing perineal wounds with the measuring tool being a reeda scale observation sheet which was assessed on the pretest on day 1 and posttest three measurements on day 3, day 5 and day 7 (Dona, 2023). This study also looked at confounding variables, namely Hb levels the measuring tool is digital HB, while the variable nutritional status, namely protein intake, calorie intake and Fe intake in mothers with perineal lesions, it was measured with a food recall form during the third and fifth days (Faridi et al., 2022).

The instruments in this study are spray development standard operating procedure, irritation test standard operating procedure, The measuring instrument used in the organoleptic test uses the human senses, namely one panelist from a pharmaceutical laboratory such as the smell, taste and consistency of the spray, viscosity test using a viscometer device, for pH test using a pH meter, a tool used to test the homogeneity of glass preparations. Reeda scale observation form, compliance form, food recall form, characteristic sheet, expert validity test sheet, and preference test assessment sheet. The development of the Kelakai leaf spray is made and tested for physical preparation in the laboratory of pharmaesthetics and pharmaceutical technology. The irritation test was carried out with Indonesian Food and Drug Authority standards in pharmacology and toxicology laboratories (Chairperson of The Indonesian Food and Drug Authority, 2022). This research was declared ethical clearence obtained from Health Research Ethics (KEPK) with number 1156/EA/F.XXIII.38/2024 Polytechnics of the Ministry of Health, Semarang.

The intervention group was given 4x4 Kelakai Spray or equivalent to 1g until Day 7 and health care about perineal wound care, in the intervention group was given 4x4 placebo spray equivalent to 1g until Day 7 and health care about perineal wound care. The inclusion criteria in this study are the inclusion criteria in the intervention group and the control group are postpartum mothers on the first day, postpartum mothers with second-degree perineal lacerations and suturing, postpartum mothers in the age range of 20-35 years.

The place of this research was carried out at the Mendawai Health Center and the Pegatan I Health Center, which are located in Katingan Regency. This research was carried out within 3 months, from September 2024 to November 2024. The existing data are grouped according to the variables studied and data processing is carried out in the form of frequency distribution, for which a sattistic test is carried out. While the statistical tests used were nonparametric tests, namely the Friedman test and the Mann Whitney test, as well as the stratification test using the SPSS 26 application to test the hypothesis of the given sample after which the difference between the intervention group and the control group was seen. As for the analysis used in calculating the effect of size spray made from Kelakai leaves is effective in healing perineal wounds to determine the statistical significance test using Cohen's d test by taking the difference between two mean and dividing it by the standard deviation of the data.

3. RESULTS AND DISCUSSION

Spray made from Kelakai *leaves (S. palustris),* which has been made with a concentration of 20% is made with a reference formula that has been modified. The dosage of formulation and administration has been consulted with pharmacists in the field of Pharmathetics and Pharmatechnology. The spray of Kelakai leaves (*S. palustris)* used was as much as 20% in accordance with the previous study conducted on experimental animals. A significance of $p < 0.05$ was obtained there was an effect of giving ointment of Kelakai leaf and stem *extract (S. palustris (burm.f)bedd)* on the healing of cut wounds on the skin of white rats (Sikumbang et al., 2020; Jamilah et al., 2022).

Table 1. Formulation of Kelakai Leaf *Spray (S.palustris).*

Ingredient Name	Uses	Concentration (g/ml)
Kelakai Leaf Extract	Active Substances	35
Karbopol 940	Polymer	0.5
TEA	Patcher	0.5
Propylene gichole	Solubilizer	5
Methyl Paraben	Preservatives	0.2
Paraben Profile	Preservatives	0.1
DMSO	Co-solvent	7
Aquades	Solvent	AD 100
Peppermint oil	Essential oils	1.2

To reduce the distinctive smell of kelakai leaves, peppermint is added to the process of making kelakai leaf spray. The content of peppermint itself is a combination of volatile metabolites with activities as anti-inflammatory, antibacterial, antiviral, antioxidant and antifatigue. Evidence from the results of the study shows that the activity contained in peppermint itself shows an inhibitory effect on *Staphylococcuc aureus* bacteria and similar bacteria that are commonly found in the respiratory tract and digestive tract (Zhao et al., 2022). Peppermint can be classified as a strong antioxidant category in IC50 with the DDPH method of 92.994 µg/mL, and IC50 with the ABTS method of 27.180 µg/mL (Kusuma et al., 2024). The antioxidant, anti-inflammatory and antibacterial properties contained in peppermint can add to the effect of the developed Kelakai leaf spray, but there has been no further testing to see if the addition *of peppermint essential oil* has an effect in the developed Kelakai leaf spray.

Therefore, it is necessary to conduct further laboratory tests in the future to assess the addition *of this essential peppermint oil* to Kelakai leaf spray.

The description of the Kelakai *spray product (Stenochlaena palustris)* produced is as follows:

Table 2. Results of Physical Test of Kelakai Leaf Spray *(S. palustris).*

Organoleptic Test	**Color : Green**	**Texture : Liquid**	**Smell : Typical Smell of Kelakai Leaves**
Replication	Replication I	Replication II	Replication III
Homogeneity Test	Homogeneous	Homogeneous	Homogeneous
Viscosity Test	4.425 mPa's	4.321 mPa's	4.494 mPa's
pH Test	6.05	6.04	6.06

Based on the test results, a homogeneity test was obtained in 3 replications that were completely homogeneous, and a viscosity test of 4.413 mPa's, and an average pH test of 6.05. Kelakai, which is a fern that has a variety of biological activities, is inseparable from the high concentration of antioxidants contained in it. The results of the physical preparation test of Kelakai leaf spray (*S. Palustris)* include organoleptic test, viscosity test, pH test, homogeneity test. Based on the test results, the homogeneity test on 3 replications was completely homogeneous, and the viscosity test was 4.413 mPa's, and the average pH test was 6.05. The results of the organoleptis test identify physical parameters based on the color, smell, and consistency of the spray made, dengan menggunakan indrawi manusia yang selanjutnya data dianalisis dan diinterprestasikan (Nurjaya et al., 2023). Kelakai leaf spray is made in brownish-green color, has a peppermint (*essential oil*) smell, and has a consistency in the form of a slightly thick liquid.

The results of the spray viscosity test using an ostwald viscometer were carried out to determine the time recording and calculation of the viscosity value of the spray sample, looking at the viscosity of the liquid with a result of 4,413 mPa's (Fadhila et al., 2023). While the pH test aims to determine the safety of the skin, the pH of the spray made from leaves is 6.05. pH measurement is carried out according to the pH of the skin, which ranges from 4.5-7, replication 3 times (Maesaroh & Fahmilik, 2021).

Irritation Test

Irritation tests on rabbit test animals for 24 hours, 48 hours and 72 hours according to the standard operating procedure standart operation, obtained results of no irritation or lesions, normal skin mucosa, normal hair growth on sprays made from kelakai leaves *(Stenochlaena palustris)* completed with a certificate of observation results by a veterinarian (Chairperson of The Indonesian Food and Drug Authority, 2022). Based on the results of irritation tests at 24 hours, 48 hours and 72 hours, the use of sprays made from Kelakai leaves (*S. palustris*) did not cause redness and swelling. The test results do not cause irritation because the spray made from Kelakai *leaves (S. palustris)* has a pH level that is in accordance with the physiological pH of the skin. The principle of the dermal acute test is the exposure of the test preparation in a single dose on the skin of animals with the untreated skin area serving as a control. The degree of irritation is assessed at certain time intervals, namely at the 1st, 24th, 48th and 72nd hours after the exposure of the test preparation to see reversibility. The purpose of the dermal acute irritation test is to determine the presence of irritating effects on the skin and to assess and evaluate the characteristics of a substance when exposed to the skin. The results of this test were obtained as non-irritating in animal trials. So that it is safe to use on human skin, the test results are also equipped with an observation certificate from a veterinarian (Badan Pengawas Obat dan Makanan Indonesia, 2022).

Expert Validation Test

The validity of the Kelakai Leaf Spray *(Stecnochlaena palustris)* was carried out by 6 validators using expert judgment instruments. Each validator has different expertise, the laboratory of pharmacology and pharmaceutical technology, general practitioners, pharmacists, pharmaceutical technical personnel, and midwives. It was obtained from all validators that spray products made from Kelakai *leaves (Stecnochlaena palustris)* are suitable for use. The results of the validity test show that the product that has been made is declared very valid because it has a value of 90.26%. The product is declared fit for use by considering and adjusting the purpose and benefits of the product.

Product Usage Test

The trial use of the product was carried out by 3 postpartum mothers (20%) for the control group, and 3 postpartum mothers (20%) with second-degree perineal lesions for the intervention group. Based on the observation results in the initial product test, it was found that the difference in perineal wound healing with the REEDA score in the intervention group on day 7 obtained an average of 0.6 smaller than the control group with a placebo spray, which was with an average of 1.3. The largest decrease in the REEDA scale in the initial product test was on the 1st to 3rd day, where in the current range the inflammatory phase occurred. Hemostatic reactions and inflammatory (inflammation) responses. The inflammatory response is a normal response that is important for wound healing. Inflammation helps isolate damaged tissue and reduces the spread of infection. The content of tannins in the stomach is useful as an astrigen or stopping bleeding, accelerating wound healing, and inflammation of the mucous membrane, as well as regeneration of wound tissue (Karimah et al., 2022).

There was a difference in the average number of REEDA scores in the product trial in the intervention group given Kelakai leaf spray along with health education about perineal wound care obtained a score of 0.6 smaller than the control group given placebo spray or spray-based spray with health education about perineal wound care of 1.3. This is in line with the research conducted by Fitriana where postpartum mothers with perineal wounds who only do dry clean treatment have a difference in REEDA score with a difference of 1.39, compared to the group that was given the intervention (Sindi et al., 2024).

Effectiveness Analysis

The Effectiveness of Spraying Lotion Made from Kelakai Leaves *(Stenochlaena palustris)* in Healing Perineal Wounds

Assessment refers to redness*, edema, echymosis, discharge*, and *approximation* which is abbreviated as REEDA. Each factor is given a score of 0-3 which assesses whether there are signs of wound healing (Girsang, 2021). The analysis was carried out by a nonparametric statistical test, namely *the Friedman* test was carried out to determine the difference in the healing process of perineal wounds before and after the treatment. Furthermore, the *Mann Whitney test was carried* out to determine the difference in the average healing rate of perineal wounds in the intervention group (Spray made from Kelakai leaves *(S. palustris*) presented in the following table.

Table 3. REEDA Pre and Post Score Frequency Distribution Control Groups and Interventions.

Skor REEDA	**Interventions**								**control**							
	Pre 1		**Post 3**		**Post 5**		**Post 7**		**Pre 1**		**Post 3**		**Post 5**		**Post 7**	
	n	**f**	**n**	**f**	**n**	**f**	**n**	**f**	**n**	**f**	**n**	**f**	**n**	**f**	**n**	**f**
0							7	41.2							1	5.9
1							10	58.8							15	88.2
2					1	5.9									1	5.9
3					12	70.6							4	23.6		
4					1	5.9							3	17.6		
5			3	17.6	3	17.6							9	52.9		
6			7	41.2							5	29.4	1	5.9		
7			4	23.6							1	5.9				
8			3	17.6							5	29.4				
9											4	23.5				
10	6	35.2							3	17.6	2	11.8				
11	1	5.9							4	23.6						
12	7	41.2							6	35.3						
13	2	11.8							3	17.6						
14	1	5.9							1	5.9						
15																
SUM	17	100	17	100	17	100	17	100	17	100	17	100	17	100	17	100

Table 3. Results of Perineal Wound Healing Test Based on REEDA Score In the intervention group and control group.

Pre-test and Post-test	**Intervention group (n=17)**	**Control Group (n=17)**	***p-value***
	Mean ± SD	**Mean ± SD**	
Pre test (Day 1)	11.47 ± 1.28	11.70 ± 1.15	0.590[a]
Post test 1 (Day 3)	6.41 ± 1.0	7.82 ± 1.42	0.005[a]
Post test 2 (Day 5)	3.35 ± 0.86	5.41 ± 0.93	0.000[a]
Post test 3 (Day 7)	0.58 ± 0.50	2.00 ± 0.35	0.000[a]
P	0.000[b]	0.000[b]	

Description: *[a] Mann-Whitney Test [b]Friedman Test*

Based on the results of *the Friedman test* in Table 3, a p < value of 0.05 was obtained, which means that there was a difference in the average healing of perineal wounds at the observation time of the third, fifth, and seventh days with an assessment using the REEDA score. Based on *the Mann Whitney* test after the treatment on the third, fifth, and seventh days, a p < value of 0.05 was obtained, there was a significant difference in the average wound healing value using the REEDA scale in the group given Kelakai *spray (S. palustris)* in the intervention group and the control group with placebo spray (palsebo spray whose contents are the constituent ingredients of the spray base such as aquades, essential oils, methyl paraben, TEA, Karbopol 940, DMSO). A Decrease in the rate of perineal lesions based on REEDA scores is presented in the following graph.

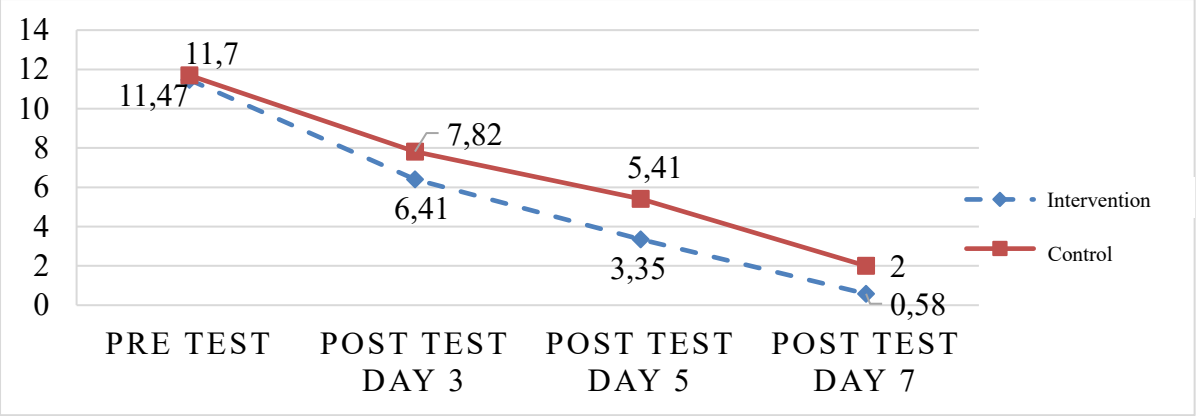

Figure 1. Average Perineal Wound Healing Rate Based on REEDA Score

Based on figure 1, it is known that on the first day of observation before the treatment was given, the results were obtained, namely there was no decrease in the average healing of perineal wounds in the intervention group with an average value of 11.47 and the control group 11.70. Meanwhile, after being given treatment on the third day, the hem and the seventh were obtained, namely there was a significant decrease in the average healing rate of perineal wounds based on the REEDA score in the group given the kelakai spray (intervention) with an average of 0.58 with the control group given a placebo spray with an average of 2.00. According to Girsang, the higher the REEDA score (0-15), the worse the assessment of trauma healing in wounds. If left untreated it causes complications such as infections characterized by symptoms such as fever, pus discharge, foul odor, tenderness and swelling around the perineum (Girsang, 2021).

The highest decrease in REEDA score is in the range of day 1 to day 3 where in this range the inflammatory/inflammatory phase occurs. The phytochemical compounds in the mucosa that play a role in this phase are tannins useful in the inflammatory process of the mucosal membrane (Karimah et al., 2022). Flavonoid compounds contained in kelakai leaves also act as anti-inflammatory and have an effect on the process of fibroblast cell proliferation. The mechanism of action of phytochemical compounds of the family basellaceaae flavonoids, phenols, tannins, triphenoids, alkaloids, saponins is to increase cicatrizant activity, collagen density, percentage of wound healing, collagenase activity, pro-collagen production, MMP-1, migration and flavonoids proliferation of human skin fibroblasts, and/or decrease the spacing of wound edges, wound diameter and granulation tissue (Akhmadi et al., 2022).

Therefore, it can be concluded that the results of the REEDA score in the intervention group on the observation of the post test on the Third day, fifth day and seventh day are more close to healing, which is close to a score of 0 than the control group. The results of this study showed the effect of Kelakai leaf spray *(Stenochlaena palustris)* and its effectiveness in healing perineal wounds in postpartum mothers. Based on the results of *the Friedman* test, the result showed a result of p=0.000 (<0.05) which means that there is a difference in REEDA scores in pre and post, a mechanism that helps the healing process of perineal wounds after the application of a spray made from Kelakai leaves *(S. palustris)* which contains active compounds of flavonoids, tannins, saponins, alkaloids. These active compounds help reduce inflammation and increase tissue regeneration. This is in line with the research conducted by Jamilah et al., (2022) with *a p* < value of 0.05 with the conclusion that there is an effect of giving 20% leaven extract ointment *(S.palustris (Burm.f)bedd)* on the healing of cut wounds on the skin of white rats compared to the control group, namely betadine ointment and the kelakai ointment group 10%, and 15%. The content of active substances in kelakai leaves that is more effective in accelerating the wound healing process is 20%. The antioxidant and cytotoxic properties of the Kelakai plant have been effective in wound healing (Oksal et al., 2023).

Flavonoids function to protect, not a detail in which they have the properties of antibiotic activity. The properties of this antibiotic can interfere with the micro-function of organisms by

damaging cell membranes, so that there is a change in cell permeability that results in cell damage or death. In addition, flavonoids also have the ability to accelerate wound healing (Hanifa et al., 2020). Tannins are glutamic acid compounds or tannic acid that have various properties such as antidiarrheal, antioxidant, antibacterial, and astringent. The results of phytochemical screening on kelak leaves also contain tannins that function as astringents. Astringents can function in accelerating the process of stopping bleeding in wounds (Putria et al., 2022).

Saponins are glucosides that are soluble in ethanol and water. Saponins have the ability to act as anti-bacterial, anti-fungal, and antiviral by interfering as an intermediary of bacteria, thus causing lysis in addition to that saponins also have the ability to spur the formation of collagen I. Collagen is a protein that plays a role in the wound healing process (Karimah et al., 2022). Its antibacterial ability in preventing infection, so that the inflammatory phase in the wound healing phase ends quickly, and the proliferation phase (Karimah et al., 2022).

In line with where kelakai is also known to contain flavonoid compounds, in almost all parts of the plant, and is known to have antioxidant properties that can play a role in anti-inflammatory agents. Based on the results of the tests conducted, kelakac has a better anti-inflammatory ability than the sodium diclofenac drug (Saputri et al., 2023).

There was a decrease in the number of REEDA scores between intervention groups that were given sprays made from Kelakai *leaves (Stenochlaena palustris)* and health education on how to treat perineal wounds with a placebo or spray-based spray control group and health education on how to treat perineal wounds on day 3, day 5, day 7 on the *Mann-Whitney* testwith a p < of 0.05 as seen from the average REEDA score in the intervention group decreased a lot compared to the control group, which means that the intervention group administered a spray made from Kelakai *leaves (S. palustris)* and health education on how to treat perineal wounds was proven to improve the healing of perineal wounds in postpartum mothers. However, further laboratory tests are needed to assess the magnitude of the antioxidant and antibacterial effects of peppermint added to the kelakai leaf spray.

Table 4. Results of the Confounding Variable Difference Test on Perineal Wound Healing.

Variable *Confounding*	**Intervention group (n=17)**	**Control Group (n=17)**	***p-value***
	Mean ± SD	**Mean ± SD**	
HB Levels	11.47 ± 1.28	11.70 ± 1.15	0.696
Intake Protein	2.70 ± 1.4	4.05 ± 1.08	0.005
Calorie Intake	1.05 ± 0.24	1.05 ± 0.24	1.000
Intake Fe	1.82 ± 0.72	2.64 ± 0.60	0.002

Description: *Mann-Whitney Test*

Based on Table 4, the results of the statistical test of *the confounding* variables of hb levels and calorie intake were obtained *with a p* > 0.05 which means that there was no difference in HB levels and postpartum maternal calorie intake between the control group and the intervention group regardless of the treatment given. As for the protein intake variable and fe intake , a $p < 0.05$ was obtained, which means that there was a difference in protein intake and *fe* intake in both control and intervention groups.

Table 5. Confounding Variables (HB Levels, Protein intake, Calorie intake, fe intake) against the healing of perineal wounds.

Variable	*Odds Ratio Lower*	*Odds Ratio Upper*	*Estimate*
HB Levels	0.589	52.73	5.571
Intake Protein	0.232	6.620	1.238
Calorie Intake	0.013	4.238	0.231
Intake Fe	0.275	4.324	1.091

Description: *Crostabulation Test*

Based on Table 5, the Estimate and OR values were obtained through grouping (stratification) for the HB level variable, an estimate value of 5.571 was obtained with a 95% confidence interval between 0.589 to 52.73 affecting the healing process of perineal wounds. Protein intake has an estimate of 1.238 with a 95% confidence interval between 0.232 to 6.620 affecting the healing process of perineal wounds. The calorie intake variable had an estimate value of 0.231 with a 95% confidence interval between 0.013 to 4.238 affecting the healing process of perineal wounds. The fe intake variable with an estimated value of 1.091 with a 95% confidence interval between 0.275 to 4.324 affected the healing process of perineal wounds.

Wound repair is a process that requires a lot of energy. Human energy is obtained by breaking the chemical bonds of nutrient molecules, especially carbohydrates, lipids, and proteins. Nutrition and hydration are important for optimal wound healing. Where proteins and amino acids provide the main building blocks for the growth, renewal, and repair of tissues in the proliferation phase (Grada & Phillips, 2022). The estimated value of the HB level variable was obtained 5.571 affecting the healing of perineal wounds. Abnormal hb levels will result in a decrease in the capacity of blood to transport oxygen and tissue hypoxia will occur because haemoglobin is a protein contained in erythrocytes where its function is to bind oxygen, if hypoxia occurs due to anemia, then automatically leukocyte function can be reduced and wound healing becomes delayed and can slow down the healing process of perineal wounds (Hopipah, 2024). The estimated value of protein intake of 1.238 affects wound healing, where protein intake is the function of the immune system from amino acids. Protein has the function of accelerating the return of uterine organs, increasing the amount of breast milk production, and accelerating the healing of perineal wounds in postpartum mothers. Adequate protein intake during the postpartum period will help the formation of new tissues in the perineal wound so that the perineal wound will heal faster (Hopipah, 2024).

The calorie *intake* variable estimated at 0.231 has an effect on the healing process of perineal wounds, where calories are the unit of energy needed for wound healing according to experts at 30 kcal/kg. While the variable Intake fe with *an estimated* value of 1.091 has an influence on the healing of perineal wounds, this variable is one of the vitamins and minerals that play an important role in the wound healing phase, where iron is needed for the formation of red blood cells which are an integral part of hemoglobin plays a role in the formation of collagen (Festy et al., 2021).

Effect Size

Effect size in research is a measure that shows the magnitude of the effect of treatment in a study in the intervention group. Effect size using *Cohen's d formula* is that the administration of Spray made from kelakai leaves *(Stenochlaena palustris)* for 7 days compared to the control group obtained a value of 3.2, which is considered a relatively large effect size measure. Effect size is a part of statistical tests that play a role in helping researchers understand the magnitude of the difference found in a research experiment. The results of the study on the effect of spraying with Kelakai leaves *(S. palustris)* on the healing of perineal wounds Es= 3.2

which means that the administration of sprays made from Kelakai *leaves (S. palustris)* and the effectiveness in healing perineal wounds in this study have a very strong influence on the healing of perineal wounds in postpartum mothers. In line with a similar study conducted by Sismeri Dona the Kelakai tea intervention on the healing of perineal wounds was shown to be effective on the 6th day of the intervention with an average REEDA score of zero, but the study presented descriptive data and was carried out in one intervention group only, so it could not provide size effect data (Dona et al., 2024).

The limitation of this study is that no further laboratory tests were conducted to see the effect of Kelakai leaf spray *(Stenochlaena palustris)* on antibacterial healing of perineal wounds. And no follow-up laboratory tests were carried out, namely the DPPH (diphenyl-1-picryhydrazyl) test to see how much antioxidant effect the addition of peppermint *essential oil* is in the spray made from Kelakai leaves that has been developed in the healing of perineal wounds. The implication in this study is that the relatively large effect size of kelakai leaf spray can accelerate the healing process of perineal wounds, this can increase comfort in postpartum mothers, and can be an alternative treatment option with natural ingredients that are safer, more effective, while encouraging the use of local natural resources to improve public health.

4. CONCLUSION

Kelakai leaf spray (Stenochlaena palustris) 20% kelakai leaf extract has been successfully developed and is effective in accelerating the healing of perineal wounds in postpartum mothers with a dose of four times a day with a dose of 1 gram or equivalent to four sprays for seven day of intervention, in perineal lesions of the second degree. As seen from the REEDA score by conducting pretest and posttest where there is a significant difference in the average at the time of observation and the average REEDA score in the intervention group and the control group on day three, day five, and day seven. Judging from the content and benefits of Spray Kelakai leaves (Stenochlaena palustris) as an alternative for healing perineal wounds. As for Researchers can then expand the scope of the study by adding other variables and expanding the coverage of the population and samples, conducting follow-up laboratory tests to see the effect of essential oils that have been added to the spray and testing bacteria on the healing of perineal wounds.

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