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Forest Honey Cream Formulation and Test of Its Effectiveness in Accelerating Burn Wound Healing

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Abstract: Honey contains various essential nutrients, including carbohydrates, proteins, amino acids, vitamins, minerals, dextrin, plant pigments, and natural compounds. This study aims to develop the formulation and effectiveness of forest honey cream as a therapeutic agent for second-degree burns. The research design used was a pure experimental laboratory. This study used five rabbits divided into five treatment groups. Burns were given on the first day and treatment was given every day. Observations were made every three days for 15 days. Statistical analysis was carried out using a Completely Randomized Design (CRD), and the Least Significant Difference (LSD) test, by comparing the condition of the wound before and after treatment, as well as the control group that was not given treatment. The results of the study showed that based on the test of the effectiveness of healing burns between the 30% concentration honey cream group when compared to the positive control group (Biopacenton® ointment) showed a difference but was not very significant (0.03 < 0.07). The calculated F value is greater than the F table at the level of α = 0.05 (8.70 > 2.78) so the hypothesis Ho is rejected and Ha is accepted which means that there is a significant influence/effect of administering high concentration forest honey cream formulation on burns in rabbit test animals. In conclusion, the application of forest honey at a higher concentration significantly improves burn healing in the rabbit model. Further research is recommended to investigate the optimal frequency of forest honey application to further accelerate the burn healing process.

Keywords: Biopacenton ointment; Burns; Honey cream

Introduction

Burns are a type of tissue injury that is quite serious and often occurs, generally caused by exposure to high temperatures, chemicals, electric currents, or radiation (Apriyani, 2023). This injury causes damage to the layers of the skin and the underlying tissue, and if not treated properly, can cause complications such as infection, loss of body fluids, prolonged pain, and even death at high levels of severity (Sugiyanto & Sumarni, 2022). The process of healing burns is relatively complicated and slow, and has the potential to produce scar tissue that can interfere with physiological function and the appearance of the skin (Gunawan, 2017). Burn treatment requires a comprehensive strategy, including controlling infection, controlling inflammatory reactions, and stimulating new tissue regeneration (Awaluddin & Sugiyanto, 2022). Although various topical agents such as antibiotic ointments and modern wound dressings are currently available, their use is inseparable from side effects, high costs, and the potential for microbial resistance if used in the long term (Sigala, 2021). Therefore, the development of alternative therapies for

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burns that are safe, affordable and based on natural ingredients is a very important effort and is in line with the trend of modern medicine that is more friendly to the body.

Honey, especially forest honey, is one of the natural ingredients that shows great potential in supporting the wound healing process (Sigala & Sugiyanto, 2022). Forest honey comes from wild bees that collect nectar from various plants in tropical forest ecosystems, and is known to have a high content of bioactive compounds, such as flavonoids, phenolic compounds, enzymes, and components that are antibacterial and anti-inflammatory (Asiah et al., 2018; Wulandari, 2017). The combination of these compounds contributes to the activity of honey in accelerating the wound healing process, including by suppressing the growth of pathogenic microorganisms, reducing the inflammatory response, and stimulating the regeneration of damaged skin tissue (Sakri, 2022; Kholil, 2020).

This study focuses on the development and evaluation of the effectiveness of forest honey in treating mild to moderate burns in rabbit test animals. Rabbits were chosen because their physiological characteristics and skin structure are quite close to humans, so they can provide a more relevant picture in assessing the potential application of the cream in a clinical context (Notoatmojo, 2018). Through this study, it is expected to obtain an effective and safe forest honey cream preparation as a topical therapy for burns. This study is also expected to contribute to the development of natural-based medicines, especially from local natural resources, as an alternative therapy that is sustainable and oriented towards natural medicine based on science.

Method

Research Method

This study used a True-Experimental Design to reveal the causal relationship between burn treatment and the use of forest honey. This experimental study involved two groups: an experimental group that was given treatment and a control group that was not given treatment. The group selection was done randomly. (Notoatmojo, 2018).

Population and Sample

The population in this study was male rabbits (*Orytolagus cuniculus),* which were selected because their body structure and digestive system are similar to humans. The sample consisted of 5 rabbits that met the criteria, namely adult male rabbits weighing 2-3 kg, healthy, and with the same nutritional conditions. Burns will be made on the rabbit's back with a uniform wound size, namely a diameter of ± 2 cm.

Research Procedure

Rabbits were divided into 5 groups, each group consisting of one rabbit, with the following treatments: Group I: Forest honey cream with a concentration of 1%, Group II: Forest honey cream with a concentration of 2%, Group III: Forest honey cream with a concentration of 4%, Group IV: Positive control, given Biopacenton® ointment, dan Group V: Negative control, given a cream base without active ingredients.

Before treatment, the fur on the rabbit's back was shaved according to the desired burn area. After that, the burn was made using heated metal. The burn was cleaned three times a day (morning, afternoon, and evening) using distilled water. In the treatment group, forest honey cream was applied to the burn after cleaning. The positive control group was smeared with Biopacenton® ointment, and the negative control group was smeared with a cream base. Treatment was carried out every day for 15 days. Observations were made every 3 days to evaluate changes in the condition of the burn until the therapy was complete.

Analysis Method

Data processing was carried out statistically using a Completely Randomized Design (CRD), and the Least Significant Difference Test (LSD) to analyze changes in burn wound conditions between the experimental group and the control group (Sugiyono, 2018).

Result and Discussion

The results of the observations and measurements of burns carried out in this study for 15 days are shown in Table 1. Referring to the Table 1, it can be stated that wound healing with 30% concentration honey cream showed more optimal results (total value 7.5) compared to other treatments. In addition, the use of Biopacenton® is also considered effective because the diameter of the burn wound healing is almost equivalent to the use of 30% concentration honey cream.

In this study, the test animals were divided into five groups, namely: group I was given honey cream with a concentration of 10%, group II with a concentration of 20%, group III with a concentration of 30%, group IV (positive control) was given Biopacenton® ointment, and group V (negative control) was given a cream base. Observations of burn healing were carried out macroscopically every day for 15 days, with periodic evaluations every three days until the end of treatment.

Based on the results of the analysis using the ANOVA test, it was obtained that F_{count} (8.70) was greater than F_{table} (2.78) at a significance level of $\alpha = 0.05$. Thus, the null hypothesis (Ho) is rejected and the alternative hypothesis (Ha) is accepted, which indicates a significant effect of administering forest honey cream

formulation, especially at high concentrations, on accelerating the healing of burns in rabbits. The use of honey-based creams or gels has been proven effective in supporting the healing process of second-degree burns. These results are in line with research conducted by Sinulingga et al. (2018) which showed that wound care using honey gel was more effective than the use of 0.9% NaCl in postoperative patients at the Sunan Kudus Islamic Hospital.

In this study, the Least Significant Difference (LSD) test was conducted to compare the effectiveness of various treatments on healing burns. The constant value of LSD obtained was 0.07, which was then used as a basis for comparison between groups. The results of the analysis showed several significant differences, including: there was a real difference between the 10% honey cream group and the 20% honey cream (0.13 > 0.07); there was a real difference between the 10% honey cream group and the 30% honey cream (0.23 > 0.07); there was a real difference between the 10% honey cream group and the Biopacenton® ointment (0.2 > 0.07); there was no real difference between the 10% honey cream group and the cream base (-0.2 < 0.07); there was a real difference between the 20% honey cream and the 30% honey cream (0.1 > 0.07); there was no real difference between the 20% honey cream and the Biopacenton® ointment (0.07 = 0.07); there was no real difference between the 20% honey cream and the cream base (-0.33 < 0.07); there was no real difference between 30% honey cream and Biopacenton® ointment (0.03 < 0.07); there was no significant difference between 30% honey cream and cream base (-0.43 < 0.07); there was no significant difference between Biopacenton® ointment and cream base (-0.4 < 0.07).

Table 1. The results of statistical calculations of the diameter data of burn healers using a Completely Randomized Design (CRD)

Treatment Group	Burn Wound Diameter (in cm)						Total	Mean
	First day	Third day	Sixth day	Ninth day	Twelfth day	Fifteenth day		
Using 10% honey cream	2.00	1.90	1.60	1.30	1.10	1.00	8.90	1.48
Using 20% honey cream	1.90	1.80	1.60	1.20	0.90	0.70	8.10	1.35
Using 30% honey cream	2.00	1.80	1.50	1.10	0.70	0.40	7.50	1.25
Using Biopacenton®	2.00	1.80	1.60	1.20	0.80	0.40	7.70	1.28
Use a cream base	1.90	1.80	1.70	1.70	1.60	1.40	10.10	1.68

Based on the observation of wound diameter, the 30% honey cream group showed the smallest average healing diameter (1.25 cm), followed by Biopacenton® ointment (1.28 cm), 20% honey cream (1.35 cm), 10% honey cream (1.48 cm), and cream base (1.58 cm). From the first day to the 15th day, the wound diameter in the 30% honey cream group shrank from 2 cm to 0.4 cm, indicating a faster healing process compared to other groups. Clinically, wound healing with 30% honey cream was faster than Biopacenton® ointment.

These results are in line with the research of Hendy & Lister (2019) which showed that honey as a primary dressing accelerates the epithelialization of shallow second-degree burns compared to tulle gauze. Another study by Sigala (2021) and Rusyanti et al. (2024) also showed that the effectiveness of flora nectar honey was comparable to silver sulfadiazine in accelerating the healing of burns in rabbits.

According to Sakri (2022) and Khumaidi et al. (2022) it is able to stimulate the formation of new tissue through the anti-histamine effect which reduces tissue edema, thus facilitating the flow of oxygen and nutrients to the wound area. In addition, the hydrogen peroxide content in honey functions as a natural antimicrobial that supports the formation of cytokines and increases ischemic tissue perfusion. Honey also contains various other antimicrobial components, both peroxidative and non-peroxidative. Hydrogen peroxide in honey is effective against various bacteria such as Staphylococcus aureus and Streptococcus. Honey also contains catalase which breaks down hydrogen peroxide into compounds that are safer for body tissues (Wulandari, 2017).

In addition, honey has non-peroxidative antimicrobial properties through its acidic pH, osmotic effect, flavonoid content, phenols, lysozyme enzymes, and good microbes such as Aspergillus and Penicillium, all of which contribute to inhibiting the growth of pathogens (Attsani et al., 2022; Hasbi et al., 2023).

Gunawan (2017) supports these findings, showing that honey can be an alternative treatment for burns as a substitute for topical gentamicin, especially in areas with limited access to medicine.

Honey also acts as an important anti-inflammatory agent in accelerating wound healing. By reducing the levels of inflammatory mediators such as thromboxane B2, PGE2, and PGF2α, honey helps reduce capillary permeability and tissue edema, thereby accelerating the regeneration process (Apriana et al., 2019; Atis, 2020).

Conclusion

The results of the study showed that the administration of 30% concentration honey cream was more effective in healing burns when compared to the treatment group of 10 and 20% concentration honey cream and the negative control group (administration of

cream base). The effectiveness of healing burns between the 30% concentration honey cream group when compared with the positive control group (Biopacenton® ointment) showed a difference but was not very significant (0.03 < 0.07).

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The content of this article does not create a conflict of interest.

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