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THE EFFECTIVENESS OF ACACIA FOREST HONEY GEL ON HEALING BURNSON WHITE RATS

[1]Riski Dwi Utami, [2]Sharfina Oktafajriati, [3]Bimby Irenesia

[1,3]Department of Physiology, Faculty of Medicine, Abdurrab University, Pekanbaru-Riau
[2]Medical Study Program, Faculty of Medicine, Abdurrab University, Pekanbaru-Riau
Email: riski.dwi.utami@univrab.ac.id

ABSTRACT
Background: Prevalence of burns in Indonesia is 0.7%. Proper management can reduce complications due to burns, one of which is the use of acacia forest honey gel from Riau Province.Objective: To analyze the effectiveness of acacia forest honey gel on healing burns in white rats.Method: Randomized post test only control group design. 30 white rats were treated with burns and divided into 5 groups, namely groups that were given acacia forest honey gel 20%, 60%, 80%, bioplacenton, and gel without active ingredients. Burn healing was assessed by measuring the diameter of the wound that had not healed on days 7, 14, and 21. Data analysis was carried out with the one-way ANOVA test and followed by the LSD Post Hoc Test.Results: There was a significant difference in the mean diameter of burns on the 7th, 14th, and 21st days ($p<0.05$). The post hoc LSD test showed a significantly difference between the group given 80% acacia forest honey gel and the control group and the group given bioplacenton.Conclusion: The administration of acacia forest honey gel was able to accelerate the healing of burns and the 80% concentration was the most adequate for the healing of burns.
Keywords: Acacia Honey, Burn, Gel, Wound Healing

INTRODUCTION

Burns are body skin damage caused by heat trauma such as fire, hot water, electricity, chemicals, radiation, and cold trauma (frost bite). Based on World Health Organization (WHO) data, the most common cause of burns is caused by fire, which is 53.1%. The highest incidence of burns in the world occurs in women in the Southeast Asian region [1]. The prevalence of burns in Indonesia reaches 0.7% and the highest rate of 2% occurs in Papua [2].

Burns are damage to the body's skin caused by heat trauma such as fire, hot water, electricity, chemicals, radiation, and cold trauma (frost bite). Based on data from the World Health Organization (WHO), the most common cause of burns is fire, which is 53.1%. The highest incidence of burns in the world occurs in women in the Southeast Asian region [1]. The prevalence of burns in Indonesia reaches 0.7% and the highest rate of 2% occurs in Papua [2].

Epidemiological study at Cipto Mangunkusumo Hospital (RSCM) 2011-2012 data on patients treated during period 2 year was 303 patients. The comparison between men and women is 2.26: 1 and the average age is 25.7 years (15-54 years) Data from Sanglah General Hospital, Denpasar, Bali shows the number of burn cases in 2018-2019 was 55 people with a mortality

rate of 11%. Next is Soetomo Hospital Surabaya in 2011 out of a total of 145 patients, 127 patients (87.6%) recovered were discharged, and 15 patients (10.3%) died [3].

Based on medical record data at Arifin Achmad Hospital Pekanbaru for the period January 2011 - December 2013, there were 12 incidents of contractures in burn patients at Arifin Ahmad Hospital. Based on the degree of burn injury, the most common cause of contractures was grade II with 7 incidents (58.3%) and grade III with 5 incidents (41.7%).. [3] Based on medical record data at Arifin Achmad Hospital Pekanbaru for the period January 2011 – December 2013, it was found that the number of contractures in patients with burns at Arifin Ahmad Hospital was 12 incidents. If based on the degree of burn, the most common causes of contractures in grade II were 7 events (58.3%) and grade III were 5 events (41.7%) [4].

Burn healing goes through several phases, namely the inflammatory phase, the proliferative phase, and the maturation phase which lasts about 8 weeks [5]. Burns are complex wounds, because infected burns can cause further disability and even death. In patients who have extensive and deep burns, the healing process will also take longer and the costs to be borne by the patient will also be higher [6]. Therefore, the management of burns has several goals, namely to reduce pain, accelerate the healing process, and prevent infection and complications [2].

Honey is one of the natural ingredients that can be used for the treatment of burns [7]. The composition of honey is very complex, there are at least 181-200 different substances, so that honey has enormous benefits in both the pharmaceutical, food, beverage and aesthetic industries [8]. Honey has also been widely explored as a tissue regenerative agent. Honey can contribute to all stages of wound healing [9]. The use of honey can increase the granulation and epithelialization process, reduce the amount of exudate, and sterilize the wound from microbes. Honey also has anti-inflammatory and antioxidant activity which is good for wound healing [10].

Honey is a commodity from Riau with high value and well-known in Indonesia [11]. The results of research by Pribadi in 2020 stated that the characteristics of forest honey originating from six bioregions in Riau Province had values that were not significantly different, one of which was honey from Acacia (Acacia Mangium) forests. Forest honey in Riau Province originating from Pelalawan Regency has diastase enzyme parameters that represent the bioregion and has a higher value than other bioregions [12].

Several studies have shown that giving honey can help heal burns. One of them is a study conducted by Hendy in 2019, where giving 1x1 honey can help heal burns for 7 days compared to 1x1 topical nebacetin for 9 days. [13] In addition, other studies have also shown that honey in gel preparations can accelerate the healing of burns. Research conducted by Mulia in 2019 showed that the administration of local Aceh honey gel for 15 days had an effect on healing degree IIB burns in white rats (Rattus norvegicus) [14]. Meanwhile, research conducted by Rahmawati, et al (2020) regarding the effectiveness of honey in the healing

process of second degree burns, it can be concluded that the use of honey in the treatment of burns is superior to other treatments [15].

Based on the data above, this study aims to see the effectiveness of acacia forest honey originating from Riau Province in gel preparations for healing burns in white rats.

METHODS

This research is an experimental study with a randomized post only control group design. Preparation of acacia forest honey gel using the formulation below.

Tabel. 1 Preparation of Acacia Forest Honey Gel

Material	Use	Composition
Honey	Active substance	20%, 60%, 80%
Karbopol 940	Basic gel	2%
Metil paraben	Preservative	0,2%
Gliceryn	Humectants	10%
Triethanolamin	Surfactant	2%
Aquades	Solvent	Added up to 100%

Honey Gel Procedure :

- Measure the ingredients to be used while boiling water at 300c until it boils
- After boiling water, pour it into the crusher then add carbopol940 as a basic gel by sprinkling it, let it stand for 5-10 minutes
- Grind until smooth and without lumps
- After the basic gel is ready, mix the other ingredients (methyl paraben, glycerin, triethanolamine
- Then add distilled water gradually
- Stir well until all is mixed
- Add honey according to the concentration

The picture below is a picture of acacia forest honey gel preparations with concentrations of 20%, 60%, 80%, as well as gels without active ingredients that have been prepared

Figure 1. Gel preparations

The sample for this study used 30 wistar strain white rats (Rattus novergicus) aged 2-3 months and weighing 150-250 grams. Rats were acclimatized for 7 days and divided into 5 groups, namely the group that was given 20%, 60%, and 80% acacia forest honey gel, the negative control group that was given gel without honey, and the positive control that was given bioplacenton. The rat sample was shaved on the back and given inhalation anesthesia with ether. Furthermore, second degree burns were made on the rat's back. Metal with a diameter of 2 cm wrapped in gauze was immersed in water with a temperature of 98 ℃ for 3

minutes, then the metal was affixed for 10 seconds to the rat's back until a second degree burn was formed. The following is a picture showing the process of making burns in rats.

Figure 2. Burn Wound Procedure

After the mice were injured, the wounds were cleaned with normal saline. Then carried out according to the treatment group. Group C1 as the negative control was given a gel without an active ingredient, C2 was given a 15 g bioplacenton rub as a positive control, P1 was given a honey gel spread with a concentration of 20%, P2 was given a honey gel spread with a 60% concentration, and P3 was given a honey gel spread with a concentration of 80 %, the gel was given as much as 0.5 gram once a day, then it was observed and maintained so that the experimental animals did not lick or scratch the wound. Healing of burns was observed by looking at changes in burn diameter on the 7th, 14th and 21st days using a ruler. An increase in the area of the scab on a burn can be a sign for burn healing.

The statistical test used in this study was the One Way Anova test to observe differences in the number of fibroblasts in the five treatment groups. The magnitude of the difference in each group was further analyzed using the LSD Post Hoc Test. The significance value in this study is if the variables analyzed have a p value <0.05.

RESULTS AND DISCUSSION

All samples had an average body weight that was almost the same between groups until day 14. During the study, 2 samples dropped out, namely in the treatment group with bioplacenton, 1 rat on day 4 and in the 60% acacia forest honey gel group, 1 rat on day 7. The following is a table showing the average burn diameter on days 7, 14 and 21.

Table 2. The Mean Diameter of Burns On the 7th Day

Groups	Mean ± SD	*p value*
Gel without active ingredients	4.66± 0.421	p = 0,000
Bioplacenton	3.38± 0.164	
Acacia forest honey gel 20%	4.34± 0.439	
Acacia forest honey gel 60%	4.12± 0.363	
Acacia forest honey gel 80%	3.70± 0.158	

Table 3. The Mean Diameter of Burns On the 14th Day

Groups	Mean ± SD	*p value*
Gel without active ingredients	4.34 ± 0.384	p = 0,000
Bioplacenton	3.12 ± 0.130	
Acacia forest honey gel 20%	4.22 ± 0.526	
Acacia forest honey gel 60%	3.78 ± 0.258	
Acacia forest honey gel 80%	3.34 ± 0.134	

Table 4. The Mean Diameter of Burns On the 21th Day

Groups	Mean ± SD	*p value*
Gel without active ingredients	3.96 ± 0.180	p = 0,000
Bioplacenton	2.68 ± 0.91	
Acacia forest honey gel 20%	3.62 ± 0.152	
Acacia forest honey gel 60%	3.34 ± 0.67	
Acacia forest honey gel 80%	2.84 ± 0.40	

Table 5. Post Hoc Test on the 7th Day

Groups	Gel without active ingre-dients	Gel with-out active ingre-dients	Gel without active ingre-dients	Gel without active ingre-dients	Gel without active ingre-dients
Gel without active ingredients		0.000	1,000	0,186	***0,002**

Bioplacenton		***0,002**	***0,022**	1.000
Acacia forest honey gel 20%			1,000	0,065
Acacia forest honey gel 60%				0,061
Acacia forest honey gel 80%				

Table 6. Post Hoc Test On the 14th Day

Groups	Gel without active ingre-dients	Gel with-out active ingre-dients	Gel witho ut active ingre-dients	Gel witho ut active ingre-dients	Gel witho ut active ingre-dients
Gel without active ingredients		0.000	1,000	0,130	***0,000**
Bioplacenton			***0,000**	***0,044**	1.000
Acacia forest honey gel 20%				***0,046**	***0,004**
Acacia forest honey gel 60%					0,146
Acacia forest honey gel 80%					

Table 7. Post Hoc Test On the 21th Day

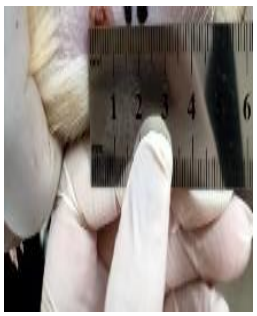
Groups	Gel without active ingre-dients	Gel with-out active ingre-dients	Gel without active ingre-dients	Gel without active ingre-dients	Gel without active ingre-dients
Gel without active ingredients		1.000	***0,010**	***0,033**	1,000
Bioplacenton			***0,05**	***0,018**	1.000
Acacia forest honey gel 20%				1,000	0,08
Acacia forest honey gel 60%					***0,027**
Acacia forest honey gel 80%					

Based on the table of average burn diameters above, it appears that burn healing was measured on days 7, 14, and 21, the smallest average value of burn diameter was in the treatment group with bioplacenton. Furthermore, the smallest burn diameter was in the group that was treated with 80% acacia forest honey gel. This research shows that when compared to the group that was given a gel without an active ingredient, the administration of acacia forest honey gel was able to accelerate the healing process of burns, although its effectiveness had not exceeded that of the group that was given bioplacenton.

The one way ANOVA test on the mean diameter of burns on days 7, 14, and 21 obtained a p value = 0.000 (p value $\leq$ 0.05). This means that there were differences in burn healing between treatment groups on days 7, 14 and 21 significantly. The results of the post hoc test analysis on day 7 showed that there was a significant difference (p value = 0.05) in the 20% and 60% acacia forest honey gel group and the group that was given bioplacenton. In addition, there was a difference between the group that was given 80% acacia forest honey gel and the group that was given the gel without active ingredients significantly.

The post hoc test on the 14th day showed a significant difference (p value <0.05) between the group given the gel without the active ingredient and the group given acacia forest honey gel with a concentration of 80%, then there was a significant difference between the group given bioplacenton and the group given acacia forest honey gel with a concentration of 20% and 60%. In addition, there was a difference between the groups that were given 20% acacia forest honey gel and the 60% and 80% acacia forest honey gel groups significantly. The results of the post hoc test analysis on the 21st day, showed that there was a difference (p value ≤ 0.05) in the gel without active ingredient and bioplacenton group with the acacia forest honey gel group with concentrations of 20% and 60%, and in the 20% honey gel group with 60% honey gel group significantly.

The following is a comparison of burns between groups on the 7th, 14th, and 21st days.



(a)

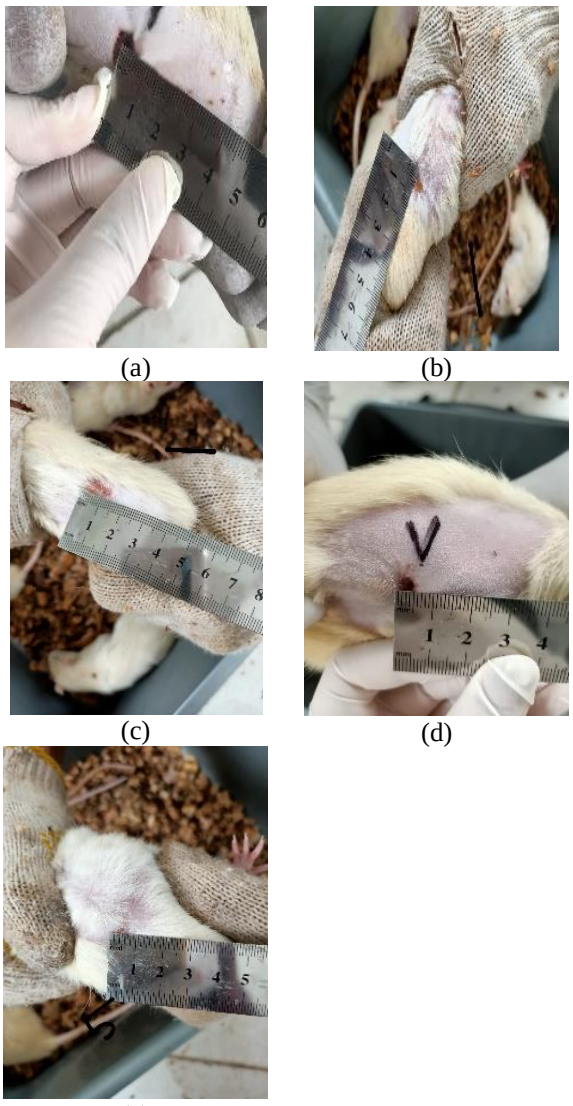
(b)

(c)

(d)

(e)

Figure 3. Burns on the 7th day with the order of the group being given a gel without active ingredients (a), bioplacenton (b), acacia forest honey gel with concentrations of 20% (c), 60% (d), and 80% (e)

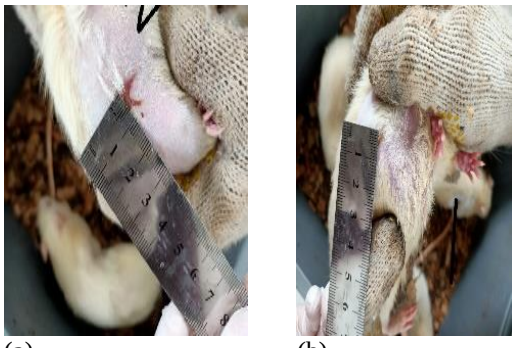


(a) (b)

(c) (d)

(e)

Figure 4. Burns on the 7th day with the order of the group being given a gel without active ingredients (a), bioplacenton (b), acacia forest honey gel with concentrations of 20% (c), 60% (d), and 80%(e)



(a) (b)

(c)

(d)

(e)

Figure 5. Figure 3. Burns on the 7th day with the order of the group being given a gel without active ingredients (a), bioplacenton (b), acacia forest honey gel with concentrations of 20% (c), 60% (d), and 80% (e)

The results showed that giving acacia forest honey gel was able to accelerate the healing process of burns when compared to the group that was given the gel without active ingredients. Although the best healing on days 7, 14, and 21 was in the group that was given bioplacenton, administration of acacia forest honey gel with a concentration of 80% was able to approach almost the same results as the bioplacenton group. The ability of acacia forest honey gel in the healing process of burns is because honey contains flavonoids, phenols and various ingredients that can help the wound healing process. This honey content plays an osmotic, anti-bacterial, anti-inflammatory and anti-oxidant effect which plays an important role in the wound healing process which consists of the inflammatory, proliferation, and maturation phases [8,9,10].

Giving acacia forest honey with gel preparations with various concentrations is expected to have a better effect because the gel preparations are moist where the water content can keep moisturizing the wound area and its surroundings. Skin moisture can increase cell migration and re-epithelialization thereby accelerating the wound healing process. In addition, gel preparations are cold and soothing to the wound and will provide comfort with reduced pain. Gel preparations were made with various concentrations to see which concentrations were most effective in accelerating the healing process of burns. In addition, with the concentration of honey given, the expected effect in healing burns will be more consistent than direct administration of honey without knowing the concentration given.

The results of this study are in accordance with previous research conducted by Hendy, where giving 1x1 honey can help heal burns for 7 days compared to 1x1 topical nebacetin for 9 days. The difference is in this study using gel preparations and comparison with the positive control group using bioplacenton [13]. In addition, the results of Mulia 2019 also showed results that administration of local Aceh honey gel for 15 days had an effect on healing degree IIB burns in white rats (Rattus norvegicus) [14]. These results are the same as our research.

The results of the study were not exceeded in the group that was given bioplacenton, so further consideration could be given to giving acacia forest honey gel with a concentration higher than 80%. This increase in concentration is expected to be able to get the best concentration and be effective in healing burns. In addition, it is necessary to carry out further examination of the composition of the content of acacia forest honey originating from Pelalawan Riau in order to find out the active substance content in the honey and to carry out a toxicity check on this honey so that the trial can proceed to the next stage.

CONCLUSION

The administration of acacia forest honey gel was able to accelerate the healing of burns in white rats with the most effective dose being a concentration of 80%. There were significant differences between the treatment groups, namely the group that was given gel without active ingredients, bioplacenton, acacia forest honey gel with concentrations of 20%, 60%, and 80% on healing burns in rats.

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