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The Effect Of Topical Robusta Coffee Extract (Coffea Robusta) In Accelerating The Healing Process Of Cuts In The Backs Of White Wistar Rats (Rattus Norvegicus)

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ABSTRACT

The purpose of this study was to test the research hypothesis, namely whether topical administration of coffee extract affects the acceleration of the healing process of cuts on the backs of rats. Based on the results of the research that has been done, it can be concluded that the administration of the Robusta coffee extract (Coffea Robusta) can accelerate the healing of cuts in white Wistar rats, which is characterized by an average difference in the percentage of the recovery. However, after the T-test, the results obtained for H0 were rejected, meaning there was no significant difference between the control group, which was only given 0.9% NaCl and the treatment group, which was given Robusta coffee extract. Topical can accelerate wound healing. The results of this study are expected to be suggestions and references for other researchers who wish to study the use of Robusta coffee extract in understanding the healing process of cuts.

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1. INTRODUCTION

The skin is the body's outermost part, which protects itself from external trauma and the entry of foreign objects [1]. Humans, in their daily activities, often cannot be avoided accidents. Even though these daily activities are routine and usually carried out, humans are always faced with certain hazards such as infectious hazards, toxic reagents, and electrical equipment or glasses that are used daily can potentially experience a risk of injury. If the skin is exposed to trauma, it can cause sores/*Vulnus*. These injuries can damage the tissue, thus disrupting bodily functions and can interfere with daily activities [2]. Wounds are damage to a network unit or component, where specifically, there is a damaged or missing tissue substance. A wound is a state of damage to the continuity of the skin, mucosa, bones, or other organs that can occur intentionally or unintentionally for certain purposes. A wound can be interpreted as damage to a part of the body that appears on the skin as tissue cut off, torn, or damaged for some reason [2].

Wounds can be caused by trauma, sharp or blunt objects, changes in temperature, chemicals, or animal bites. Damages, in traumatology, are grouped into several categories, namely categories of wounds based on their causes, such as cuts, bruises, stab wounds, abrasions, and torn wounds. Cut wounds are usually caused by sharp objects such as knives, razors, or scalpels in processes characterized by the edges of the wound being straight and regular lines [3]. In general, wounds can heal by themselves. However, the wound will fail to cure if factors hinder it, so the initial, unexpected damage becomes extremely difficult to heal [4]. Wounds that do not heal properly can affect the sufferer's condition and cause high expenses for treating the injury [5].

Therefore, it is not enough to allow the wound to heal independently because if the damage is not treated, it can lead to wound healing complications, namely infection and bleeding. Wound healing is a continuous process of inflammatory, epithelial, endothelial cells, platelets, and fibroblasts that interact to repair tissue damage. The wound-healing process is important because the skin is the only organ exposed to the outside world. The skin has specific functions for the body, namely protective, sensory, thermoregulatory, metabolic, and sexual signaling functions. When the skin loses its continuity, the procedure cannot function as it should [6]. Therefore, the wound-healing process

requires proper management and treatment so that the wound area does not become infected and does not cause chronic wounds.

Wound healing involves several components, including cells and chemical substances needed in inflammation, angiogenesis, and collagen deposition [7]. This process goes through several phases: hemostasis, inflammation, proliferation, and remodeling. The hemostatic phase occurs shortly after the wound and is characterized by the formation of platelet aggregation. This process is needed to close the damage that occurs in blood vessels. The next phase is inflammation occurring 1–4 days after injury. This phase is characterized by infiltrating neutrophils and macrophages in the wound tissue. Macrophage cells will release inflammatory mediators and enzymes to start the next phase, namely the proliferative phase. The proliferative phase occurs 4 to 21 days after injury, characterized by angiogenesis, collagen deposition, granuloma tissue formation, wound contraction, and epithelialization. The final phase is remodeling 21 days to 2 years after the injury. This phase is marked by forming new networks [8].

The process of wound healing is a biological process that occurs in the body, involving a series of processes that are complex, vulnerable, and highly likely to be disrupted or failed, so optimal conditions are needed to obtain wound healing [9]. The goals of wound management are minimizing tissue damage, oxygenation, proper nutrition for wound tissue, reducing risk factors that inhibit wound healing, accelerating the healing process, and reducing the incidence of infected wounds [9].

Wound care is a process that accelerates wound healing with various methods. Treating wounds aims to prevent trauma (injury) to the skin, mucous membranes, or other tissues caused by trauma, fractures, and surgical wounds that can damage the skin surface. Several types of treatment can be done to support the wound healing process, such as keeping the wound area clean to speed up the tissue healing process [10]. In recent years, wound care methods have also experienced developments supported by technological advances in the health sector. In wound care, there is local (topical) or systemic (oral) administration of drugs, or you can also combine the two in the wound care process [11]. Today's principles in topical wound therapy include removing necrotic tissue, controlling bacteria, managing wound exudate, and providing the wound surface to keep it moist and protected.

Drugs that are given topically can also increase patient compliance because they are easier to use and have lower risks [12]. Topical preparations consist of creams, lotions, ointments, and gels. The cream is a semi-solid emulsion in either the water-in-oil (w/o) or oil-in-water (o/w) type. The advantage of cream preparations compared to other topical preparations is that creams are easier to spread evenly on the skin surface [13]. Products that are often used in clinical practice for wound care are antiseptic products such as povidone-iodine, chlorhexidine, or hydrogen peroxide. Product selection must be based on cost, convenience, and security [5].

Treatment and healing of wounds using herbal or natural ingredients have been widely used, including coffee extract (*Coffee*). Coffee is one of the plants that is empirically used as an antibacterial drug. Coffee grounds as a wound treatment have been used as traditional medicine almost all over the world in coffee plantations. Since tens of years ago, residents in coffee plantations in Indonesia have known him. The results of treating wounds using coffee do not appear to cause infectious complications (Pangestu, 2020). Arabica coffee (*Coffea Arabica*), Liberika coffee (*Coffea Liberica*), and Robusta coffee (*Coffea Robusta*) are the most widely cultivated types of coffee in Indonesia. Compared to fruits and vegetables, coffee contains more antioxidants. Some coffee compounds are polyphenols, flavonoids, proanthocyanins, coumarins, chlorogenic acids, trigonelline, and tocopherols (Pangestu, 2020). The part of the coffee plant that can be used for wound healing is the coffee bean grinding the dry coffee beans into coffee powder.

Based on the background described above and the benefits of coffee grounds which the people of Indonesia have long known as traditional treatment and wound healing, this is an important reason for researchers to conduct a more in-depth study through experimental laboratory research on the effect of giving Robusta coffee extract (*Coffea Robusta*) manually. Topical in accelerating the healing process of cuts on the backs of white Wistar rats (*Rattus norvegicus*).

2. METHOD

This research is a type of laboratory experimental research or true experiment. The research design used a post-test with a control group design to analyze the effect of topical administration of Robusta coffee extract (*Coffea Robusta*) in accelerating the healing process of cuts on the backs of white Wistar rats (*Rattus Norvegicus*). The sample for this study were adult male Wistar white rats (Rattus norvegicus) weighing 160-200 grams and 2-3 months old. The rat samples to be used in the study consisted of two treatment groups, namely coffee extract (test group) and 0.9% NaCl (control group). The number of rat samples used was 16 and considered a large selection with eight mice in each group. Research variables are everything that will become the object of research observation [14]. The variables in this study consist of independent variables and dependent variables.

Test Animal Acclimatization

Acclimatization is an adjustment (self) to a new climate, environment, conditions, or atmosphere. Before being given treatment, all white rats were first adapted to the Animal House laboratory for one week. The white rat is adapted to a new place of residence, environment, food, and drink. Rats were given food and drink according to their needs (*ad libitum*).

Making Cuts on Test Animals, Handling Wounds, and Observing Wounds

The fur around the rat's wound area (back) is shaved according to the desired area of the incision wound. After being shaved, the rats were desensitized by using a combination of ketamine (80 ml/kg BW) and xylazine (5 ml/kg BW) so that the rats did not feel pain and avoided the excessive movement that the rats would cause. The rats were then injured by slashing with a scalpel blade ± 2 cm long to the dermis layer.

After the incision, treatment was given based on the wound care protocol and continued according to the treatment group. Control group: Rats were treated with 0.9% NaCl (no coffee extract) and then covered with gauze. Treatment group: The rats were treated with coffee extract topically and then covered with gauze. Treatment of the incisions in the rats was carried out twice daily, in the morning and evening, for 14 days. The healing of cuts in white rats was observed by measuring the average length of the wound every day, starting from the first day of making the wound until the 14th day, by calculating the percentage of damage healing with the formula:

$$P = \frac{do - dx}{do} \times 100\%$$

Information:

P: Percentage of wound healing

Do: Initial wound length

Dx: Length of a wound on a given day

Observations were carried out for up to 14 days according to the length of the normal wound healing process reaching the proliferative phase, which lasted around the 3rd and 14th day after the wound occurred. After 14 days, all rats were euthanized by inhalation of excess technical chloroform.

Phytochemical Screening

Testing for secondary metabolites was carried out to determine the presence of secondary metabolites in natural product samples. Secondary metabolites are metabolic compounds that are not essential for the growth of organisms and are found in different and unique forms between one species and another. This screening was carried out by identifying secondary metabolites such as flavonoids, alkaloids, saponins, and tannins contained in Robusta coffee extract preparations.

Data analysis

The research data were analyzed using the SPSS program. The data normality test was analyzed using the Kolmogorov-Smirnov test approach. The hypothesis was analyzed using the t-test or the independent sample T-test approach at a significant level (α) of 0.05 to test the hypothesis [15].

3. RESULTS AND DISCUSSION

The results of the phytochemical test indicated the presence of secondary metabolites contained in the cream of Robusta coffee extract (*Coffea Robusta*). Flavonoids, alkaloids, saponins, glycosides, tannins, and steroids/triterpenoids. These compounds will later work to accelerate the healing process of cuts on the backs of Wistar-strain white rats (*Rattus Norvegicus*).

Graph.1 Wound Healing Percentage Graph

Table 1. Data Normality Test

Kolmogorov-Smirnov Test		
N		16
Normal Parameters[a,b]	Mean	1.7217857141
	Std. Deviation	.22924973751
Most Extreme Differences	Absolute	.114
	Positive	.114
	Negative	-.114
Test Statistic		.114
Asymp. Sig. (2-tailed)		.200[c,d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

Based on the results of the normality test that was carried out using the One-Sample Kolmogorov-Smirnov Test, a significant effect of 0.200 was obtained. The data is said to be normally distributed if the p-value> 0.05 [16]. Therefore, it can be concluded that the data is normally distributed.

Table 2. Homogeneity Test Results

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Result	Based on Mean	.078	1	14	.785
	Based on Median	.077	1	14	.786
	Based on Median and with adjusted df	.077	1	13.995	.786
	Based on trimmed mean	.079	1	14	.782

Based on the output of the homogeneity of variance test using the Levene test, the probability value in the significance column is 0.785. Because the significance probability value is more than 0.05, it can be concluded that the control and treatment groups come from populations with the same variance or both groups are homogeneous.

Table 3. T-test results

Independent Samples Test									
Levene's Test for Equality of Variance			t-test for Equality of Means						
Result in Equal variances	F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
								Lower	Upper
Assumed	.078	.785	.436	14	.669	.05142	.11784	-.20133	.30418
Not assumed			.436	13.79	.669	.05142	.11784	-.20168	.30453

In Table 3, it can be seen that the probability value (sig.2-tailed) with the t-test is 0.785. The significance value obtained was greater than 0.05, so H0 was accepted, or the wound healing in the two groups was not significantly different.

Discussion

The purpose of this study was to test the research hypothesis, namely whether topical administration of coffee extract affects the acceleration of the healing process of cuts on the backs of rats. In the initial phenomenon, it has been described that generally, wounds can heal through several phases, namely hemostasis, inflammation, proliferation, and remodeling, which involve several components, including cells and chemical substances needed in inflammation, angiogenesis, and collagen deposition [7]. However, wounds can fail to heal if factors hinder them, so common injuries become extremely difficult to heal [4]. Wounds that do not heal properly can affect the patient's condition. Therefore, the damage is not enough to be left to heal and requires wound treatment using natural ingredients such as topical drugs such as Robusta coffee extract (Coffea Robusta). Robusta coffee extract (Coffea Robusta) contains chlorogenic acid, which has an antioxidant effect and can protect the body from the effects of free radicals and anti-bacterial [17]. The coffee extract can also accelerate wound healing and remove wound odor because the hygroscopic nature of coffee can absorb water in the wound and maintain wound moisture, so it is often used as a herbal treatment for injuries.

The materials used in this study included: coffee powder, alcohol, or 96% ethanol. The incisions in the control group were treated with 0.9% NaCl (no coffee extract) and then covered with gauze. The cuts in the treatment group were given coffee extract topically and then covered with gauze. The research and trials on the control and treatment groups showed that the administration of Robusta coffee extract accelerated wound healing in white Wistar rats. These results can be seen from the comparison of the mean length of the wound in the control group and the treatment group in healing cuts; topical administration of Robusta coffee extract was better in accelerating the wound healing process in the treatment group than the control group which was only given 0.9% NaCl with an average value an average of 48% in the control group and 50% in the treatment group. However, after the t-test was conducted to see the average difference between groups, the significance value obtained was 0.785 or ≥ 0.05, then H0 was rejected, or there was no significant difference between the control and treatment groups.

Based on the results obtained, this study generally showed that the wound-healing process between the control and treatment groups was not significantly different. This might happen because researchers did not compare the effectiveness and optimality of doses of just one dose. Although these findings provide further information regarding the effect of topical administration of Robusta coffee (Coffea Robusta) extract in accelerating the healing process of cuts on the backs of white Wistar rats (Rattus norvegicus), there are several opportunities to improve and develop research in the future. In this study, researchers did not compare doses and dosages of coffee extract preparations. As a result, there is no information regarding differences in effectiveness between dose levels and which doses of Robusta coffee extract are most effective in accelerating the healing of cuts on the backs of white Wistar rats.

4. CONCLUSION

Based on the results of the research that has been done, it can be concluded that the administration of the Robusta coffee extract (Coffea Robusta) can accelerate the healing of cuts in white Wistar rats, which is characterized by an average difference in the percentage of the recovery.

However, after the T-test, the results obtained for H0 were rejected, meaning there was no significant difference between the control group, which was only given 0.9% NaCl and the treatment group, which was given Robusta coffee extract.

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