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Comparison of the Effectiveness of Giving Jicama Extract (*Pachyrhizus Erosus*) with Egg White in the Process of Healing Burns on the Backs of Wistar White Rats (*Rattus Norvegicus*)

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ABSTRACT

Burns are tissue damage caused by heat, chemicals, electricity, radiation, or the sun. The seriousness (degree) of the wound is based on the depth of the wound and the amount of skin affected. This condition can be painful and cause infection if not treated. For this reason, it is necessary to treat and treat burn wounds using various forms of medication to help the burn wound healing process. This study aims to determine whether a cream made from yam extract (Pachyrhizus Erosus) and egg white can speed up recovery from burn damage. In this study, we compared the efficacy of treating burns on the backs of white rats (Rattus norvegicus) of the Wistar strain using jicama (pochyrhizus erosus) extract vs. egg white using a pre-test, post-test, with control group design. This study tests the claim that jicama extract cream heals burn wounds better than egg white. When undertaking this research, it's crucial to consider other factors, such as extract concentration. Another factor affecting this study's results is the small sample size of 24 white mice. A large number of samples in a research study minimizes the chance of generalization errors. Stress can significantly affect wound healing in rats. Therefore, it must be considered as an internal factor. Stress in mice raises cortisol levels, suppressing cellular immunity and slowing wound healing.

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1. INTRODUCTION

The skin is an organ that reflects the state of one's health and vitality and an elastic outer layer that shields the body from the effects of the human environment (Mawarni et al., 2020; Rumpf, Burger, & Schulze, 2023). In addition to insulating internal organs from the sun's rays, fire, hot water, pressure, scrapes, and other irritants, the skin also acts as an intermediary between the body and the outside world. Wounds, boils, and burns are just a few skin lesions that can develop (Andriana, Lister, Fachrial, Ginting, & Lie, 2020; Sun et al., 2023).

Whether on purpose or by accident, the skin can be burned by touching a hot liquid, fire, chemicals, electricity, or radiation (Ivanalee et al., 2018). There is a significant frequency of burns in the home setting, making it a primary public health concern (Hendy & Lister, 2019). Burns are the detrimental effects inflicted upon bodily tissues due to exposure to various heat sources, chemicals, electricity, UV light, or radiation. The phenomenon above leads to elevated morbidity rates following burn injuries over an extended duration.

In 2015, 67 million fire and heat injury cases caused 176,000 deaths. The American Burn Association National Burn Repository reports that the most common causes of burns in the world are flames (44%), boiling water (33%), flame contact (9%), electricity (4%), and chemicals such as anesthetics and alcohol (3%). The Ministry of Health's 2013 Basic Health Report reported that burns rank sixth due to unintentional injuries, with a prevalence rate of 0.7%. The Ministry of Health also indicates that children aged 1-4 years are a vulnerable group with a prevalence rate of up to 1.5% (Latcuba, Chiuman, Nasution, & Ginting, 2022). The pain caused by burns can be so severe that it interferes with daily activities; if not treated, the burns experienced will worsen. Burns affect the skin

and subcutaneous tissue and have primary or secondary effects on every body system around the wound (Thahir & Wahyuni, 2021).

Antimicrobials like bioplacenton, silver sulfadiazine, and bacitracin can help burn wounds recover. These treatments are pricey; thus, consumers choose natural ones (Hendy & Lister, 2019). Indonesia has significantly increased the use of plants and natural compounds in traditional medicine; some have even been mass-produced. Chemical-based medications have more adverse effects than conventional medicine. Traditionally, raw materials are cheap and readily available (Adha, Dewana, Suyono, Chiuman, & Ginting, 2022). The WHO recognizes natural goods as cheap medicinal components for much of the world. Additionally, several research studies have demonstrated that medicinal plants have antioxidant and therapeutic ingredients (Ginting et al., 2020). WHO also reported that about 80% of people in underdeveloped nations use plants as medicine. Secondary metabolites, including alkaloids, flavonoids, saponins, tannins, steroids, and triterpenoids, are produced by plants and can treat many ailments (Syaputri, Girsang, & Chiuman, 2022).

Jicama (pachyrhizus erosus) is a popular medicinal herb. Jicama treats kidney and gallstones, improves digestion, prevents constipation, stops diarrhea, treats burns, prevents cancer, moisturizes skin, and maintains healthy skin (Li & Li, 2020). Fiber, inulin, vitamin C, flavonoids, and daidzein in jicama tubers are prebiotics, anti-diabetes mellitus, immunomodulators, phytoestrogens, and cosmetic Jicama seeds contain isoflavonoids, tannins, saponins, proteins, lipids, Fe, Ca, and rotenoids (Rahminiwati, 2020). Natural burn treatment can include free-range chicken eggs. Egg whites are mostly protein—ovotransferrin, lysozyme, ovomucin, ovomucid, ovalbumin, and avidin. Antibacterial and antiviral properties of ovotransferrin, lysozyme, and ovomucin. Ovalbumin, another egg white component, could be employed as a medication carrier and growth amino acid supply. Egg whites create new cell tissue and speed wound healing (Hendriati, Hamid, Widodo, Wandasari, & Rista, 2018; Mulyaningsih & Mufidah, 2021). Protein in egg whites includes vitamins and essential amino acids. This protein releases growth factors aiding the healing of burn wounds (Juleli, Amir, & Serudji, 2020). In keeping with the issue above statement, the goal of this study was to compare the efficacy of treating burns on the backs of Wistar-strain white rats (Rattus norvegicus) using yam extract (pochyrhizus erosus) to that of treating burns with egg white.

2. METHOD

This study is a controlled experiment in which the researchers attempt to establish a causal connection between the independent and dependent variables by eliminating confounding factors (Notoatmodjo, 2018). In this study, we compared the efficacy of treating burns on the backs of white rats (Rattus norvegicus) of the Wistar strain using jicama (pochyrhizus erosus) extract vs egg white using a pre-test, post-test, with control group design. This research comprises independent and dependent variables (Suwarno & Nugroho, 2023). the independent variable is jicama extract and egg white, and the dependent variable is the process of healing burns on the backs of white Wistar rats.

Animals are acclimated, jicama extract and cream are prepared, egg white preparations are made, burn wounds are created on acclimated mice, and histological observations are made on tissue samples using a microscope. SPSS was used to do the statistical analysis of the research data. The Kolmogorov-Smirnov test was used to examine the normality of the data ($p > 0.05$). The t-test, also known as the independent sample T-test, was used to determine whether or not there was a statistically significant difference in the levels of efficacy between the trial groups (p 0.05).

3. RESULTS AND DISCUSSION

Research Result

The University of North Sumatra's Faculty of Mathematics and Natural Sciences studied jicama's composition and phytochemical analyses (Pachyrhizus erosus). Sampled was a jicama (Pachyrhizus erosus) extract from local farmers in the Parapat region of Samosir Island, North Sumatra. The concentration of secondary metabolite chemicals in jicama extracts was calculated using findings from phytochemical studies performed on ethyl acetate, n-hexane, and 90% alcohol/ethanol fractions. Jicama (Pachyrizus arosus) extracts were tested for their phytochemical composition, and the results showed that they included flavonoids, saponins, tannins, and alkaloids. Because of its

potent antioxidant components, jicama extract must contain phytochemicals that can be employed in medicine.

Participants in the study were administered 0.9% NaCl or control (P0), 10% jicama extract cream (P2), or egg white (P3). Burn wound healing was observed every two days for 14 days. From day one to day 14, the P1 therapy group had a 27.31% burn wound healing rate. In groups P1 and P0, burn wound healing averaged 17.61% and 6.47%. Group P1 had 58.05% healing on day 14. Burn wound healing averaged 33.54% and 11.59% in groups P1 and P0 on day 14. According to the average percentage of burn wound healing in each group, group P1 or the 10% jicama extract cream group recovered burn wounds faster. Control wound healing was slowest (P0).

Table 1. Normality Test (Shapiro-Wilk Technique)

Group Extract Dose	Statistical	Significance
Control (P0)	0,827	0,056
Jicama Extract 10% (P1)	0,931	0,529
Egg White (P2)	0,932	0,534

Based on Table 1, a normality test using SPSS showed that the control and treatment groups had significant values for the burn wound healing % variable from day 1 to day 14. The Shapiro-Wilk Test significance value (p) exceeds the conventional margin of p>0.05, 0.056 for Group P0, 0.529 for Group P1, and 0.534 for Group P2. Shapiro-Wilk normality test shows data is usually distributed.

Table 2 displays the percentage of burn wound healing process seen in each group P0, P1, and P2 after 14 days of treatment. The results demonstrate a significant difference (p0.05) in the data variance from the research variables between the control group (P0), group P1, and group P2.

Table 2. Test Of Homogeneity of Variances

Results Category	Levene Statistical	Significance
Mean	3,570	0,046
Median	1,705	0,206
Trimmed Mean	3,400	0,053

Table 3. ANOVA Test

Comparison of wound healing percentages	Number of Comparisons	df	Significance Value
Between Groups	1740,229	2	0,000
In Group	31,637	21	
Total	1771,866	23	0,000

The percentage of time it took for burn wounds to recover was compared across the four study and observation groups shown in Table 3 below. According to the "Sig" column data in the table. The p-value (p-value) that was calculated is 0.000. Consequently, Ho is rejected at the 5% significance level, leading one to the conclusion that the four groups differ significantly concerning the mean percentage of healing of burn wounds.

Table 4. Post Hoc Bonferroni Test Results

Test	Percentage Healed Wounds (I)	Percentage Extract Dosage (J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Bonferroni	Control (P0)	Jicama Extract 10% (P1)	-20.84125*	.61370	.000	-22.4377	-19.2448
		Egg White (P2)	-11.14500*	.61370	.000	-12.7415	-9.5485
	Jicama Extract 10% (P1)	Control (P0)	20.84125*	.61370	.000	19.2448	22.4377
		Egg White (P2)	9.69625*	.61370	.000	8.0998	11.2927
	Egg White (P2)	Control (P0)	11.14500*	.61370	.000	9.5485	12.7415
		2 Jicama Extract 10% (P1)	-9.69625*	.61370	.000	-11.2927	-8.0998

*. The mean difference is significant at the 0.05 level.

Additional tests utilize the Bonferroni Post Hoc Test, with results shown in Table 4. White rats (Rattus norvegicus) of the Wistar strain show differences in the average percentage of burn wound

healing when compared across all groups, as shown by the comparison between groups I and J. These differences are indicated by an asterisk ("*"). SPSS for Windows was used for the Bonferroni Post Hoc Test on groups (Campbell & Stanley, 2015).

Table 5. Physiological Average Visual

Rat Group		Observation Day 2							
		0	2	4	6	8	10	12	14
Control (P0)	Color	White	White	White Brown	Brown	Brown	Brown	Dark Brown	Dark Brown
	Scab formed	No	No	Yes	Yes	Yes	Yes	Yes	Yes
	Scab Loose	No	No	No	No	No	No	No	No
Jicama Extract 10% (P1)	Color	White	White Brown	Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Reddish Brown
	Scab formed	No	Yes	Yes	Yes	Yes	Yes	Yes	No
	Scab Loose	No	No	No	No	No	No	No	Yes
Egg White (P2)	Color	White	White Brown	Brown	Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown
	Scab formed	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Scab Loose	No	No	No	No	No	No	No	No

Table 5 shows that the control group (P0) and treatment group P2 had a longer healing process until the 14th day, as seen by the burn wound's color change, scab formation, and scab removal. Since the P0 group received no therapy, wound healing was routine. The P2 treatment group with egg whites had a little more significant effect on burn healing than the P0 group, but not enough. Table 5 shows that the P1 treatment group's burn lesion healed on the 14th day when the color turned reddish brown, and the scab fell off. The P1 group healed faster than P0 and P2.

Collagen density in the skin tissue of mice from each group was examined using a histopathological preparation and a Java-based image processing program application developed at the National Institutes of Health and the Laboratory for Optical and Computational Instrumentation.

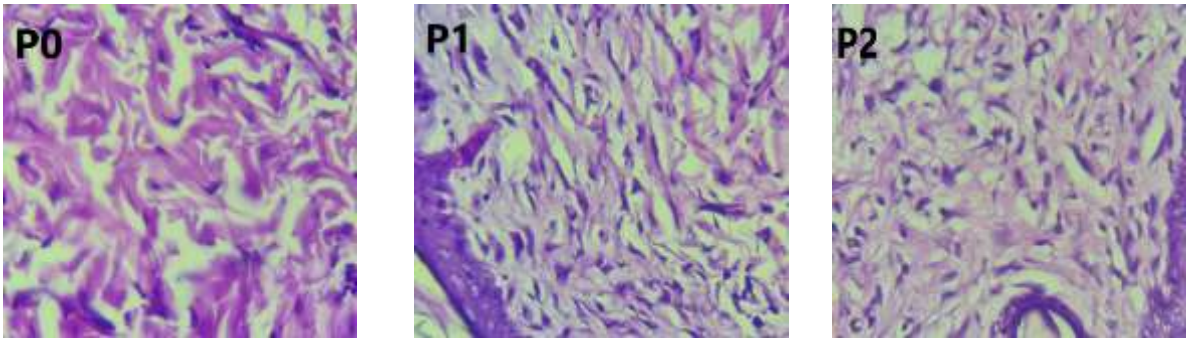

Figure 1. P0 (Control) Moderate collagen density remains rare—P1 (10% Jicama Extract) Dense, plentiful collagen. P2 (Egg White Administration) Medium collagen density is becoming dense.

In Figure 1, the standard control group (P0), which had burns and was given 0.9% NaCl, had the lowest collagen density. Image J software was used with the area fraction method to observe collagen density preparations in 5 fields of view at 400x magnification. The photo shows that the P0 group (blue) has less collagen density than the others. Group P1, who had burns and 10% jicama extract cream, had higher collagen density than group P2, who received egg whites. This is because jicama extract has 10% more metabolites than egg white.

Research Discussion

The P0 control group had the lowest burn wound area reduction of all treatment groups. This is because the control group lacks active chemicals that speed burn wound healing. The negative control

is merely a wound dressing that prevents skin water evaporation (Asadi et al., 2013; Grey & Harding, 2009; Latcuba et al., 2022; Sorg, Tilkorn, Hager, Hauser, & Mirastschijski, 2017). At 10% or P1, Yam extract cream reduced burns more than P2 or egg white. Because creams with 10% jicama extract include more active ingredients, they can minimize burn wound healing. According to numerous experts, antibacterials are only inhibitory (bacteriostatic) at low doses but kill microorganisms at high ones (Baquero & Levin, 2021; Enwemeka, Baker, & Bumah, 2021; Lin, Bao, & Wu, 2019; Shehabeldine et al., 2023).

Cream preparations reduce burns better than gel preparations because they contain an oil phase and a water phase, so they stick to the skin longer than gel preparations, which only contain water-soluble ingredients (Erwiyani, Haswan, Agasi, & Karminingtyas, 2020; Grey & Harding, 2009). The secondary metabolites in jicama affect burn wound reduction. Antibacterial flavonoids produce complex molecules against external proteins that damage bacterial cell membranes. Anti-inflammatory, antioxidant, and pain-relieving flavonoids increase blood circulation and prevent blood vessel obstructions (Enwemeka et al., 2021; Lin et al., 2019).

Flavonoids inhibit leukotriene production enzyme lipoxygenase—flavonoids also lower prostaglandin synthesis by inhibiting arachidonic acid metabolism. Flavonoids also suppress inflammatory lysosomal enzymes. Blocking these inflammatory mediators can slow inflammation (Salem, Helmi, & Assaf, 2018). Quercetin increased collagen and sebaceous gland production, wound diameter decrease, and wound color intensity reduction in grade IIA burn wounds (Ahmed et al., 2019; Coskun, Kanter, Korkmaz, & Oter, 2005; Kurniawan, Pertiwi, & Lestari, 2021). The antioxidants in quercetin can boost collagen synthesis and VEGF. Collagen, a protein found in connective tissue, strengthens new tissue after injury and aids wound healing. Histopathological investigations showed that the P1 group had denser and more plentiful collagen, as was expected.

Tannins are antioxidants and anti-inflammatory. Antioxidants reduce inflammation in numerous ways. The first method inhibits neutrophil, monocyte, and macrophage oxidant production, inhibiting HOCl and OH oxidant formation. Second, tannins directly inhibit reactive oxidants such as OH and hypochlorous acid (Ahmed et al., 2019; Alamgir, 2018; Mawarni et al., 2020). Research shows that saponins stimulate fibroblast collagen synthesis and decrease matrix metalloproteinase expression in skin tissue. Protein phosphorylation by saponin boosts skin fibroblast collagen production. Saponins enhance wound matrix resynthesis. Saponin accelerates wound re-epithelialization and reduces early inflammation (Ahmed et al., 2019; Zuhaira, Nizam, & Ridzuan, 2018).

Egg white applied to burn burns in group P2 in this trial did not accelerate healing. Egg whites include growth factor-producing ovalbumin protein. Based on multiple research and conversations, they found no difference in the mean number of blood vessels on day three and day seven between the control group (0.9% NaCl) and the treatment group (egg white), Which matters. On day 14, the control and treatment groups had significantly different mean blood vessel counts. On days 3, 7, and 14, the control and treatment groups had similar fibroblast formation rates. The research found that egg whites do not promote wound healing; other elements are needed (Andritoiu et al., 2021; Enwemeka et al., 2021; Lin et al., 2019).

4. CONCLUSION

This study investigates the hypothesis that using jicama extract cream is more productive in the wound-healing process for burns than administering egg whites. While conducting this research, it is essential to acknowledge that other aspects, such as the degree or concentration of the extract utilized, should not be disregarded. In addition, another variable that may impact this study's outcomes is the minimal sample size, namely, 24 white mice. The utilization of a substantial quantity of samples in a research study can have a significant impact since an increased number of examples reduces the likelihood of encountering errors in generalization. One must consider the potential influence of stress as an internal component on the outcomes since it can significantly impact the wound-healing process in rats. Additionally, it has been discovered that stress in mice can induce an elevation in cortisol levels, suppressing cellular immunity and thereby impeding the process of wound healing.

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