Effectiveness Of Dermapen Action Using Green Belt Leaf Extract Cream (Piper Betle L) On Hair Growth On The Skin Surface Of Female Wistar Strain Rats (Rattus Norvegicus)

Novy Hardianti[1], Henny[2], Taufik Delfian[3*]

[1,2,3] Master Study Program in Biomedical Sciences, Faculty of Medicine, Dentistry and Health Sciences, Prima Indonesia University, Medan, Indonesia
[*]Corresponding Author:
Email: taufikdelfian@unprimdn.ac.id

Abstract.

Hair loss is a very prevalent hair issue. Hair loss is typical for all humans, but if it becomes severe, it can lead to baldness. Hair goes through a unique cycle of development and loss for each strand, and one herbal plant that has the activity of fertilizing hair growth and overcoming the problem of hair loss is green betel leaf (Piper betle L). The purpose of this study was to determine the efficacy of a derma pen utilizing green betel leaf extract cream (Piper betle L) on hair development on the skin surface of female Wistar rats (Rattus norvegicus). Betel leaves have been shown to help with issues such as hair loss. Using betel leaves regularly aids in It promotes hair growth, conditions hair, and makes it thick and long. Betel leaves can also assist with itching, dandruff, and broken ends. The polyphenol and flavonoid content in betel leaves is an antioxidant and anti-inflammatory, protecting hair from damage caused by inflammatory skin illnesses and free radicals that cause hair loss on the head.

Keywords: *Hair Loss, Green Betel Leaves, Hair Thinning and Dermapen Treatment.*

I. INTRODUCTION

A person's hair is a crown, and it has a significant influence on their appearance, self-esteem, and psychological roles, whether they are male or female. Therefore, many people take extra precautions to ensure the health of their hair and protect it from harm [1].Hair thinning is a very prevalent problem. Although some hair thinning is natural for every human being, too much thinning might result in baldness. Each hair goes through its own growing phase and shedding phase. Losing anything from 60-100 strands daily is considered normal, as hair falls out as part of the hair development cycle. However, excessive hair loss, either in frequency or volume, can lead to baldness [2], [3].Physiological circumstances, emotional and physical stress, nutritional inadequacies, hormonal imbalances, and medicines can cause hair loss, baldness, breakage, and thin hair [4]. Free radicals or oxidative stress can damage hair follicles and cause hair loss. Hereditary and environmental factors affect hair development and quality. Thus, hair care is necessary to maintain health and prevent shedding. Minoxidil and other synthetic hair loss treatments are employed. However, Minoxidil may cause skin allergies, headaches, vertigo, edema, hypotension, itching, and dermatitis [5], [6]. Active hair growth chemicals made from natural ingredients prevent the side effects of synthetic ones. Natural hair growth ingredients include saponins, phenols, and flavonoids.

Saponins in the body encourage blood flow to hair follicles, which will suffer and fall out if the blood supply is restricted. Numerous studies have demonstrated that green betel leaf (piper betle L) promotes hair growth and prevents loss. Today, shampoo, feminine cleansers, toothpaste, tonics, and food additives contain green betel leaf extract [5]. Shampooing hair and intimate regions with betel leaf helps treat dandruff, grow hair, and reduce hair loss. Green betel leaves contain saponins, flavonoids, tannins, and essential oils. Betel leaf extract contains steroid-triterpenoids, alkaloids, quinones, and flavonoids that prevent inflammation, free radical damage, and hair loss through antioxidant and anti-inflammatory processes [7].Hair loss can be treated with betel leaves. Tel leaves increase hair development, condition it, and make it thick and long. Betel leaves relieve itching, dandruff, and broken ends [8]. Betel leaves for hair loss work because their polyphenol and flavonoid content is an antioxidant and anti-inflammatory that

protects hair from inflammatory skin diseases and free radicals that cause head hair loss [8], [9].Dermapen treatment or action can promote hair growth with betel leaf extract.

A motorized pen-shaped microneedling therapy device called a dermapen can be modified to suit skin conditions [10]. It includes 9-12 needles in rows and a needle depth of 0.25–2 mm with a disposable guide to modify the needle length. An electric pen with several single-use microneedles vibrates stamp-like to create microchannels in the skin.Many people use Dermapen microneedling to address hair loss and balding. Microneedling is a dermatological procedure that uses tiny needles to encourage the formation of elastin and collagen, essential to youthful skin, and can treat many skin issues and hair loss. The idea is to cause controlled damage to stimulate collagen production [11]. Dermapen treatment promotes angiogenesis (new blood vessel growth), which feeds each hair and activates and maintains healthy hair growth [12].Based on the preceding, researchers are inspired to investigate further the benefits and efficacy of betel leaf extract cream in the hair development process. Furthermore, no research on the action of a derma pen using green betel leaf extract cream (piper betle L) on hair growth has been found in previous studies, so there is a strong reason for researchers to conduct laboratory experiments on the effectiveness of derma pen using leaf extract. Green betel (piper betle L) affects hair growth on the skin surface of female Wistar rats (Rattus norvegicus).

II. METHODS

This study is a type of laboratory experimental research or actual experiment in which the effectiveness of a derma pen using green betel leaf extract cream (piper betle L) on hair growth on the surface of the skin of female Wistar rats (Rattus norvegicus) is tested using a pretest-posttest with control group design [13]. Adult female Wistar white rats (Rattus norvegicus) measuring 160-200 grams and aged 2-3 months were used in this investigation. The number of white rat samples utilized was 20, divided into four (four) groups of five rats each, with the control group (P0) and treatment groups 1, 2, and 3 (P1, P2, and P3).This study's variables include both independent and dependent factors [14]. Dermapen activity utilizing green betel leaf extract cream (Piper betle L) is the independent variable. Meanwhile, the process of hair growth on the skin surface of female white Wistar rats is the dependent variable.

This study's variables include both independent and dependent factors. Dermapen activity utilizing green betel leaf extract cream (Piper betle L) is the independent variable. Meanwhile, the process of hair growth on the skin surface of female white Wistar rats is the dependent variable. For one week, all-female white Wistar rats were acclimated in the Animal House, Faculty of Mathematics and Natural Sciences, University of North Sumatra. Rats adapt to changing living conditions and settings, and their food and drink are standardized to meet their demands (ad libitum).The SPSS application was used to examine the research data. The Kolmogorov-Smirnov test was used to explore the data normality test ($p > 0.05$). The One-way ANOVA test was used to determine the significance of treatment groups (p 0.05). A Post Hoc Test employing the LSD approach was used to determine which treatment group was the most beneficial.

III. RESULTS AND DISCUSSION

Result

The University of North Sumatra's Faculty of Mathematics and Natural Sciences studied green betel leaf extract's composition and phytochemistry. Green betel leaf extract (piper betle L) from farmers near Gurusinga Village in Berastagi, Karo Regency, was used. The ethyl acetate, n-hexane, and 90% alcohol/ethanol fractions of green betel leaf extract were phytochemically assayed for secondary metabolite compounds. The table below shows green betel leaf extract phytochemical test results:

Table 1. Green Betel Leaf Extract Phytochemical Test Results

Phytochemistry	Reactor	Color Results	Information
Flavonoid	Mg, HCL Concentrated	Yellow	Positive
Saponin Test	Akuades	There is foam	Positive
Tannin Test	FeCl3	Green Blackish	Positive
Alkaloids	Reagen Wagner	Brown Precipitate	Positive

Green betel leaf extract (piper betle L) included flavonoids, saponins, tannins, and alkaloids, according to phytochemical testing. Therefore, green betel leaf extract contains phytochemicals with potent antioxidant properties that can be employed as medicines.The treatment group was given dermapen and smeared with green betel leaf extract cream at 10%, 20%, and 30% concentrations, and the control group (given dermapen and 0% base cream) had their average hair growth measured in cm. The table below shows the trend from day 1 to day 22 (the day after therapy).

Table 2. Average Length of Hair Growth

Group	Average Hair Length (CM) Days			
	0	**7**	**15**	**22**
K	0.00	0.36	0.55	0.73
P1	0.00	0.51	0.73	0.92
P2	0.00	0.62	0.84	1.22
P3	0.00	0.72	0.92	1.45
Mean	0.00	0.55	0.76	1.08
SD	0.00	0.13	0.14	0.28

Based on observations (Table 2) of the average hair growth in each group, it can be inferred that hair development in the P3 group happened faster, followed by groups P2 and P1. In contrast, the control group (K) experienced the slowest hair growth.

Table 3. Shapiro-Wilk Normality Test Results

Group	Statistics	Significance
Control (K)	0,937	0,642
Treatment 1 (P1)	0,914	0,490
Treatment 2 (P2)	0,894	0,377
Treatment 3 (P3)	0,914	0,492

Table 3 shows the results of an SPSS normality test on the data gathered, which shows that the hair growth variable from day 1 to day 21 of wound exposure shows significant values for both the control and treatment groups. Group K had a considerable value (p) of 0.642, Group P1 at 0.490, Group P2 at 0.377, and Group P3 at 0.492, all beyond the threshold of p0.05 in the Shapiro-Wilk Test. The Shapiro-Wilk test indicates that the data follow a normal distribution.Table 4 of the ANOVA results (attached page) was used to examine whether or not the four study/observation groups had significantly different hair growth rates. Concerning the table data in the "Sig." The p-value (p-value) that was calculated is 0.000. This means that Ho is rejected at the 5% significance level and that the average (mean) length of hair growth among the four groups is significantly different.

Table 4. Test of Homogeneity of Variances

Result	Levene Statistics	Significance
Based on the Mean (average)	1,792	0,189
Based on Median	0,914	0,456
Based *Trimmed Mean*	1,700	0,207

Table 5. Post Hoc Bonferroni Test Results

Multiple Comparisons

Dependent Variable: Hair Growth

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Bonferroni	Control (K)	Treatment 1 (P1)	-.13200*	.01507	.000	-.1773	-.0867
		Treatment 2 (P2)	-.26200*	.01507	.000	-.3073	-.2167
		Treatment 3 (P3)	-.37600*	.01507	.000	-.4213	-.3307
	Treatment 1 (P1)	Control (K)	.13200*	.01507	.000	.0867	.1773
		Treatment 2 (P2)	-.13000*	.01507	.000	-.1753	-.0847
		Treatment 3 (P3)	-.24400*	.01507	.000	-.2893	-.1987
	Treatment 2 (P2)	Control (K)	.26200*	.01507	.000	.2167	.3073
		Treatment 1 (P1)	.13000*	.01507	.000	.0847	.1753
		Treatment 3 (P3)	-.11400*	.01507	.000	-.1593	-.0687
	Treatment 3 (P3)	Control (K)	.37600*	.01507	.000	.3307	.4213
		Treatment 1 (P1)	.24400*	.01507	.000	.1987	.2893
		Treatment 2 (P2)	.11400*	.01507	.000	.0687	.1593

Note: Control group (P0): dermapen-treated + cream base (0%). Treatment group 1 (P1): dermapen-treated + 10% green betel leaf extract cream. Treatment group 2 (P2): dermapen-treated + 20% green betel leaf extract cream. Treatment group 3 (P3): dermapen-treated + 30% green betel leaf extract cream.

Based on the results of additional tests using the Bonferroni Post Hoc Test, a comparison of group I and group J shows that there is a difference in the average length of hair growth in the Wistar strain of white rats (Rattus norvegicus), which is marked with an asterisk "*." The SPSS for Windows application was used for group testing utilizing the Bonferroni Post Hoc Test.The macroscopic examination compared pre- and post-treatment photos of mice's hair growth. Histology preparations are examined under a 10x and 20x light microscope to determine melanocyte proliferation, follicle health, and other skin epidermal tissues. In a light microscope, hair follicles stand out from the dermis. Examination is needed since tissue sample hair follicles are not all oriented the same.

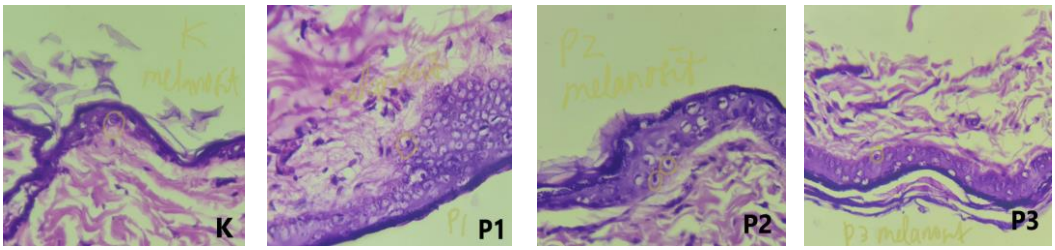

Fig 1. Growth of Skin Epidermal Melanocytes

Figure 1 shows that the number of melanocytes was higher in the group treated with 20% green betel leaf extract cream (P2). Group P1 came next, then P2, and finally P3. The lowest levels of melanin were observed in group K, the control group. Staining performed during histopathological examinations will reveal melanin's dark purple tint. In this image, melanin is found in the dermis, a layer below the hair follicles.

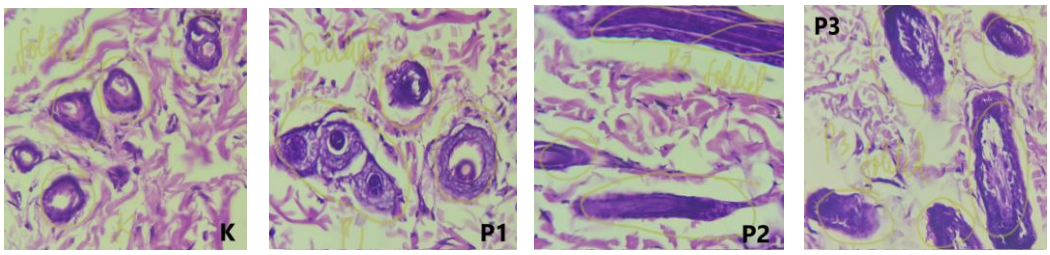

Fig 2. Hair follicle condition.

Figure 2 shows that the 30% green betel leaf extract cream (P3) group had thicker follicles than the other groups. The second group, P2, came next, then P1. Whereas follicles formed cylindrical tubes in groups P3 and P2, they did not in group K, the control group. Meanwhile, tube formation had begun among some follicular cells in group P1.

Discussion

Researchers used a dermapen and a lotion made from natural plant extracts to stimulate hair growth on the mice's backs. In this research, green betel leaf (Piper Betle L) extract was used. Get yourself 1.5 kg of fresh green betel leaves, wash them in running water, and let them dry in the air. The green betel leaves were dried, ground into a powder, weighed (500 grams), and then macerated in a solvent from distilled ethanol (90%) for five days.The thick extract of gambier leaves was then obtained by vacuuming the maceration products using a rotary evaporator. Ethanol is utilized because it is a suitable solvent for creating quotes. Ethanol's solvent is universal, meaning it can dissolve polar and non-polar molecules [15]. The extract from the green betel leaves is then made into a cream. The yield is proportional to the amount of solvent used, so increasing the amount used increases the output.Male white rats were employed in this study due to their accessibility, manageability, and human-like physiology and anatomy. Twenty mice were used, and they were split into four groups. The mice were given a week to acclimate before receiving therapy. Group I (K) received dermapen treatment but no green betel leaf extract cream, Group II (P1) received dermapen action

and applied 10% green betel leaf extract cream topically, Group III (P2) received dermapen action and used 20% green betel leaf extract cream topically, and Group IV (P3) received dermapen action and applied 30% green betel leaf extract cream topically.On day 22, on average, hair growth was 0.92 centimeters in the P1 therapy group, according to data collected throughout the hair development process for each group. On day 22, the average length of hair growth in the P2 group was 1.22 centimeters.

In the P3 therapy group, the average hair growth on day 22 reached 1.45 cm. On day 22, the average hair growth in the K therapy group was 0.73 centimeters. Average hair growth rates across all groups show that P3 experienced the fastest growth rate, followed by P2 and P1. In contrast, the control group (K) experienced the slowest hair growth.This study's findings explain why green betel leaf extract affects hair development in dermapen-treated mice. Green betel leaves contain chemicals that affect hair growth in rats. These chemicals include flavonoids, saponins, tannins, and alkaloids. This study's findings are consistent with those of Anwar et al. (2019); yeast (bud cells) from Pityrosporum ovale have their growth inhibited by the anti-fungal effect of green betel leaf extract, which increases membrane permeability to foreign objects and causes cell death, leading to hair loss, according to their research. Will flourish and become dandruff-free [16].Hair growth was also improved in the dermapen treatment group with 30% green betel leaf extract cream compared to the dermapen treatment groups with base cream, 20% green betel leaf extract cream, and 30% green betel leaf extract cream. When applied to the backs of shaved and dermapen-treated mice, the metabolite compound of green betel leaf extract had a reasonably good effect. Still, at low concentrations, it only inhibited microorganisms, making it less effective in healing wounds. Since antibacterials have only inhibitory (bacteriostatic) qualities at low doses but lethal properties at high concentrations, they have not been utilized previously.

IV. CONCLUSION

The conclusion of the research on the effectiveness of dermapen using green betel leaf extract (piper betle L) on hair growth on the surface of the skin of female Wistar rats (Rattus norvegicus) is that the results of the phytochemical test of green betel leaf (piper betle L) were carried out, the phytochemical content in the extract found are flavonoids, saponins, tannins and alkaloids. Therefore, it is reasonable to assume that the phytochemicals found in green betel leaf extract have therapeutic potential.The results demonstrated a significant difference in average hair growth between the control group (P0) and the treatment groups (P1, P2, and P3). This is because participants in the control group (P0) received no dermapen treatment and used merely base cream.

The mice given 30% green betel leaf extract cream had much higher hair growth than those given 10% and 20% green betel leaf extract cream, according to this study. However, the condition was very similar in the group treated with 30% betel leaf extract cream and the group given 20% betel leaf extract cream.This is because the secondary metabolite compounds in green betel leaf extract only inhibit microorganisms at low concentrations, making them less effective in hair growth after dermapen action. In contrast, at a concentration of 10%, they have begun to influence the hair growth process.Green betel leaf extract (Piper betle L) has shown promise in several studies, but further work is needed to compare different concentrations of this extract with one another and with a positive control group (for example, those who were administered bioplacenton).

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