

WHITE RAT HAIR GROWTH ACTIVITY TEST COMBINATION CELERY LEAVES (*Apium graveolens* L.) AND RAJA BANANA PEEL (*Musa acuminata* L.)

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Received: March, 2025

Accepted: June, 2025

Abstract

Celery leaves and Raja banana peel contain flavonoids that can stimulate the hair growth process. This study aims to determine the effect of a combination of ethanol extracts of celery leaves and raja banana peel on the hair growth. This type of research is a laboratory experimental study using test animals that are randomly grouped and given combination extract topically, group I (7.5%: 6.25%), group II (7.5%: 12.5%), group III (7.5%: 25%), group IV (normal control) and group V positive control (hair tonic 2% minoxidil). The results of hair weight in this study showed that the group given a combination of extracts was able to affect the growth of rat hair. Data on the 21st day was analyzed using the one way ANOVA statistical test, obtained a value of $p < 0.01$ which means there is a significant difference in the average hair growth of rats treated, then continued with the LSD post hoc test showed treatment II significantly different ($p < 0.001$) with all treatments. It can be concluded that the treatment group given a combination of extracts can affect the hair growth of rats.

Key words: : *Apium graveolens* L., celery leaves extract, Hair growth, *Musa acuminata* L., raja banana peel extract.

INTRODUCTION

Hair loss is a disorder in which the amount of hair falls out more than usual, with or without visible thinning of the hair. Head hair usually loses 80 to 120 hairs per day, but hair loss is considered abnormal if the amount is above normal (Jafar et al., 2017).. Many herbal plants have been shown to have hair growth-enhancing effects, and each plant contains different compounds that have different hair growth-enhancing effects as well (Triarini and Hendriani, 2019).

Celery leaves have been studied to stimulate hair growth. The main components of celery leaves include apiin, apigenin, and sodium. Apigenin is known to have anti-inflammatory properties and is the main chemical component of celery that has a stimulating effect on hair growth (Yasir and Nofita, 2021). Because of its nutritional content, celery is known to stimulate hair growth and keep hair healthy and shiny (Nurjanah and Krisnawati, 2014).

Banana peel is a waste material (waste of bananas) contains fat, calcium, protein, iron, phosphorus, vitamin B, vitamin C, water and antioxidant compounds, where the antioxidants in plantain skin are higher than those in the fruit. Therefore, banana peel has the potential to be large enough to be produced as a source of antioxidants in food (Saputri et al., 2022). According to Muhammad et al. (2022), ripe plantain

peels contain alkaloids, flavonoids, saponins, phenols, and tannins, which, when combined with celery leaves, can affect hair growth faster. Therefore, researchers are interested in combining celery leaves (*Apium graveolens* L.) and raja banana peel (*Musa acuminata* L.) as a hair grower.

RESEARCH METHODS

This is a laboratory experimental study that will test the activity of a combination of celery leaves extract and banana peel against white rat hair with 5 strokes on male white rats as a test board. The tools used in this study are rat cages, feed containers, beverage containers, analytical scales, razors, permanent markers, sterile hasa fabrics, roller plasters, telenan, zipper bags, glass containers, gloves, stirring rods, aluminum foil, blenders, ovens, filter paper, rotary evaporators, and cameras for documentation. Ingredients used include simple lettuce leaves, plantain peel, ethanol (96%), aquadest, and carbopol (940).

Extraction

Extraction is carried out by the maceration method. Each prepared simplicia was placed in a glass container and soaked in 96% ethanol solvent for 24 hours, filtered, and then produced filtrate 1 and debris 1. Debris 1 is then remastered again with 96% ethanol solvent until everything is submerged and left again for 24 hours. This is done until it produces filtrate 3 and debris 3. Filtrate from the maceration and remaceration processes is put together, homogenized, and evaporated using a rotary evaporator at 60°C. The extract is then weighed using analytical scales.

Preparation of Carbopol Gel 0.5%

Carbopol, weighing as much as 0.125 g, was then dispersed with 100 ml of hot water and stirred until homogeneous.

Manufacturing Test Preparations

The test preparations were made in three groups of 25g, which were distinguished by the concentration of celery leaves extract in combination with plantain leaves extract. Each of the preparations contains celery leaves extract in combination with plantain peel.

Table 1. Composition of the Test Preparation

Ingredients	Concentration (%)		
	A	B	C
Celery leaves Extract	7,5	7,5	7,5
Raja Banana Peel Extract	6,25	12,5	25
Carbopol Gel 0,5%	Ad 100	Ad 100	Ad 100

Preparation of Test Animals

The test animals were 15 male white mice aged 2–3 months with BB weighing 150–200 g. White rats are obtained from the cultivation of white rats. Before the study began, the white mice were acclimatized to adapt to their new environment. White rats were placed in rat cages, with each cage containing three white rats. During the acclimatization process, white rats are given standard feed and a sufficient amount of drinking water.

Activity test against hair growth

Hair Removal on the Back of a White Rat The hair on the backs of white rats is shaved using scissors and razors in as many locations as possible, with each location measuring 2x1 cm and each location being spaced. The location of the treatment is delimited using a permanent marker to distinguish between the locations of the treatment and each other. Administration of a Combination of Extracts on the Backs of White Rats (Table 1). The number of white mice needed for this study is 5 male white rats per treatment; there are 5 treatments in this study, so it takes as many as 15 white mice. The test preparation was applied to the backs of white rats in the amount of 1 ml once a day for 3 weeks.

- a. Treatment 1 white mouse back smeared celery leaves extract with a concentration of 7.5% and a combination of raja banana peel extract with a concentration of 6.25% (Group a).
- b. Treatment 2: smeared celery leaves extract with a concentration of 7.5% and a and a combination of raja banana peel extract with a concentration of 12.5% (Group B).
- c. Treatment 3: smeared celery leaves extract with a concentration of 7.5% and a and a combination of raja banana peel extract with a concentration of 25% (Group C).
- d. Treatment 4 was smeared as a normal control, that is, those that did not contain extracts of celery leaves and raja banana peel(Group D).
- e. Treatment 5 was smeared with a hair tonic containing 2% minoxidil as a positive control (Group E).

Every day, the backs of white rats were smeared as much as once on each treatment for 21 days, with the smeared extract being the smeared extract being cleaned first so that no previous extract was still attached.

Data Analysis

The data obtained were analyzed by statistical methods of measuring the weight of white rat hair using SPSS (Statistical Package for the Social Sciences). The data obtained were tested for normality using the Shapiro-Wilk test, which is said to be distributed if $p > 0.05$. Then proceed with the homogeneity test using the Levene test. It can be said that the data is homogeneous if $p > 0.05$. Then the data continued with a one-way ANOVA test (analysis of variance) to see the real difference between treatments.

After the ANOVA test of the study, the data is significant ($p < 0.01$), meaning there is a real difference between the averages, but it is not known which group provides the difference. Therefore, a

follow-up test was carried out, namely the post-hoc LSD test ($p < 0.001$), to determine which variables had the most effect or were significantly different from the other groups.

RESULTS AND DISCUSSION

This study uses statistical tests using a one-way ANOVA analysis test to determine the mean difference between groups. Normality test results $p > 0.05$ indicate that the distribution of data in all groups is normal. The result of the homogeneity test in this study is $p = 0.085$. Homogeneity Test value ($p > 0.05$) so that the results of this study can be said to be homogeneous.

Table 2. Average percentage of rat hair weight growth

Group	Research Days (g)			Percentage Growth (%)		
	Day 7	Day 14	Day 21	Day 7	Day 14	Day 21
Normal Control	1,154 1,119 1,077	1,156 1,177 1,166	1,206 1,206 1,207			
Average	1,117	1,167	1,206	0,01	0,08	0,15
Positive Control (hair tonic Minoxidil 2%)	1,190 1,189 1,185	1,218 1,221 1,229	1,245 1,239 1,251			
Average	1,188	1,223	1,238	0,12	0,19	0,21
Group 1 7,5% : 6,25%	1,177 1,176 1,163	1,200 1,199 1,198	1,208 1,210 1,201			
Average	1,172	1,199	1,207	0,09	0,14	0,16
Group 2 7,5% : 12,5%	1,183 1,187 1,187	1,207 1,206 1,207	1,225 1,224 1,225			
Average	1,186	1,207	1,225	0,12	0,16	0,19
Group 3 7,5% : 25%	1,176 1,177 1,166	1,208 1,205 1,205	1,208 1,206 1,205			
Average	1,173	1,206	1,206	0,09	0,15	0,16

Normal control: does not contain extracts; Positive Control: contains minoxidil

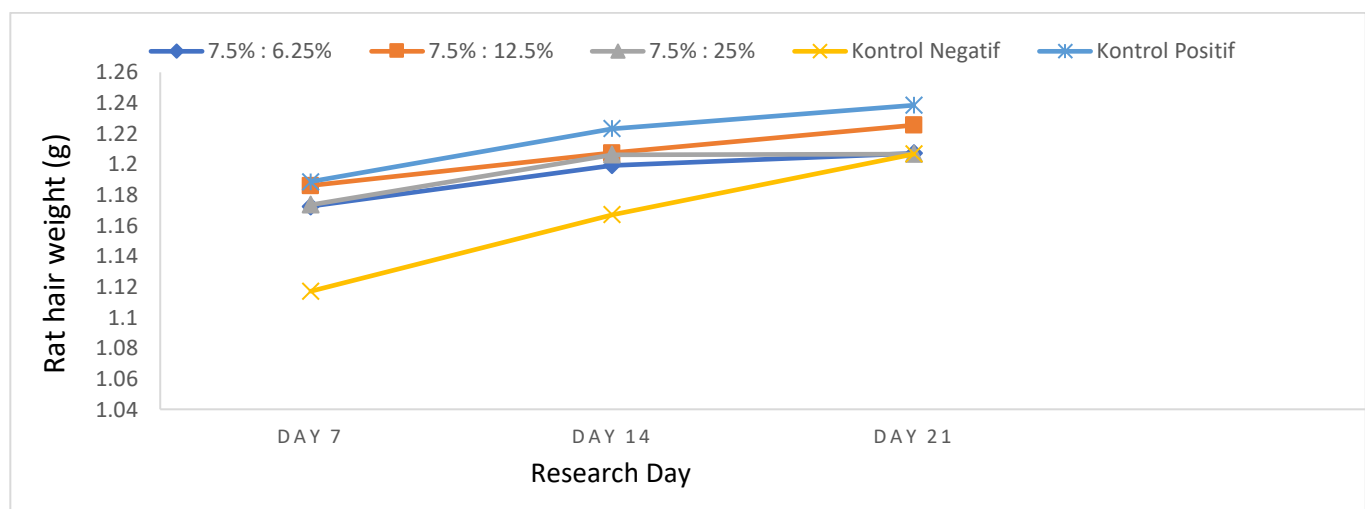


Figure 1. Rat hair weight average chart

Table 3. Test results of one-way SPSS ANOVA analysis

Group	Value <i>p</i>
Normal Control	
Positive Control	
Group 1 (7,5% : 6,25%)	<0,001
Group 2 (7,5% : 12,5%)	
Group 3 (7,5% : 25%)	

Based on the results of the one-way ANOVA analysis in Table 2, we obtained a value of $p = <0.001$, which shows that there are significant differences between treatment groups and can answer the hypothesis in this study that H_1 is accepted and H_0 is rejected, so further analysis using the LSD (Least Significant Difference) test can determine which treatment is significantly different if H_0 is rejected Table 4). This LSD test was conducted to test, more specifically, the average difference from the treatment given.

From the results of the LSD test, the normal control group was significantly different from the positive control group ($p = 0.001$), the normal control group was no different from group 1 ($p = 0.873$), the normal control group was significantly different from group 2 ($p = 0.001$), and the normal control group with group 3 was no different ($p = 0.991$).

The positive control group differed significantly with all treatments ($p = <0.001$). groups 1 and 2 differed significantly ($p = 0.991$), groups 1 and 3 did not differ ($p = 0.864$), and groups 2 and 3 differed significantly ($p = <0.001$).

Table 4. LSD test results (Least Significant Difference).

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Normal Control	Group 1	-.0004667	.0028391	.873	-.006793	.005859
	Group 2	-.0188667*	.0028391	<.001	-.025193	-.012541
	Group 3	.0000333	.0028391	.991	-.006293	.006359
	Group 5	-.0388333*	.0028391	<.001	-.045159	-.032507
Positive Control	Group 1	.0383667*	.0028391	<.001	.032041	.044693
	Group 2	.0199667*	.0028391	<.001	.013641	.026293
	Group 3	.0388667*	.0028391	<.001	.032541	.045193
	Group 4	.0388333*	.0028391	<.001	.032507	.045159
Group 1	Group 2	-.0184000*	.0028391	<.001	-.024726	-.012074
	Group 3	.0005000	.0028391	.864	-.005826	.006826
	Group 4	.0004667	.0028391	.873	-.005859	.006793
	Group 5	-.0383667*	.0028391	<.001	-.044693	-.032041
Group 2	Group 1	.0184000*	.0028391	<.001	.012074	.024726
	Group 3	.0189000*	.0028391	<.001	.012574	.025226
	Group 4	.0188667*	.0028391	<.001	.012541	.025193
	Group 5	-.0199667*	.0028391	<.001	-.026293	-.013641
Group 3	Group 1	-.0005000	.0028391	.864	-.006826	.005826
	Group 2	-.0189000*	.0028391	<.001	-.025226	-.012574
	Group 4	-.0000333	.0028391	.991	-.006359	.006293
	Group 5	-.0388667*	.0028391	<.001	-.045193	-.032541

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

DISCUSSION

Extraction was carried out using the maceration method using an ethanol 96% solvent, which produces thick extracts of dense green celery leaves and brownish yellow plantain skin. This method was chosen because it is simple and suitable for *simplicia* because the nature of metabolite compounds that have hair growth activity is not heat resistant and easily oxidized at high temperatures (Hidun, et al., 2017). The yield value of celery leaf extract obtained from 23.6 grams of *Simplicia* powder is 2.44%, and that of plantain peel obtained from 21.5 grams of *simplicia* powder is 2.47%. It is necessary to determine the ratio of the dry weight of the resulting product to the weight of the raw materials (Senduk et al., 2020). In addition, according to Whika et. al., (2017), a high yield value indicates the number of bioactive components contained in plants.

In this study, the measurement of the diameter of the mouse weight is done by weighing the weight of the white mouse hair in the area that has been determined (Chart 2). The observation of hair growth is carried out every 7 days because, in the anagen phase, the hair already shows significant growth, allowing a noticeable change in its length, so that the weekly interval provides a sufficient time frame to evaluate the effectiveness of a product or therapy on hair growth (Yuda et al., 2023).

In Figure 5, there was an increase in the average length of hair growth per day in each treatment group. Therefore, day 21 is used to test the data using a one-way ANOVA. Based on the results of one-way ANOVA data, the obtained value ($p = 0.001$) indicates that there are significant differences between treatment groups and shows that the combination of celery extract and raja banana peel has an effect on the hair growth activity of white rats, which means that the combination of extracts with a certain concentration is able to provide a significant difference to the hair growth of white rats. Therefore, it can be said that hypothesis H1 is accepted and hypothesis H0 is rejected.

The results of the post-hoc LSD test showed which pairs of variables provided significant average differences. The hair weight of rats in treatment group 5 or positive controls gave significantly different results ($p = 0.001$) with normal controls and other treatments, as well as in the observation of treatment 2 with a concentration of 7.5% to 12.5%, it was also significantly different ($p = 0.001$) with other treatment groups. This shows that treatment group 5 containing the active substance minoxidil is more effective in increasing hair growth because, according to Kuncari (2014), minoxidil is an active substance that functions as a vasodilator by widening blood vessels and opening potassium bridges so that more oxygen, blood, and nutrients reach the hair follicles, which causes faster hair growth. Then followed treatment 2 with a combination of celery leaves extract and raja banana peel at a concentration of 7.5% to 12.5%. This is because celery leaves contain flavonoids, which, when hydrolyzed into aglycone apigenin, cause dilation of blood vessels in the hair, which allows a smooth blood supply to the hair growth process. Hindun et al. (2017). Plantain peels that contain various antioxidants, such as flavonoids, are good for getting rid of free radicals and UV rays that can damage the structure of the hair and scalp so that hair growth can be increased and maintained (Pradigdo et al., 2022). Because this combination of extracts is herbal, it is likely to perform more slowly when compared to active substances such as minoxidil, which is a pure

compound.

The combination of celery leaves extract and raja banana peel at a ratio of 7.5% to 12.5% is more effective in hair growth activity than the concentrations of 7.5% to 6.25% and 7.5% to 25% due to the right balance between the active components of the two extracts that allow both extracts to work together optimally to stimulate and strengthen hair (Lestari et al., 2021). According to Tari and Indriani (2023), concentrations between 10% - 20% tend to be more physically and chemically than concentrations that are too low or too high for one of the ingredients, which can only reduce the overall effectiveness of the mixture. As with flavonoids and polyphenols, which are powerful antioxidants but at high concentrations can interfere with the effectiveness of the extract, and vice versa, when combined with concentrations that are too low, the active compounds can cause ineffective biological activity because the amount of active compounds is not sufficient to provide a significant effect.

CONCLUSION

Based on the results of the research that has been done, it can be concluded that the combination of celery leaves extract (*Apium graveolens* L.) and raja banana peel (*Musa acuminata* L.) significantly promoted the hair growth of white rats by showing a higher average weight than normal controls.

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