Eduvest – Journal of Universal Studies
Volume 5 Number 2, February, 2025
p- ISSN 2775-3735- e-ISSN 2775-3727

TEST OF THE EFFECTIVENESS OF KEPOK BANANA PEEL EXTRACT SERUM ON HAIR GROWTH IN GUINEA PIGS

Fenny Theresia Sihombing, Rudi Chandra, Widyaningsih Oentari
Kedokteran Gigi Dan Ilmu Kesehatan, Universitas Prima Indonesia
Email: therexia88@gmail.com, rudichandra1989@gmail.com, widyaningsihoentari@gmail.com

ABSTRACT

Hair plays an important role in supporting appearance and confidence, while hair loss is a common problem. In Indonesia, the prevalence of hair loss reaches 20% in adults and increases with age. Natural approaches such as Kepok banana peel extract, which is rich in antioxidants, flavonoids, and vitamins, are increasingly in demand as an alternative to hair care. This study aims to evaluate the effectiveness of Kepok banana peel extract serum on hair growth in guinea pigs. The method used was a laboratory experimental study with five treatment groups, namely Kepok banana peel extract serum with concentrations of 20%, 30%, 40%, negative Control, and positive Control (minoxidil® 5%). Each group consisted of five guinea pigs (n = 5), and observations were made over four weeks. The results showed that the 30% concentration of Kepok banana peel extract serum had the best effectiveness, with an average hair growth of 0.17814 ± 0.084711 g, close to the effectiveness of 5% minoxidil® (0.19124 ± 0.050439 g). Statistical analysis showed a significant difference between the negative Control and the 30% treatment (p = 0.003 in the third week). In conclusion, Kepok banana peel extract serum with a concentration of 30% has the potential to be an effective alternative to hair care..

KEYWORDS *hair loss, kepok banana peel extract serum, guinea pigs*

INTRODUCTION

Hair has an important role in supporting appearance. Several studies report that hair has a significant role in self-confidence and psychological role for both men and women. Hair is another physical feature that is relatively easy to manipulate without a surgical procedure. Many factors can cause unhealthy hair, such as the influence of the weather, dust or dirt, and chemicals. Hair that is kept in good condition helps a person feel comfortable and confident. Unknowingly, we treat our hair inappropriately, which results in damage to the hair.

How to cite: Shiombing F.T et all. (2025). Test of The Effectiveness of Kepok Banana Peel Extract Serum on Hair Growth in Guinea Pigs. Journal Eduvest. *5*(2): 2920-2933
E-ISSN: 2775-3727

The most common hair problem is acute hair loss or slow hair thinning. One of the problems that everyone is most worried about is hair loss. Hair is found in almost all parts of the body and has various functions, including as a protector against environmental temperature, a physical barrier between external air and the skin, and keeping the body warmer. hair has its aesthetic value for humans. Some people can experience hair abnormalities, moe caused by excessive outdoor activities and rarely due to congenital abnormalities.

Hair loss (*hair loss*) occurs in many people, so it can reduce aesthetic function and protection of the body and head from the environment. It is estimated that about 50% of men and women worldwide experience hair loss problems at various stages of their lives (Iryanti et al., 2022). Based on data *from the Global Hair Loss Epidemiology Study*, in developing countries, the prevalence of hair loss reaches 40-50% in men and 25-30% in women, especially in the productive age group. In Indonesia, a survey by the Indonesian Ministry of Health (2019) shows that hair loss is experienced by 1 in 5 adults, with an increasing prevalence rate in individuals over 35 years old.

Reduced head hair can cause psychological stress, especially in women (Rassman in Horev, 2017). Hair loss is said to be severe enough when the hair loss exceeds 100 strands per day. In developing countries, most people still use traditional medicine, especially to meet basic health needs. According to the resolution *Promoting the Role of Traditional Medicine in the Health System: Strategy for the African Region*, about 80% of people in African countries use traditional medicine for health purposes.

Several sources mention that the use of traditional medicine by the population in France reaches 49%, 70% in Canada, 40% in the United Kingdom and 42% in the United States (Dipen, 2018). The concept *of going back to nature* or return to nature has been widely known among the public. The use of plants as medicine has long been known by the Indonesian people, which is referred to as traditional medicine. Traditional medicine treatment today is very popular and increasingly preferred by the community. This is because the price is affordable, easy to get, and has relatively few side effects. In addition, Indonesia is also the second mega biodiversity country after Brazil, which is estimated to have 30,000 species of plants living in the Indonesian archipelago, and at least 9,600 species are known to be efficacious as medicine (Ministry of Health of the Republic of Indonesia, 2017).

Among the plants that can be used as hair growers, Banana Kepok was chosen as the main ingredient in this study because its skin contains various compounds that are beneficial for hair health. The peel of the *Kepok* banana is rich in antioxidants, especially flavonoids, which can protect the scalp from free radicals and UV rays that can inhibit hair growth (Iman et al., 2023; Rahmi et al., 2021). Flavonoids are also known to stimulate new hair growth, so kepok banana peel has the potential to be a raw material for making hair care products such as anti-loss shampoo. In addition, kepok banana peel contains vitamins A and C and various antioxidants such as flavonoids that effectively eliminate free radicals and protect the hair structure and scalp from damage caused by UV rays. Flavonoids, as antioxidant compounds, can increase the stimulation of hair growth by reducing the

effects of free radicals entering the hair and scalp (Broto et al., 2022; Pradigdo et al., 2022).

Kepok banana peel is also known to be one of the natural ingredients which contains 14.28% potassium. This potassium content's potential can be developed to manufacture natural shampoos. Potassium, which forms this alkaline specimen, reacts with hair impurities such as acidic sweat, sot a neutralization reaction occurs, whi,ch, when rin,sed, will remove dirt (Harahap, 2022). Cellulose and hemicellulose were also found in the content of kepok banana peels. Cellulose is a structural element and a major component of the cell wall of trees and other plants. Vitamin C contained in kepok banana peels is also present, which is beneficial for hair and skin health. Vitamin C deficiency causes dry and split ends, and vitamin C functions to restore fatigue of the adrenal glands. This adrenal gland maintains hormonal balance, thus stopping hair loss and promoting hair growth.

Based on the background above, research on *Kepok* banana peel as a hair growth ingredient has been done very little. Therefore, researchers are interested in researching the benefits of *Kepok* banana peel extract serum on hair growth in guinea pigs.

Problem Formulation

How effective is the kepok banana peel extract serum on hair growth in guinea pigs.

Research Objectives

To determine the potential effectiveness of *Kepok* banana peel extract serum on hair growth in guinea pigs.

Research Benefits

1. For Researchers

Broadening the researcher's scientific insight by using the knowledge gained during the lecture and adding insight into the effectiveness of *Kepok* banana peel extract serum on hair growth in guinea pigs.

2. For Institutions

This research is expected to be a reference for those who will research the effectiveness of *Kepok* banana peel extract serum on hair growth in guinea pigs.

3. For the Community

This research is expected to be used by the public to determine the effectiveness of kepok banana peel extract serum on hair growth. RESEARCH METHODS

Type of Research

This type of research is a laboratory experimental test conducted to determine the effectiveness of kepok banana peel extract on hair growth in guinea pigs.

Place and Time of Research

Research Venue

The location of this research is as follows:

1. The manufacture of ointment and cinnamon extract is carried out at the Chemistry Laboratory of the University of North Sumatra
2. The maintenance and treatment of guinea pigs is carried out at the Chemistry Laboratory of the University of North Sumatra.
3. Measurement of the length of guinea pig's hair was carried out at the Chemistry Laboratory of the University of North Sumatra.

Research Time

This research was conducted in October – November 2024.

Research population and sample

The size of the research sample was calculated using the Federer formula as follows (Rasyid et al., 2020):

$$(T-1) (n-1) \geq 15$$

Information:
n: Number of samples per group
t: Number of research groups

$$(t - 1) (n-1) \geq 15$$
$$(5 - 1) (n-1) \geq 15$$
$$4 (n - 1) \geq 15$$
$$4n – 4 \geq 15$$
$$4n = 19$$

In this study, the number of treatment groups was (t = 5), with each group as much as (n=5), so the number of samples in this study was 25.

1. Group I (20% kepok banana peel extract serum): 5 heads
2. Group II (30% kepok banana peel extract serum): as many as 5
3. Group III (kepok banana peel extract serum 40%): as many as five heads
4. Negative Control: as many as 5
5. Positive Control (minoxidil ® 5%): as many as 5

Sample grouping was carried out randomly with the same physiological status benchmark.

Research Variables

Independent Variable

The free variables in this study were 20%, 30%, and 40% kepok banana peel extract serum.

Dependent Variable

The bound variable in this study was the growth of guinea pig hair.

Operational Definition

Table 1. Operational Definition

Variable	Operational Definition	Measuring Instruments	Measurement Results	Measure Scale
Kepok banana peel extract serum	The peel of the kepok banana has been extracted so that a thick extract is obtained, which is then mixed with serum ingredients into several concentrations	Digital scales	g	Ratio

Guinea pig hair growth	The length of hair in guinea pigs was measured using a caliper.	Caliper	Mm	Ratio

Research Tools and Materials

The tools used in this study were an analytical balance, watch glasses, beaker glass, measuring cups, droppers, stirring rods, spray bottles, plastic bottles, vials, tissues, filter paper, spatula, pH meter, and viscometer. The ingredients used were Kepok banana peel extract, ethanol 96%, *Propylene glycol, Sodium metabisulfite, para-hydroxybenzoate, methylparaben, and Menthol.*

Research Tools

1. Caliper
2. Digital scales
3. Blender
4. *Vacuum rotary evaporator*
5. Sieve
6. Pumpkin base
7. Oven
8. Scalpel
9. Razor
10. Animal scales
11. Plastimometer
12. Wistar cage
13. Storage containers
14. Glove
15. Mask
16. Serum container
17. Plaster/base
18. Filter Paper

Research Materials

1. Banana peel
2. Tween 80 as much as 35 g
3. Glycerin 25 g
4. Nipagin 0.2 g
5. Nipasol 0.02 g
6. Perfume to taste (q.s)
7. Aquadest up to a total volume of 100 ml
8. Marmot
9. Guinea pig feed
10. Minoxidium ® 5%

RESULTS AND DISCUSSION

Banana Peel Extract Serum Against Marmot Hair Weight Growth

Table 2. Average growth in guinea pig hair weight after administration of banana peel extract serum in each treatment group

Group	X	Std. Dev
Negative Group	0.08674	0.051153
Positive Control (minoxidil ® 5%)	0.19124	0.050439
Group I (20% Kepok banana peel extract serum)	0.07220	0.060158
Group II (30% kepok banana peel extract serum)	0.17814	0.084711
Group III (kepok banana peel extract serum 40%)	0.17498	0.058237

Source: Research Data Processing, 2025

Based on the table above, data were obtained on the average growth of guinea pig hair weight after administering kepok banana peel extract serum in each treatment group. In the negative group, namely the group not given minoxidil or kepok banana peel extract serum, the average hair weight growth was 0.08674 ± 0.051153 g. This indicates a relatively low rate of hair growth without the influence of any particular treatment. Here is an overview of guinea pig hair growth in the negative group for 4 weeks involving three guinea pigs.

Banana Peel Extract Serum Against Marmot Hair Long Growth

Table 3. Average growth of guinea pig hair length after administration of banana peel extract serum in each treatment group

Group	Week 1		Week 2		Week 3		Week 4	
	X	Std.Dev	X	Std.Dev	X	Std.Dev	X	Std.Dev
Negative Group	0.194	0.063875	0.292	0.086139	0.496	0.082946	0.652	0.10895
Positive Control	0.23	0.023452	0.694	0.172134	1.308	0.335961	1.724	0.344282
Group I	0.204	0.055045	0.608	0.169912	1.056	0.256281	1.476	0.289879
Group II	0.23	0.066332	0.618	0.172829	1.32	0.168671	1.694	0.091269
Group III	0.208	0.058481	0.58	0.061237	0.942	0.480645	1.32	0.659924

Source: Research Data Processing, 2025

Based on the table above, data were obtained on the average growth of guinea pig hair length after administering kepok banana peel extract serum in each treatment group for four weeks of observation. In the negative group, namely the group that was not given minoxidil or kepok banana peel extract serum, the average hair length growth showed a gradual increase from 0.194 ± 0.063875 cm in the first

week to 0.652 ± 0.10895 cm in the fourth week. This reflects the normal growth of hair without additional treatments. The positive control group, which was given 5% minoxidil ®, showed a more significant average hair length growth, from 0.23 ± 0.023452 cm in the first week to 1.724 ± 0.344282 cm in the fourth week. This growth was much higher than that of the negative group, indicating the effectiveness of minoxidil in stimulating hair length growth.

Treatment group I, which was given kepok banana peel extract serum with a concentration of 20%, experienced an increase in hair length from 0.204 ± 0.055045 cm in the first week to 1.476 ± 0.289879 cm in the fourth week. Although the growth was higher than that of the negative group, the effectiveness was still lower than that of the positive control group. In the treatment group II, which was given a serum of kepok banana peel extract with a concentration of 30%, the average hair length growth increased from 0.23 ± 0.066332 cm in the first week to 1,694 ± 0.091269 cm in the fourth week. These results are close to the effectiveness of minoxidil, suggesting that a 30% serum concentration has optimal potential in stimulating hair length growth. Meanwhile, treatment group III, which was given a serum of kepok banana peel extract with a concentration of 40%, showed an average hair length growth that increased from 0.208 ± 0.058481 cm in the first week to 1.32 ± 0.659924 cm in the fourth week. However, this growth was lower than that of the treatment II group and the positive control group, which suggests that the 40% concentration may not have an optimal effect on hair growth.

Overall, the administration of kepok banana peel extract serum showed the ability to stimulate the growth of guinea pig hair length, with a concentration of 30% providing the most optimal results.

Based on the results of the *Post Hoc Bonferroni* test in weeks 1, 2, 3, and 4, here is a comparison between groups each week:

Week 1

1) In the Negative Group, there was a significant difference with the Positive Control Group (minoxidil ® 5%) with a value *of p* = 0.026. Still, there was no significant difference with Group I (20% Kepok Banana Peel Extract Serum), Group II (30% Kepok Banana Peel Extract Serum), and Group III (Kepok Banana Peel Extract Serum 40%).
2) In the Positive Control Group (minoxidil ® 5%), there was a significant difference with the Negative Group with a value *of p* = 0.026. Still, there was no significant difference with Group I (20% Kepok Banana Peel Extract Serum), Group II (Kepok Banana Peel Extract Serum 30%), and Group III (Kepok Banana Peel Extract Serum 40%).
3) In Group I (20% Kepok banana peel extract serum), there was no significant difference with the Negative Group, Positive Control (minoxidil ® 5%), Group II (30% Kepok banana peel extract serum), and Group III (40% Kepok banana peel extract serum).
4) In Group II (30% kepok banana peel extract serum), there was a significant difference with Group Negative and Group III (kepok banana peel extract serum 40%) with *p* = 0.026 and p = 0.026 values. Still, there was no significant difference with Group I (kepok banana peel extract serum 20%) and Positive Control (minoxidil ® 5%).

5) In Group III (40% kepok banana peel extract serum), there was no significant difference with the Negative Group, Positive Control (minoxidil ® 5%), Group I (kepok banana peel extract serum 20%), and Group II (kepok banana peel extract serum 30%).

Week 2

1) In the Negative Group, there was a significant difference with the Positive Control Group (minoxidil ® 5%) with *a value of p* = 0.050. Still, there was no significant difference with Group I (20% Kepok Banana Peel Extract Serum), Group II (30% Kepok Banana Peel Extract Serum), and Group III (40% Kepok Banana Peel Extract Serum).
2) In the Positive Control Group (minoxidil ® 5%), there was a significant difference with the Negative Group with a value *of p* = 0.050. Still, there was no significant difference with Group I (20% Kepok Banana Peel Extract Serum), Group II (30% Kepok Banana Peel Extract Serum), and Group III (Kepok Banana Peel Extract Serum 40%).
3) In Group I (20% Kepok banana peel extract serum), there was no significant difference with the Negative Group, Positive Control (minoxidil ® 5%), Group II (30% Kepok banana peel extract serum), and Group III (40% Kepok banana peel extract serum).
4) In Group II (30% Kepok banana peel extract serum), there was no significant difference with the Negative Group, Positive Control (minoxidil ® 5%), Group I (20% Kepok banana peel extract serum), and Group III (40% Kepok banana peel extract serum).
5) In Group III (40% kepok banana peel extract serum), there was no significant difference with the Negative Group, Positive Control (minoxidil ® 5%), Group I (kepok banana peel extract serum 20%), and Group II (kepok banana peel extract serum 30%).

Week 3

1) In the Negative Group, there was a significant difference with the Positive Control Group (minoxidil ® 5%) with a value of p = 0.003. With Group II (30% Kepok Banana Peel Extract Serum) with a value of p = 0.003, but there was no significant difference with Group I (Kepok Banana Peel Extract Serum 20%) and Group III (Kepok Banana Peel Extract Serum 40%).
2) In the Positive Control Group (minoxidil ® 5%), there was a significant difference with the Negative Group with a value of p = 0.003. Still, there was no significant difference with Group I (20% Kepok Banana Peel Extract Serum), Group II (30% Kepok Banana Peel Extract Serum), and Group III (40% Kepok Banana Peel Extract Serum).
3) In Group I (20% Kepok banana peel extract serum), there was no significant difference with the Negative Group, Positive Control (minoxidil ® 5%), Group II (30% Kepok banana peel extract serum), and Group III (40% Kepok banana peel extract serum).
4) In Group II (30% kepok banana peel extract serum), there was a significant difference with the Negative Group with a value *of p* = 0.003. Still, there was no significant difference with the Positive Control Group (minoxidil ® 5%), Group

I (kepok banana peel extract serum 20%), and Group III (kepok banana peel extract serum 40%).

5) In Group III (40% kepok banana peel extract serum), there was no significant difference with the Negative Group, Positive Control (minoxidil ® 5%), Group I (kepok banana peel extract serum 20%), and Group II (kepok banana peel extract serum 30%).

Week 4

1) In the Negative Group, there was a significant difference with the Positive Control Group (minoxidil ® 5%) with a value of p = 0.011. Still, there was no significant difference with Group I (20% Kepok banana peel extract serum), Group II (30% Kepok banana peel extract serum), and Group III (40% Kepok banana peel extract serum).
2) In the Positive Control Group (minoxidil ® 5%), there was a significant difference with the Negative Group with a value of p = 0.011, but there was no significant difference with Group I (20% Kepok banana peel extract serum), Group II (30% Kepok banana peel extract serum), and Group III (Kepok banana peel extract serum 40%).
3) In Group I (20% Kepok banana peel extract serum), there was no significant difference with the Negative Group, Positive Control (minoxidil ® 5%), Group II (30% Kepok banana peel extract serum), and Group III (40% Kepok banana peel extract serum).
4) In Group II (30% Kepok banana peel extract serum), there was no significant difference with the Negative Group, Positive Control (minoxidil ® 5%), Group I (20% Kepok banana peel extract serum), and Group III (40% Kepok banana peel extract serum).
5) In Group III (40% kepok banana peel extract serum), there was no significant difference with the Negative Group, Positive Control (minoxidil ® 5%), Group I (kepok banana peel extract serum 20%), and Group II (kepok banana peel extract serum 30%).

Discussion

The study's results showed that the average increase in the weight of guinea pig hair (Cavia porcellus) varied based on the treatment given. In the negative control group, which did not receive treatment in the form of minoxidil or kepok banana peel extract serum, the average hair weight growth was recorded at 0.08674 ± 0.051153 g, representing physiological growth without the influence of external intervention. In contrast, the positive control group given minoxidil® 5% showed an average hair weight growth of 0.19124 ± 0.050439 g, the highest value among all groups, which confirms that minoxidil is the gold standard in stimulating hair growth through stimulation of proliferation and dermal activity of papilla.

In the treatment group that received Kepok banana peel extract serum, the effectiveness showed variations based on concentration. The treatment group with a concentration of 20% (Group I) recorded an average hair weight growth of 0.0722 ± 0.060158 g, slightly lower than the negative control group, so it showed a insignificant effect. At a concentration of 30% (Group II), the average hair weight growth increased to 0.17814 ± 0.084711 g, close to the effectiveness of positive controls using minoxidil. Meanwhile, at a concentration of 40% (Group III), the

average hair weight growth reached 0.17498 ± 0.058237 g, slightly lower than the 30% concentration, but still higher than the negative control group and the 20% concentration treatment. Based on this data, the serum concentration of 30% kepok banana peel extract was the most effective in stimulating hair weight growth in guinea pigs.

An increase in hair length was also analyzed during four weeks of observation. In the negative control group, hair length increased from 0.194 ± 0.063875 cm in the first week to 0.652 ± 0.10895 cm in the fourth week, reflecting natural growth without external influences. In contrast, in the positive control group given 5% minoxidil, a more significant increase in hair length was recorded, from 0.23 ± 0.023452 cm in the first week to 1.724 ± 0.344282 cm in the fourth week, which strengthened the effectiveness of minoxidil in increasing cellular proliferation activity in the dermal papilla.

In the treatment group with Kepok banana peel extract serum, the results of the increase in hair length varied according to the concentration used. The group with a concentration of 20% (Group I) showed an increase in hair length from 0.204 ± 0.055045 cm in the first week to 1.476 ± 0.289879 cm in the fourth week, which was higher than the negative control group, but lower than the positive control group. The group with a concentration of 30% (Group II) recorded an increase in hair length from 0.23 ± 0.066332 cm in the first week to 1.694 ± 0.091269 cm in the fourth week, almost equivalent to the positive Control. Meanwhile, the group with a concentration of 40% (Group III) showed an increase in hair length from 0.208 ± 0.058481 cm in the first week to 1.32 ± 0.659924 cm in the fourth week, which was lower than the 30% group and the positive control group. The results of this study indicated that the 30% concentration of kepok banana peel extract serum had the best effectiveness in stimulating hair growth in guinea pigs, although the effectiveness was slightly lower than that of positive Control using 5% minoxidil®.

Compared to a study that used papaya peel ethanol extract (Carica papaya L.), which contains alkaloid compounds, flavonoids, saponins, steroids, and glycosides, papaya extract at a concentration of 30% resulted in an average hair growth of 16,375 mm, which is almost equivalent to a positive control (16,782 mm). Although the two show comparable results, the main difference lies in the composition of the bioactive compounds contained in the extracts of each ingredient. The compounds in papaya extract are believed to be able to stimulate the proliferation of dermal papilla cells as well as increase blood microcirculation in the hair follicles, supporting more optimal hair growth (Mella Candani, Muhammad Gunawan, Siti Aisyah Tanjung, 2024).

Another study examining moringa leaf extract (Moringa oleifera L.) showed that moringa leaf extract at a concentration of 20% had a similar potential in stimulating hair growth, with results not significantly different from positive controls. Although moringa leaf extract also contains flavonoids and saponins, the bioactive compounds in kepok banana peel extract, especially at a concentration of 30%, have been proven to provide better results in stimulating hair growth, both in terms of weight and hair length, showing the superior potential of kepok banana peel extract (Hasty Martha Wijaya, Eka Setyaningrum, Rifda Naufa Lina, 2024).

In addition, research by Dwi Saryanti regarding cream preparations based on kepok banana peel extract revealed that this extract has strong antioxidant properties, protecting hair follicles from oxidative stress that can interfere with the hair growth process. While the study did not directly measure the effect of the extract on hair growth, these antioxidant properties could potentially support overall hair health, by reducing damage caused by free radicals (Saryanti, Setiawan, & Safitri, 2019) Research conducted by Shofa Fauziah regarding the formulation of anti-dandruff shampoo based on ethanol extract of kepok banana peel shows that this extract has antimycotic activity against Pityrosporum ovale, a microorganism that causes dandruff. Although these results do not focus directly on hair growth, the inhibition of the growth of this fungus can create a healthier scalp condition, which supports optimal hair growth (Fauziah, Adlina, & Rizkuloh, 2024).

Overall, kepok banana peel extract shows therapeutic potential that is almost equivalent to other active ingredients in stimulating hair growth. Although minoxidil® 5% is still considered the gold standard in hair growth stimulation, kepok banana peel extract at a concentration of 30% shows significant effectiveness, even exceeding lower concentrations and other active ingredients such as moringa and papaya leaves. The advantage of kepok banana peel extract lies in the composition of bioactive compounds, including flavonoids, saponins, and tannins, which play a role in cell proliferation, improve blood microcirculation in hair follicles, and provide protection against oxidative stress that can affect hair health.

In addition, research by Ni Luh Firda Ekayanti shows that banana peels, including banana peels, contain bioactive compounds such as flavonoids, saponins, and tannins that function as antioxidants, anti-inflammatory, and skin brighteners. These compounds synergize in caring for skin and hair health, making kepok banana peel extract a potential ingredient in the formulation of cosmetic products (Firda Ekayanti, Megawati, & Anita Dewi, 2023). As additional evidence, research by Siti Fatimah shows that shampoo based on kepok banana peel extract from Sugihmanik Village has quality that meets the standards, with optimal physical parameters, including homogeneity, pH by human shampoo standards (5), and good physical stability. This confirms that kepok banana peel extract has great potential as an active ingredient in safe and effective hair care products (Pradigdo, Arifan, Broto, & Humala, 2022).

Kepok banana peel extract (Musa paradisiaca) helps in several aspects of hair growth pathogenesis, mainly through its effect on hair follicle activity and dermal papilla. The bioactive content such as flavonoids, tannins, saponins, and alkaloids in this extract supports various important mechanisms in the hair anagen phase. Flavonoids act as antioxidants that protect hair follicles from oxidative stress while also increasing angiogenesis, which improves the supply of nutrients and oxygen to the dermal papilla. In this main area, hair follicles get metabolic support. Saponins increase the penetration of active ingredients into the skin, stimulate the proliferation of dermal papilla cells, and prolong the anagen phase, thus promoting faster and longer hair growth. In addition, the alkaloids in this extract support tissue regeneration by inhibiting cellular apoptosis around the hair follicles, contributing to the sustainability of hair growth. These effects collectively help improve the

microstructure of follicles, strengthen hair roots, and stimulate the proliferative activity of hair cells, making kepok banana peel extract a potential agent in hair regeneration therapy.

The results of the statistical test showed that there was a significant difference between the treatment groups at various weeks of observation. In the first week, the ANOVA analysis produced a significance value (*Sig*. 0.014), indicating a significant difference between the groups. In the second to fourth weeks, the Kruskal-Wallis analysis showed significant results (*Sig*. < 0.05). The Post *Hoc Bonferroni* follow-up test showed that the negative control group had a significant difference in the first week compared to the positive control group ($p = 0.026$), but did not show a significant difference with the other treatment groups. At the second week, a significant difference was found between the negative and positive control groups with ($p = 0.050$).

Furthermore, in the third week, the negative control group had a significant difference with the positive control group ($p = 0.003$) and the treatment group with a concentration of 30% kepok banana peel extract serum (Group II, $p = 0.003$). In the fourth week, a similar pattern was found with significant differences between the treatment groups (*Sig*. 0.017). The results of this study show that Kepok banana peel extract serum, especially with a concentration of 30%, has optimal potential in supporting hair weight and length growth in guinea pigs. However, the effectiveness of the Kepok banana peel extract serum is still slightly below the 5% minoxidil® effectiveness standard as a positive control.

CONCLUSIONS

Research on the effectiveness of Minoxidil and Kepok banana peel extract serum on marmot hair growth shows that Minoxidil® 5% has the highest effectiveness in stimulating hair weight growth, with an average of 0.19124 ± 0.050439 g, while Kepok banana peel extract serum at a 30% concentration achieved an average growth of 0.17814 ± 0.084711 g, making it the most effective among other concentrations (20% and 40%) and approaching the effectiveness of Minoxidil. Statistical tests revealed significant differences between groups from the first to the fourth week, with the negative group showing a significant difference from the positive control in the first week ($p = 0.026$) and further significant differences in the third week between the negative group and the positive control ($p = 0.003$) as well as the treatment group with a 30% serum concentration ($p = 0.003$). This suggests that Kepok banana peel extract serum at a 30% concentration has the potential to be an alternative for hair care, although its effectiveness remains slightly below the 5% Minoxidil® gold standard, requiring further research to optimize its formulation and application.

BIBLIOGRAPHY

Amalia, B. R., Muliasari, H., & Hidayati, A. R. (2023). Antioxidant Activity Test of Combination of Kepok Banana Peel Extract (Musa paradisiaca L.) and Red Dragon Fruit Peel (Hylocereus polyrhizus (Weber) Britton & Rose) by DPPH Method. Journal of Pharmascience, 10(1), 69.

https://doi.org/10.20527/jps.v10i1.14863
Broto, W., Arifan, F., Supriyo, E., Fatimah, S., Wardani, O. K., Nur, A., Prasetyo, F., & Faisal, M. M. (2022). Shampoo Formulation Based on Banana Extract Using the Maceration Method. Waste Technology, 10(2), 67–70. http://dx.doi.org/10.14710/wastech.10.2.67-70
Fauziah, S., Adlina, S., & Rizkuloh, L. R. (2024). Formulation of Anti-dandruff Shampoo Preparation of Ethanol Extract of Kepok Banana Peel (Musa paradisiaca L.) and Its Activity Against Pityrosporum ovale Fungus. Struggle Nature Pharmaceutical Conference, 1(1), 191–199.
Feladita, N., Astuti, S., & Saputra, A. (2023). Hair Growth Tonic Formulation From A Combination of Ethanol Extract Coffee Waste and Kepok Banana Skin Waste. Journal of Pharmaceutical Analysts, 8(2), 326–333.
Fhatonah, N., Damayanti, H., Megawati, S., Ode Akbar, L. R., & Herlinda, P. (2023). Formulation And Activity Test Of Hair Growth On Test Strain Male Rabbit Hair Tonic Extract 96% Ethanol Pandan Wangi Leaf Extract (Pandanus Amaryllifolius Roxb.). August, X(2), 6–16.
Firda Ekayanti, N. L., Megawati, F., & Anita Dewi, N. L. K. A. (2023). Utilization Of Banana Plants (Musa Paradisiaca L.) As A Cosmetic Preparation. Usadha, 2(2), 19–24. https://doi.org/10.36733/usadha.v2i2.6217
Harahap, L. (2022). The basis of shampoo in Huta Raja Village. 1(2), 120–124.
Husnawati, H., Astutik, I. Y., & Ambarsari, L. (2019). Characterization and Bioactivity Test of Pectin from Musa balbisiana Peel Extracted using Various Acid Solvents. Curr. Biochem. 2019, 6(1), 1–10.
Ida Erna Widyawati, Slamet Tuty, & Alvianti Nuraiini. (2024). A Systematic Review of the Utilization of Banana Plants (Musa Paradisiaca L.) Indonesian territory as an ingredient in cosmetic preparations. Antigen: Journal of Public Health and Nutrition Sciences, 2(3), 192–199. https://doi.org/10.57213/antigen.v2i3.334
Iman, A. Al, Sukrasno, S., Rizaldy, D., & Yanti, N. L. P. K. M. (2023). Comparison of Flavonoid Levels, Phenols, and Antioxidant Activities in the Skin of Kepok Banana (Musa acuminata x balbisiana) Using Different Extraction Methods. Journal of Science and Health, 5(6), 1010–1016. https://doi.org/10.25026/jsk.v5i6.2134
Khoirunnisa, S. M., Dirga, D., Setyawan, I. A., & Akhmad, A. D. (2022). Formulation of Ambon Banana Peel Waste Gel Mask Preparation (Musa paradisiaca var.sapientum) as an Antioxidant. Malahayati Journal of Pharmacy, 5(1), 33–47. https://doi.org/10.33024/jfm.v5i1.6350
Manuppak Irianto Tampubolon, Dhea Nur Fadhilah, & Dumartina Hutauruk. (2024). Formulation and Evaluation of Clove Leaf Ethanol Extract Shampoo Preparation (Syzygium aromaticum L) as a Hair Growth Agent in Male White Rats. Journal of Research in General Health Sciences and Pharmacy (JRIKUF), 2(3), 202–210. https://doi.org/10.57213/jrikuf.v2i3.332
Mas, P., Banana, D. A. N., & Use, N. (2021). DPPH. 18(2), 77–84.
Mauliddiyah, N. L. (2021). No Covariance Structural Analysis of Health-Related Indicators in Elderly People at Home Focusing on Subjective Health PerceptionTitle. 6.

Pradigdo, S. F., Arifan, F., Broto, W., & Humala, N. P. (2022). Formulation of Banana Peel Extract Shampoo in Sugihmanik Village. Journal of Applied Chemical Research, 03(1), 33–41. https://ejournal2.undip.ac.id/index.php/pentana/article/view/14713

Pratiwi, A., Manurung, A. F., & Sumitra, J. (2020). Determination Of Vitamin C Levels In Banana Peels (Musa Paradisiaca) By Uv-Visible Spectrophotometry Method IN 2018. Journal of Pharmacymed (Jfm), 2(2), 56–62. https://doi.org/10.35451/jfm.v2i2.363

Rudiyat, A., Yulianti, R., & Indra, I. (2020). Formulation Of Anti-Acne Cream Ethanol Extract Of Kepok Banana Peel (Musa balbisiana Colla). Journal of Health Bakti Tunas Husada: Journal of Nursing Sciences, Health Analyst and Pharmacy, 20(2), 170. https://doi.org/10.36465/jkbth.v20i2.609

S, P. N. I., Nurelly N, Yani Sodiqah, Dian Amelia, Dahlia, Solecha Setiawati, & Adharia. (2022). Comparison of the Incidence of Androgenic Alopecia with Dandruff (Pityriasis Sicca) and without Dandruff at the Indonesian Muslim University. Fakumi Medical Journal: Journal of Medical Students, 2(8), 565–572. https://doi.org/10.33096/fmj.v2i8.108

Saryanti, D., Setiawan, I., & Safitri, R. A. (2019). Optimization Of Stearic Acid And Tea In The Preparation Formula Of Kepok Banana Peel Extract Cream (Musa paradisiaca L.). Indonesian Journal of Pharmaceutical Research, 1(3), 225–237. https://doi.org/10.33759/jrki.v1i3.44

Sugirno, odan E. (2021). * Guo Dongpo 1, Liu San 1, Li Qing 2, Zhou Dongbo 2. Onesimus Dhyas Dwi Atmajaya1, Beryaldi Agam1, and Agung Wahyudi2 1Polytechnic, 9860(1), 51–60.

Yuniarsih, N., Abriyani, E., & Shadrina, A. N. (2024). Formulation, Antioxidant, And Antibacterial Test Of Serum Gel Of Kepok Banana Peel Extract (Musa balbisiana) As An Anti-Acne. Journal of Buana Farma, 4(2), 174–185. https://doi.org/10.36805/jbf.v4i2.1056