

## TOPICAL APPLICATION OF *Capsicum frutescens* LEAF EXTRACT AS HAIR TONIC IN MICE (*Mus musculus*)

Safrida Safrida<sup>1\*</sup>, Shella Nasmi<sup>1</sup>, and Devi Syafrianti<sup>1</sup>

<sup>1</sup>Department of Biology Education, Faculty of Teacher Training and Education, Universitas Syiah Kuala, Darussalam, Banda Aceh, Indonesia

\*Corresponding author: saf\_rida@unsyiah.ac.id

### ABSTRACT

The research aims to determine the effect of giving cayenne leaf extract in increasing the length and amount of hair on mice. This research belongs to the type of quantitative research. This research used a Completely Randomized Design (CRD) in consisting of 5 treatment and 4 repetitions. The treatments consisted of NC (negative control, not treated), PC (positive control, given a commercial hair extract), P1 (cayenne leaf extract 10%), P2 (cayenne leaf extract 20%), and P3 (cayenne leaf extract 30%). Research parameters included the increase of the hair length and amount of hairs growing in mice. The result showed that giving extract of cayenne leaf significantly influences the length and amount of hairs in mice, with 10% concentration (P2) was the optimum concentration of the extract that can trigger the hair growth. It can be concluded that given extract of cayenne leaf can increase the hairs growth in mice and has potential as hair tonic.

Key words: cayenne leaves, extracts, hair growth, mice

### ABSTRAK

Penelitian ini bertujuan mengetahui pengaruh pemberian ekstrak daun cabai dalam meningkatkan panjang dan jumlah rambut pada tikus. Penelitian ini termasuk jenis penelitian kuantitatif. Penelitian ini menggunakan Rancangan Acak Lengkap (RAL) yang terdiri dari 5 perlakuan dan 4 ulangan. Perlakuan terdiri atas NC (kontrol negatif, tidak diobati), PC (kontrol positif, diberi ekstrak urang-aring komersial), P1 (ekstrak daun cabai 10%), P2 (ekstrak daun cabai 20%), dan P3 (daun cabai) ekstrak 30%. Parameter penelitian meliputi pertumbuhan panjang dan jumlah rambut yang tumbuh pada tikus. Hasil penelitian menunjukkan bahwa pemberian ekstrak daun cabai berpengaruh signifikan terhadap pertumbuhan panjang dan jumlah rambut pada tikus. Disimpulkan bahwa pemberian ekstrak daun cabai rawit dapat meningkatkan pertumbuhan panjang dan jumlah pertumbuhan rambut pada tikus yang berpotensi untuk hair tonic.

Kata kunci: ekstrak cabai rawit, rambut, tikus

### INTRODUCTION

Hair is one of the derivatives of the skin that has a thin shape like a thread. Hair is spread all over the skin surface, except in certain places such as palms, soles, and lips. Hair experiences three stages of growth, namely growth phase, shedding phase, and regrowth phase. However, the duration of the 3 stages is different between one hair strand and another hair strand. This means that there are differences in the life span of hair strands (Sari and Adityo, 2016). Hair that grows on the surface of the skin comes from a follicle found in the dermis skin layer. Hair will grow well if the follicles get enough nutrition. Nutrients received by hair follicles are flowed by blood through a channel that empties into the follicles (Aditya and Agtaria, 2016).

Hair has a very important role for the body; it helps the thermoregulation function (stabilizing the surface temperature of the skin) and sensory function (increasing the sensitivity of the skin to touch), and protects the body from mechanical friction such as scratches that can cause injury or irritation to the skin. Many problems arise in hair, from thin and fragile texture, difficulty growing, loss, to baldness. Hair loss that occurs in areas of the skin that are normally overgrown by hair is called alopecia. Alopecia does not indicate a specific disease. Someone who experiences hair loss or baldness caused by various factors can be said to have alopecia (Hariyani and Jusuf, 2018).

People today use synthetic drugs to overcome hair problems, especially hair loss and poor hair growth. However, the use of synthetic materials can cause

various kinds of irritation to the skin, such as itching, allergies, and other conditions. One solution to avoid this is to use natural ingredients such as cayenne leaves. This practice has become a tradition among the people of Aceh; they rub the crushed cayenne leaves on the heads of infants who have poor hair growth. Musdalipah and Karmilah (2018) stated that cayenne leaves were used as an ingredient to grow hair because it contained active compounds at certain concentrations. These compounds are saponins and flavonoids. Saponins are secondary metabolites that increase blood flow to hair follicles, so that the follicles get enough nutrients to trigger the process of hair growth.

The application of cayenne leaf extract was carried out on mice (*Mus musculus*). This animal was chosen because its physiology is identical to humans (Kusumawati, 2004). If it works, cayenne leaves can be used by humans as the ingredient for to grow hair as well as prevent hair loss. This is supported by Kastika and Resti (2018) who have conducted research on burns on the mice skin mice that have an impact on the process of hair growth. Cayenne in Aceh is very abundant and easily obtained. Based on the above explanation, this research was conducted to evaluate the hair growth in mice by utilizing ethanol extract of cayenne leaves.

### MATERIALS AND METHODS

The total of 20 mice aged 2-2.5 months old with a body weight of 20-30 g, were use in this study. This study used a Completely Randomized Design (CRD) method consisting of 5 treatments and 4 replications.

The treatments consisted of NC (negative control, without given treatment), PC (positive control, given commercial hair product), P1 (given 10% cayenne leaf extract), P2 (given 20% cayenne leaf extract), and P3 (given 30% cayenne leaf extract).

### Cayenne Leaf Extraction

A total of 500 g of crushed cayenne leaf were soaked in 3,750 mL of 96% ethanol for 3 days and stirred frequently, then filtered using filter paper and evaporated using a vacuum rotary evaporator to obtain 250 g of thick extract of. Cayenne leaf extract were divided into 3 concentrations: 10%, 20%, and 30%.

### Maintenance and Treatment of Test Animals

The mice were acclimatized for 1 week in trial cages. The process of hair loss in mice was carried out using 1 ml of depilatory cream (Veet cream) for 1-3 minutes. Mice were then cleaned using tissue and allowed to stand for 24 hours prior to treatment. Cayenne leaf extract (*Capsicum frutescens* L.) were given by applying 1 mL of cayenne leaf extract to the skin of mice twice a day. Hair length was measured every three days using calipers. The amount of hair growth was scored as: very much, >150 strands of hair /cm (3), fair, 50-150 strands of hair /cm (2), not much, <50 strands of hairs /cm (1), and not growing (0). The observations of the growth of mice hair after given cayenne leaf extract was conducted for 24 days.

### Data Analysis

Data were analyzed using analysis of variance (ANOVA) followed by Tukey's HSD test at 5% significance level.

## RESULTS AND DISCUSSION

The results of this 24-day study showed that the average length of mice hair growth varied in each treatment. Variations in the average length of mice hair growth and the amount of hair in mice can be seen in Tables 1. Table 1 showed that hair length and number of mice in P2 group increased significantly compared to mice in groups of NC, P1, P2, and P3, but the value was similar to those mice in PC. From the obtained results, it also indicated that the administration of cayenne leaf extract was not very effective at higher concentrations (P3 treatment) with 30% cayenne leaf extract), and at a lower concentration (P1 treatment with 10% cayenne leaf extract). According to Nugraha (2011) ingredients that act as hair growth activators with concentrations that are not too high (optimum) can cause reddish conditions

on the skin and cause a feeling of warmth. This situation will trigger blood flow to the hair follicles.

This study revealed that 10 % concentration (P2) was the optimum concentration of the extract that can trigger an increase in hair length properly. This is supported by research conducted by Musdalipah and Karmilah (2018) on rabbit test animals, which found that cayenne leaf extract with a concentration of 20% is the optimum concentration of substances to increase the length of rabbit hair.

The effect given by cayenne leaf in increasing hair length in mice is due to the superiority of cayenne leaf, which is the secondary metabolite. According to Nugraha (2011), materials that can trigger hair growth are materials that contain compounds needed by parts of the hair. The parts include hair roots, hair follicles, and hair shaft. Flavonoid and phenol compounds can stimulate hair growth (Prasojo *et al.*, 2012). This is supported by Luliana *et al.* (2019) who stated the same findings, that one of the substances included in the flavonoid compound was quercetin.

The positive effect on the amount of hair in mice is caused by secondary metabolite compounds found in cayenne leaves. Some secondary metabolite compounds contained in cayenne leaves include flavonoids, alkaloids, saponins, steroids, and tannins (Yuliana *et al.*, 2018). *Capsicum frutescens* contains bioactive compounds such as capsaicin and luteolin, a phenolic compound (Milagros *et al.*, 2019). Capsaicin induces significant hair growth in the back skin of telogen mice, which is associated with substantial mast cell degranulation (Paus *et al.*, 1994). Peppers contains phenolic compounds, such as flavonoids and derivatives, phenolic acid, vitamin C, vitamin A and minerals such as iron, calcium, and manganese, which greatly provide nutrition for humans (Pandey and Rizvi, 2009). Flavonoids have bactericidal properties so they can eradicate microorganisms in the form of bacteria found in hair and scalp (Musdalipah and Karmilah, 2018). According to Kastika and Resti (2018), both flavanoid and tannin compounds have the potential to fertilize hair. Hair fertility is also influenced by the presence of stimulus to hair dermal papilla cells. When the proliferation of dermal papilla cells increases, the surface skin epidemic will become thicker and able to strengthen blood vessels. With this condition, a small cross section of hair follicles become larger. Large cross section of follicle, allows the nutrients and oxygen to enter the follicle.

Other compound that was assumed to play the most role in triggering the process of hair growth was alkaloid (Benerjee *et al.*, 2009) and saponin (Sa'diah *et al.*, 2015).

**Table 1.** Average mice hair growth in various treatments

Treatment	Length of hair (mm)	Percentage increase of hair length	Amount of hair	Percentage increase of hair amount
NC	3.109±0.24 <sup>a</sup>	-	0.8750±0.01 <sup>a</sup>	-
P1	4.940±2.01 <sup>b</sup>	58.89	1.4375±0.14 <sup>b</sup>	64.28
P2	7.261±1.74 <sup>d</sup>	133.54	2.0625±0.07 <sup>d</sup>	135.71
P3	6.021±0.11 <sup>c</sup>	93.66	1.8125±0.07 <sup>c</sup>	107.14
PC	6.751±0.83 <sup>cd</sup>	117.14	1.8750±0.07 <sup>cd</sup>	114.28

NC= Negative control, P1= Cayenne leaf extract 10%), P2= Cayenne leaf extract 20%), P3= Cayenne leaf extract 30%). PC= Positive control, given a commercial hair extract

Saponin compounds also function to improve the process of circulation to the peripheral parts of the body. Saponin compounds also help cleanse the skin and prevent the proliferation of microbes such as fungi and bacteria (Sa'diah et al., 2015).

Smooth circulation of blood to the hair follicles is due to the process of dilation of blood vessels. Blood flow through the circulatory system will carry adequate nutrition and oxygen supply for hair follicles so that the process of hair growth can occur (Musdalipah and Karmilah, 2018). This is in accordance with research conducted by Kuncari et al. (2015) that good hair growth is caused by the stimulation of nutrients received by hair follicles, the maximum process of blood circulation to the hair follicles, and the presence of a substance that can maintain moisture skin that will be overgrown by hair. According to Indriana et al. (2018) the process of dilation of blood vessels is known as vasodilation. Vasodilation is a process that is triggered by a vasodilator, which is a substance or compound that can stimulate the process of dilation of blood vessels so that circulation in blood vessels runs smoothly and nutrients and oxygen can reach the hair follicles and accelerate the process of hair growth. On the other hand, there are several factors that cause hair growth disorders. One of them is related to the production of the hormone dihydrotestosterone (DHT) by hair follicles. Inhibition of hair follicles in producing the hormone DHT can cause hair loss. Hair loss is caused by weak hair roots and lack of nutrition, giving the hair a thin and brittle texture (Triarini and Rini, 2014).

Compounds such as flavonoids, alkaloids, and saponins can increase the production of the hormone DHT. These compounds act as antioxidants that can strengthen and prevent hair damage (Kuncari et al., 2015). In addition, antioxidants are believed to be able to repair damaged hair cells and produce new cells that will accumulate into active tissue that divides to form a skin condition that is conducive to hair growth (Suhery et al., 2011).

Substances that trigger the growth of hair length can be raised by activating dormant hair cells, or by repairing oxidative damage that occurs (Kuncari et al., 2015). Besides being influenced by substances found in cayenne pepper leaves, the rate of hair growth is also influenced by the nutritional intake possessed by each test animal (Sari and Adityo, 2016).

Based on this study, it appears that the administration of cayenne leaf extract has a good effect on the amount of mice hair. The effectiveness of a substance on the processes that occur in the body is caused by the provision of higher concentrations of substances in optimum conditions. This treatment makes the hair more evenly distributed compared to other treatments (Anisah et al., 2017; Wicaksono and Hariyatmi, 2018).

## CONCLUSION

It can be concluded that the administration of cayenne leaf extract can increase the growth and length of mice hair and has potential as hair tonic.

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