Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2016, 8(5):821-830

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Activity of *Angiopteris evecta* for baldness treatment

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ABSTRACT

Baldness or abnormal hair growth is one of the problems often experienced by humans. Hormonal disorders, side effects of medication, food intake, and stress is a factor causing this problem. Pakis Munding (Angiopteris evecta (G.Forst.) Hoffm.) roots activity is thought to have hair growth based on traditional use. This study aims to determine the hair growth activity of ethanol extract and water extract of the roots of pakis munding topically on the male rabbit type Anggora with hair length parameter. Results of phytochemical screening showed the ethanol extract of the roots of pakis munding tannin containing secondary metabolites compounds, polyphenols, flavonoid, steroids, triterpenoids, quinones, monoterpenoid and sesquiterpenoids. Hair growth activity test results use modified Tanaka method showed that the ethanol extract and water extract with a concentration of 40%, 20%, 10% can significantly nourish hair by testing for 18 days. The ethanol extract with a concentration of 40%, 20% and 10% and water extract with levels of 40% and 20% showed better results than the positive control is a drug that has been marketed minoxidil. Ethanol extract and water extract with the levels of 40% showed the best results cope with minoxidil. It is suggested, before it can be used in humans, it is necessary to do further research on the bald volunteers.

Keywords: *Angiopteris evecta*, Pakis munding, fertilising hair, bald treatment.

INTRODUCTION

One of the problems often experienced by humans is baldness or hair growth that is not normal. Baldness is usually caused by hormonal disorders, side effects of medication, food intake, and stress [1]. Baldness (alopecia) can be on all the hair on the body (alopecia universalis) or the whole head of hair (alopecia totalis). The cause of this disease is still unclear, but in general this alopecia can be divided based on morphological observation into two groups: alopecia with sikatrik permanent and non sikatrik alopecia are still hopeful of hair growth. Androgenetic alopecia is one of alopecia non sikatrik which are prevalent in the community [2].

Various cosmetic products has been developed to overcome the problem of hair loss and baldness, both derived from synthetic materials or from natural materials. It has been proven that synthetic materials are used (among other minoxidil) on its use have side effects such as local irritation and erythema[3].According to the Food and Drug Administration (FDA) minoxidil is a safe and effective drug that is given in the long term for male patients with alopecia adrogenetik [2,4,5,6].

In Indonesia, traditional medicinal plants that have been widely recognized in the community as an efficacious bald treatment include: coconut, olive oil, green tea, ginkgo biloba, hazelnut seeds, etc. Some of them have been

scientifically reported. These include mixture of kemiri (*Aleurites moluccana*) and soybean (*Glycine max*) extracts [7],, seledri (*Apium Graveolens*) extract[8,9], daun pare (*Momordica charantia*) ethanol extract [10], mangkokan ((*Nothopanaxscutellarium*) leaves extract [11], kacang panjang (*Vigna sinensis*) leaves extract [12]. One of the plants that have not been recognized by the public and has long been proven for generations by the community at the foot of the Galunggung mountain is a plant called Paku Munding (Sundanese) (*Angiopteris evecta*). The plant thrives in the mountain slopes and foothills Galunggung and has been recognized by the people around Mount Galunggung can prevent and treat baldness effectively. By using modified Tanaka *et al*. method [13], this paper report on the effectiveness of the anti-baldness Paku Munding using types of Angora rabbit.

EXPERIMENTAL SECTION

Plant material

The plant material used in this study was Paku Munding (*Angiopteris evecta* (G.Forst.) Hoffm.L.) from the mountainside Galunggung, West Java, Indonesia which was then determined in Taxonomy Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Padjadjaran, Indonesia.

Rabbit

Experimental animals used were male white rabbit Angora strain, 4-5 months old, obtained from the Faculty of Animal Husbandry, Universitas Padjadjaran, Bandung. The study following ethical approval of the Kementerian Riset, Teknologi dan Pendidikan Tinggi, Fakultas Kedokteran Universitas Padjadjaran, Komisi Etik.

Extraction method

Extraction methods used in this research was the method soxhletation by using ethanol 96%. The Paku munding was made into the form of small pieces inserted into the soxhlet tube. Tools soxhlet then installed according to place and added a solvent of the top soxhlet tube for wetting bulbs and then heating mantle was turned on until the temperature reached the boiling point of the solvent. Extraction was done to look colorless solvent droplets. The extract obtained was then evaporated with a rotary evaporator and freeze dryer to obtain an thick extract with constant weight.In order to ensure the sample used was from the same source throughout the experiment, the fresh sample was collected in sufficient quantities (~10 kg) at a time [15]. First, the plant was washed thoroughly with running tap water, followed by rinsing with distilled water and then each part was cut into small pieces. They were sun dried (~30 °C) at open area with active ventilation until they attained constant weight (around one month). The Soxhlet apparatus was used for extraction process in which the extractor thimble was fitted in between a round bottom flask at the bottom and a bulb condenser at the top. Inside the thimble holder, 200 g dried sample was wrapped within a packing. Extraction using 1.8 L ethanol 96 % was carried out till obtain clear droplets. This procedure was guided by Farmakope Herbal Indonesia [14] and modified Gatbonton *et al*. [16] and Marnoto [17] methods. The obtained extractwas concentrated byusing a rotary evaporator and freeze dryer. In the same way, for comparison, also soxhletation done by using only water as a solvent

Phytochemical screening

Phytochemical screening test was done to check the content of alkaloids, polifenolat, tannins, flavonoids, monoterpenoid, sesquiterpenoids, steroids, triterpenoids, quinones, saponins in sample based on Farnsworth method[18].

1. Group Alkaloids

Principle: Alkaloid would give precipitates with salts of certain heavy metals, based on formation of insoluble complex compounds.

2. Flavonoid Compounds

Principle: The introduction of flavonoids was based on the reduction reaction of the carbonyl group of the δ-lactone ring into alcohol clusters formed hydroxy compound that had the colors depending on the functional cluster that was bound to ring A or B. The color that occurred can be drawn by amyl alcohol.

3. Polyphenols and Tanin compounds

Principle: Tannins and natural polyphenolic compounds were easily recognized through the introduction of phenol group to give a blue-black with a reagent of iron (II) chloride. The formation of a blue-black color indicated polifenolat nature. A small portion of the filtrate retested with the addition of gelatin solution 1%. The presence of white deposits indicated that there were tannins.

4. Saponin compounds
Principle: The reaction was based on the introduction of saponin it was able to provide the foam on shaking with water and persistent in adding a little acid or in the standing.
5. Monoterpenoid and sesquiterpenoids compounds
Principle: The reaction was based on the introduction of their ability to form colors with reagent anisaldehide-sulfuric acid or vanilline-sulfuric acid reagent.
6. Steroids and Triterpenoid
Principle: The introduction of triterpenoid and steroid compounds based on its ability to form a color with Lieberman-Burchard reagent. Lieberman Burchard reagent was made by mixing 20 parts of acetic acid anhydride to 1 part of concentrated sulfuric acid. This reagent should be used in water-free medium.
7. Quinone compound
Principle: The introduction of these compounds was based on his ability to form colored salts include hydroquinone with a strong alkaline solution of NaOH or KOH.

Testing Activities Fertilising Hair
Testing the activity of hair growth was made to ethanol and water extracts of munding fern roots. The method used was the method of Tanaka *et al* [13]. In this study, using one of the methods of hair growth activity was the method of shearing, backs rabbit hair removed by way until clean-shaven and then divided into seven plots with a size of 2 x 2 cm. Steps experiments were as follows:

A. **Preparation of Animal Test**
Rabbits were used as much as 3 male rabbit tails, aged 4-5 months, there were no anatomical defects and painless. Prior to use, rabbit acclimatized for 7 days, to get used to live in the neighborhood and the new treatment. Then backs cleaned of feathers and rested for 24 hours.

B**. Dilution Extracts**
Making condensed extract paku munding with a concentration of 40%, 20%, 10%, 5% and 2.5% respectively needed condensed extract paku munding as much as 40 g, 20 g, 10 g, 5 g and 2.5 g. Making each concentration was done by: CMC weigh as much as 500 mg, sprinkled over hot water in a mortar, left until fluffy, stirring vigorously until completely mixed and then add the extract, and mix until homogeneous then added to 100 ml of distilled water.

C. Grouping Rabbit
A total of 3 male rabbits were used. The first and second rabbit sheared back and divided into seven plots with a size of 2 x 2 cm and given treatment as follows:
• Compartments I: 2% minoxidil solution as a positive control
• Compartments II: treatment was not given as a negative control
• Compartments III: Paku munding condensed extract 40%
• Compartments IV: Paku munding condensed extract 20%
• Compartments V: Paku munding condensed extract 10%
• Plot VI: Paku munding condensed extract 5%
• Compartments VII: Paku munding condensed extract 2.5%

Furthermore, for the third rabbit simply be given treatment as follows:
• 1. Negative control: Not treated
• 2. Positive controls: Minoxidil 2%
• 3. Control Assay Test I: The ethanol extract 40%
• 4. Control Assay Test II: 40% water extracts

D. How Treatment
Initially backs shaved rabbits and divided into seven plots. Then given paku munding extract 2 times a day, morning and afternoon. Onwards revoked rabbit hair the longest five strands 3 days and measured using caliper for 18 days. Long hair obtained from the calculated average hair growth reached 3 per day for 18 days.

E. Data Analysis
Having obtained the data from the research, the data processing is done by using statistical analysis of variance (ANOVA) [19]

RESULTS AND DISCUSSION

Extraction

In this study, the sample was extracted by soxhletation using ethanol 96% to obtain a clear droplets. Ethanol solvent selected as the liquid because ethanol was a universal solvent that can dissolve almost all of the secondary metabolites contained in paku munding and it was not toxic and safe. With the ability to sum up the wide-ranging polarity non polar compounds that polar and precipitate proteins and inhibit the action of the enzyme so that it can avoid the hydrolysis and oxidation was the reason why ethanol was selected[20]. Soxhletation method was used based on information obtained from the Glunggung mountain communities that the use of paku munding done by water boiling, concentrated then the thick extract was rub on the head as a hair grower drug. Soxhletation result was then concentrated using a rotary evaporator at low pressure and a temperature of 40 °C to obtain a thick extract. Viscous extract obtained weighed and calculated yield of extract using the formula:

$$The\ yield\ (\%) = \frac{\text{wt of conc.extract}}{\text{wt of initial sample}} \text{ x } 100\%$$

The yield obtained after soxletation using ethanol 96 % and water only was 4.96% and 4.13 % by weight, respectively.

Results of phytochemical screening of the *Angiopteris Evecta* can be seen in Table 1.

Table 1. Results of phytochemical screening of the *Angiopteris Evecta*

Compounds	Phytochemical results
Alkaloids	-
Flavonoid	+
Tannin	+
Polyphenols	+
Saponin	-
Steroids	-
Triterpenoids	+
Quinone	+
Monoterpenoid and sesquiterpenoids	+

Note: +: Detected
-: Undetected

Wallace *et al*. [21] found flavonoid of Violanthin and isoviolanthin from the *Angiopteris evecta* wheres Taveepanich [22] reported to be able to found four compounds namely Succinic acid (1), Angiopteroside (4-O-beta-D-Glucopyranosyl-L-thero-2-hexen-5-olide) monohydrate (2), D-(+)-glucose (3) and a mixture of beta-sitosterol and stigmasterol (4). Molla *et al*[23]mentioned in their preliminary phytochemical analysis of their *Angiopteris evecta* sample the presence of saponins, tannins, alkaloids, and flavonoids. We did not found alkaloids in our sample might be due to different in sources of the sample.

Extracts dilution

The dilution of the extract was done with a concentration of 40%, 20%, 10%, 5%, 2.5% respectively. It took a thick extract as much as 40 grams, 20 grams, 10 grams, 5 grams, and 2.5 grams. Making each concentration was done by: CMC weigh as much as 500 mg, sprinkled over hot water in a mortar, left until fluffy, stirring vigorously until completely mixed and then add the extract, and mix until homogeneous then added to 100 ml of distilled water.

Activities Fertilising Hair Testing Results

Testing the activity of hair growth of *Angiopteris evecta* root extract was to know whether ethanol extract and water extract of *Angiopteris evecta* would be able to leave hair growth activity in rabbits. Onwards to know at what level the extract provided the best activity and so how the activity of hair growth *Angiopteris evecta* extract when compared to minoxidil.

Male rabbits were used as test animals. Based on the consideration that hormonal male rabbit was more stable than female rabbits easily affected psychologically by the time the menstrual cycle, pregnancy and lactation, the male sex have been selected as test animals. The first process performed was the adaptation of all the test animals for seven

days prior to treatment. On day 6 of adaptation, all shaved rabbit back and rested for one day before treatment. A total of 3 male rabbits were used in this study, rabbits were first given ethanol extract of the roots of ferns munding, when rabbits were both given water extract munding fern roots, and the latter is also given ethanol extract and water extract of *Angiopteris evecta*. Rabbits were the first and second treatment was given as follows:

1. Negative control: Not treated
2. Positive controls: Minoxidil 2%
3. Control Assay Test I: 40%
4. Control Assay Test II: 20%
5. Control Assay Test III: 10%
6. Control Assay Test IV: 5%
7. Control Assay Test V: 2.5%

Furthermore, for the third rabbit simply be given treatment as follows:
1. Negative control: Not treated
2. Positive controls: Minoxidil 2%
3. Control Assay Test I: ethanol extract 40%
4. Control Assay Test II: water extracts 40%

The negative control was to compare the results of the activity of hair growth without any given test materials treated with the test material. While the positive control was also provided for comparing the activity of hair growth between the test material with a synthetic drug that had been marketed a drug minoxidil. Minoxidil was proven to provide the activity of hair growth in rabbits by research before. Its mechanism of action is to extend the duration of the anagen phase onwards reduce hair loss, improve hair density and effect angiogeniknya can restore hair follicles undergo miniaturization [5].

The parameters measured in the testing of hair growth activity of ethanol extract and water extract of Paku munding was long rabbit hair on days 3, 6, 9, 12, 15, 18. This test was used topically on the rabbit and the effects of the extracts on hair length rabbit grow. All the control test, the positive control and a negative control was given topically to all three of the male rabbit. Award was given twice a day i.e morning and afternoon. Testing was conducted over 18 days. A total of five strands of hair removed to measure the length of each control area test, positive control and a negative control. So on the calculated average of the five strands. This process was done every 3 days for 18 days. Hair Length measurement results can be seen in Table 2.

Based on table 2 and Figure 1, in general it can be seen that the test control and a positive control showed an increase in long-hair rabbits compared with negative controls. A total of five strands of hair removed to measure the length of each control area test, positive control and a negative control. So on the calculated average of the five strands. This process was done every 3 days for 18 days. The way the measurement was to measure the length of the hair using a caliper with cm units. The process of measuring the five strands of hair did to get great results because of long rabbit hair was not all the same. With the calculated average of the five strands of hair was able to yield very good results. On the third day there had been a difference between the control test 40%, 20% and 10% with a negative control. At the control test 5% and 2.5% showed the same results as a negative control. After 18 days of testing it was found that the control test of 40% ethanol extract of the *Angiopteris evecta* roots showed the results of the highest of the hair length of 2.62 cm. When the test control 2.5% showed the lowest results with the same result with a negative control that the hair length of 1.82 cm. It can be proved that with a lower rate, the ethanol extract of the *Angiopteris evecta* roots did not give hair fertilizer activity. When the test control 40%, 20% and 10% showed better results compared with the positive control was minoxidil. It has been proved that with 10% *Angiopteris evecta* root extract can cope with the activity of the drug minoxidil hair growth.

Table 2. Ethanol Extract Hair Length Measurement

	Hair length (cm) , on the day ……					
	3	6	9	12	15	18
Positive control	0.4	0.8	1.2	1.5	1.9	2.2
	0.4	0.9	1.1	1.5	2	2.2
	0.5	0.8	1.1	1.5	2	2.2
	0.4	0.8	1.2	1.5	1.9	2.1
	0.4	0.8	1.2	1.5	2	2.2
Mean	0.42	0.82	1.16	1.5	1.94	2.18
Negative control	0.2	0.5	0.7	1.2	1.6	1.8
	0.2	0.4	0.8	1.2	1.5	1.8
	0.3	0.5	0.8	1.2	1.5	1.8
	0.2	0.5	0.8	1.2	1.5	1.9
	0.3	0.5	0.8	1.1	1.6	1.8
Mean	0.24	0.48	0.78	1.18	1.54	1.82
The Ethanol extraxt	0.2	0.5	0.8	1.2	1.6	1.9
2.50%	0.3	0.5	0.7	1.1	1.5	1.8
	0.2	0.5	0.8	1.2	1.5	1.8
	0.2	0.5	0.8	1.2	1.5	1.8
	0.3	0.5	0.8	1.2	1.5	1.8
Mean	0.27	0.5	0.78	1.18	1.52	1.82
The Ethanol extraxt	0.3	0.5	0.8	1.2	1.6	1.9
5.00%	0.2	0.5	0.8	1.2	1.5	1.8
	0.2	0.4	0.8	1.2	1.5	1.8
	0.3	0.5	0.8	1.1	1.6	1.9
	0.2	0.5	0.8	1.2	1.5	1.8
Mean	0.24	0.48	0.8	1.18	1.54	1.84
The Ethanol extraxt	0.4	0.9	1.2	1.5	2	2.3
10.00%	0.4	0.8	1.2	1.5	2	2.2
	0.4	0.8	1.2	1.6	2	2.3
	0.4	0.9	1.2	1.6	1.9	2.3
	0.5	0.8	1.2	1.5	2	2.4
Mean	0.42	0.84	1.2	1.54	1.98	2.3
The Ethanol extraxt	0.5	0.9	1.4	1.8	2	2.4
20.00%	0.5	0.9	1.3	1.7	2.1	2.5
	0.4	0.9	1.4	1.8	2	2.5
	0.4	0.8	1.3	1.8	2	2.4
	0.4	0.8	1.3	1.7	2.2	2.5
Mean	0.44	0.86	1.34	1.76	2.06	2.46
The Ethanol extraxt	0.5	1	1.5	2	2.2	2.7
40.00%	0.5	0.9	1.5	1.9	2.3	2.6
	0.4	0.9	1.4	1.9	2.2	2.7
	0.5	1	1.4	2	2.3	2.6
	0.6	0.9	1.5	2	2.2	2.5
Mean	0.5	0.94	1.46	1.96	2.24	2.62

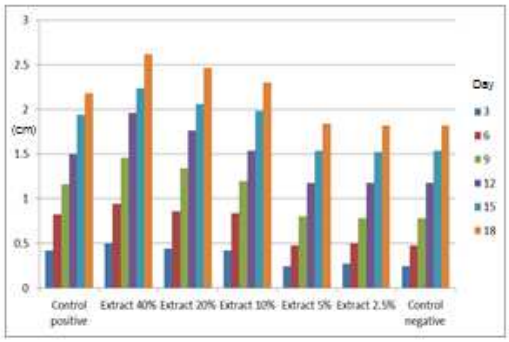


Fig. 1 Ethanol Extract Hair Length Measurement

Hair length on the measurement results of the water extract of *Angiopteris evecta* roots can be seen from Table 3 and Figure 2.

Table 3.. Water Extract Hair Length Measurement

		Hair length (cm), on the day…….					
		3	6	9	12	15	18
Positive control		0.3	0.5	0.8	1.1	1.4	1.7
		0.3	0.6	0.7	1.1	1.5	1.8
		0.3	0.6	0.8	1.1	1.5	1.8
		0.3	0.6	0.7	1.1	1.5	1.7
		0.3	0.5	0.7	1.1	1.5	1.7
	Mean	0.3	0.56	0.74	1.1	1.42	1.74
Negative control		0.1	0.4	0.6	0.8	1.2	1.5
		0.1	0.3	0.6	0.9	1.2	1.6
		0.2	0.3	0.6	0.9	1.1	1.5
		0.2	0.3	0.7	0.9	1.2	1.5
		0.2	0.3	0.7	0.8	1.1	1.5
	Mean	0.16	0.32	0.64	0.86	1.16	1.52
The Water extract		0.2	0.3	0.7	0.9	1.2	1.6
	2.50%	0.2	0.3	0.6	0.9	1.1	1.6
		0.1	0.4	0.6	0.8	1.1	1.5
		0.1	0.4	0.7	0.9	1.2	1.5
		0.1	0.3	0.6	0.9	1.1	1.5
	Mean	0.14	0.34	0.64	0.88	1.14	1.54
The Water extract		0.2	0.3	0.6	0.9	1.1	1.6
	5.00%	0.1	0.4	0.6	0.8	1.2	1.6
		0.2	0.3	0.6	0.9	1.1	1.5
		0.1	0.3	0.6	0.9	1.2	1.5
		0.2	0.4	0.7	0.9	1.2	1.5
	Mean	0.16	0.34	0.62	0.88	1.16	1.52
The Water extract		0.3	0.6	0.8	1.1	1.4	1.7
	10.00%	0.3	0.5	0.7	1.1	1.4	1.8
		0.3	0.6	0.7	1	1.4	1.7
		0.3	0.6	0.7	1.1	1.4	1.8
		0.4	0.6	0.8	1.1	1.5	1.7
	Mean	0.32	0.58	0.74	1.08	1.42	1.74
The Water extract		0.4	0.6	0.8	1.2	1.5	1.9
	20.00%	0.3	0.6	0.7	1.2	1.5	2
		0.3	0.7	0.8	1.2	1.6	2
		0.3	0.6	0.8	1.2	1.5	1.9
		0.3	0.6	0.8	1.1	1.5	1.9
	Mean	0.32	0.62	0.78	1.18	1.52	1.94
The Water extract		0.4	0.6	0.8	1.2	1.6	2.1
	40.00%	0.3	0.7	0.9	1.2	1.7	2.1
		0.3	0.6	0.8	1.2	1.6	2
		0.4	0.6	0.8	1.3	1.6	2.1
		0.4	0.7	0.8	1.2	1.7	2
	Mean	0.36	0.64	0.82	1.22	1.64	2.06

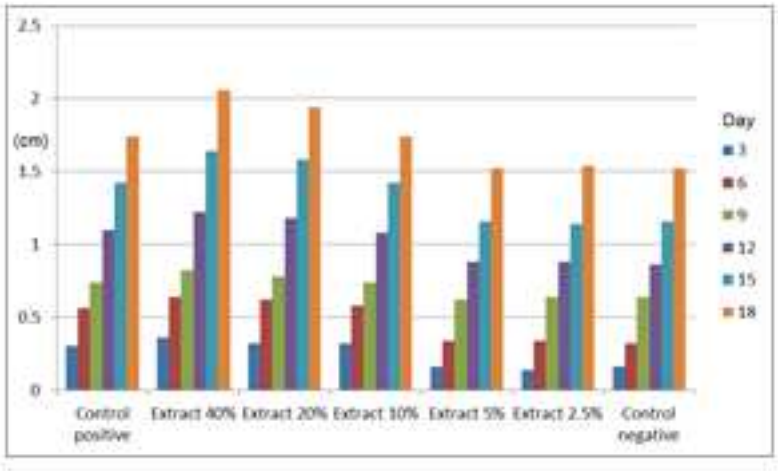


Fig. 2 Water Extract Hair Length Measurement

Based on the chart above (Fig.2), we can see an increase in the control test, the positive control and the negative controls from the first day to day 18. Control tests showed a 40% highest with long hair long record of 2.06 cm after 18 days of testing. Control test of 5% also showed the lowest results with a record 1.52 cm along the hair length is equal to the negative control after 18 days of testing. By this can be proved that the water extract of the *Angiopteris evecta*roots provide good hair grower activity.

Table 4 and Fig. 3 shows the activity of hair growth using both water and ethanol extracts of *Angiopteris evecta*roots.. The use of 40% ethanol extract showed highest levels of 2,52cm length after 18 days of testing, when the negative control showed the lowest results with long hair that is 1.66 cm after 18 days of testing. From the above table can also be concluded that the ethanol extract and water extract gives better results versus the positive control is minoxidil. In addition, the above table and figure also shows that the ethanol extract gives hair growth activity is better compared with the water extract.

Table 4. Ethanol and Water Extracts Hair Length Measurement

		Hair length (cm), on the day…….					
		3	6	9	12	15	18
Positive control		0.3	0.5	0.9	1.2	1.6	2
		0.4	0.6	0.9	1.2	1.7	2.1
		0.3	0.5	0.9	1.3	1.7	2.1
		0.3	0.6	0.9	1.3	1.6	2.1
		0.4	0.6	1	1.3	1.6	2.1
	Mean	**0.34**	**0.56**	**0.92**	**1.26**	**1.64**	**2.08**
The ethanol extract		0.4	0.8	1.3	1.7	2.1	2.5
	40%	0.4	0.9	1.3	1.8	2.2	2.5
		0.5	0.9	1.4	1.8	2.2	2.5
		0.4	0.8	1.3	1.8	2.2	2.5
		0.5	0.9	1.3	1.7	2.2	2.5
	Mean	**0.44**	**0.86**	**1.32**	**1.76**	**2.16**	**2.52**
The Water extract		0.3	0.8	1.1	1.5	2	2.3
	40.00%	0.4	0.8	1.2	1.6	2	2.3
		0.4	0.7	1.1	1.5	1.9	2.4
		0.4	0.7	1.1	1.5	2	2.4
		0.4	0.8	1.2	1.5	2	2.3
	Mean	**0.38**	**0.76**	**1.14**	**1.52**	**1.98**	**2.34**
Negative control		0.2	0.4	0.6	0.9	1.2	1.6
		0.2	0.3	0.7	0.9	1.3	1.7
		0.2	0.4	0.7	1	1.2	1.7
		0.2	0.4	0.7	0.9	1.3	1.6
		0.3	0.4	0.7	0.9	1.2	1.7
	Mean	**0.22**	**0.38**	**0.68**	**0.92**	**1.24**	**1.66**

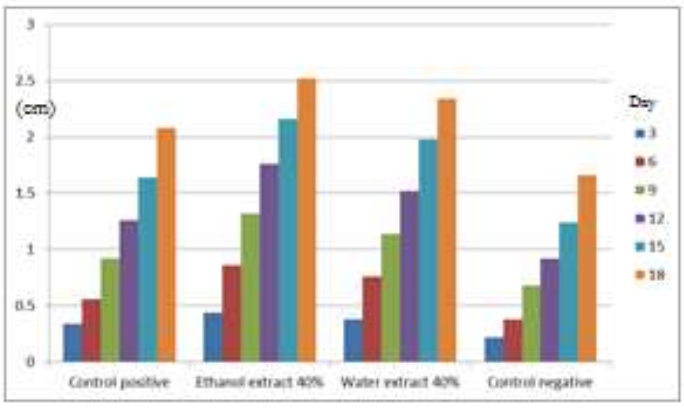


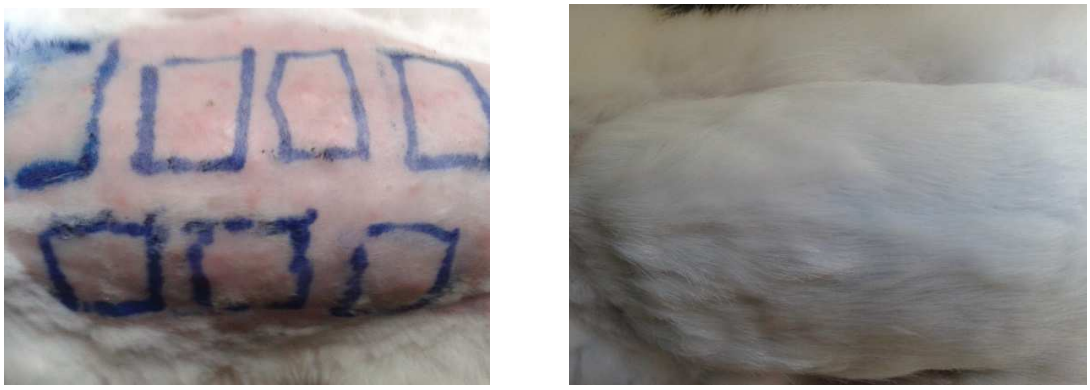
Figure 3. Ethanol and Water Extracts Hair Length Measurement

Based on the results obtained during 18 days of testing has proven that the ethanol extract and water extract of *Angiopteris evecta* roots have activity hair fertilizer. Ability as a hair grower compounds likely caused secondary

metabolites contained in *Angiopteris evecta* roots namely quinone, flavonoid, monoterpenes, sesquiterpenes, polifenolat, tannins and triterpenoids. Polyphenol compounds work to help fight the formation of free radicals. Polyphenols as well as flavonoid have the ability to change or reduce free radicals and also as an anti-free radical[24]. Free radicals derived from the human body which is the source of endogenous (from the body) and exogenous (outside the body), according to Dr. Widodo Judarwanto, Sp, .A in Candra [25]. Air pollution, UV radiation, X-rays, pesticides and cigarette smoke is an exogenous source. One stem hair loss is a free radical, so that the polyphenol compounds present in *Angiopteris evecta* roots can prevent free radicals and accelerate the growth of hair. In addition tannin compounds have properties that can bind to and protect protein. Protein is one of the molecules necessary for the hair to grow [26]. According to Kurniawan [27] saponins on the human body works to increase blood flow to the hair follicles, when blood flow to the follicles Hair is reduced then it will affect the hair follicles and causes hair loss. From the research that has been done by Sa'diah *et al*[28] had performed a negative control using ethanol 70% and showed growth similar to normal hair growth. From this it could be concluded that the ethanol used did not have the effect of hair growth. If the test preparation was able to accelerate the growth of hair could be ascertained that the effect was not caused by the solvent. The ethanol extract showed better results than the water extract was due to the possibility of solvent water was not able to attract more secondary metabolite compounds compared to ethanol. Ethanol is a universal solvent that can dissolve almost all of the secondary metabolites contained in *Angiopteris evecta* roots and it is non-toxic and safe.

The observation of rabbit hair.

Figures 4 and 5 show the observations of *Angiopteris evecta* ethanol extract and water extract on the backs of rabbits.



Before **After**

Figure 5. Treatment with *Angiopteris evecta* ethanol extract

Sebelum **Selepas**

Figure 5. Treatment with *Angiopteris evecta* water extract

CONCLUSION

The *Angiopteris evecta* ethanol extract with a concentration of 40%, 20% and 10% and its water extract with levels of 40% and 20% showed better results than the positive control is a drug that has been marketed minoxidil. Ethanol extract and water extract with the levels of 40% showed the best results cope with minoxidil. It is suggested, before it can be used in humans, it is necessary to do further research on the bald volunteers.

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