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Antipyretic effects of starfruit stem bark infusion (*Averrhoa bilimbi* L.) in rats (*Rattus norvegicus*)

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Abstract. Starfruit stem bark is a traditional medicine that is used by the community to treat fever by drinking the decoction. One of the chemical constituents in the starfruit stem bark is flavonoids. Previous studies showed that antipyretic effects were produced by flavonoids in plants. This study aimed to determine the antipyretic effect of starfruit stem bark infusion in rats. This was an experimental research using the Pretest-Posttest with Control Group design which was conducted on 15 test animals. The rats divided into 3 groups, each group consisting of 5 male rats; group I was given distilled water (negative control group), group II was given Paracetamol suspension (positive control group) and group III was given Starfruit stem bark infusion 10% (treatment group). Before being treated, the rats were made fever by injecting peptone 20% intraperitoneally with the requirement of a temperature increase of 1.5°C from the initial temperature. Data collected from the measurements of rat body temperature before treatment and every 1 hour for 4 hours of observation time after treatment. The results were analyzed descriptively presented in graphical form and analyzed statistically using the one-way ANOVA test. Based on the results of the study, it was found that the Starfruit stem bark infusion had an antipyretic effect although it was not statistically significant ($p>0.05$).

Keywords: Antipyretics, flavonoids, Starfruit stem bark

1 Introduction

Starfruit (*Averrhoa bilimbi* L) is often used by the community as a traditional medicine. Starfruit belongs to a group of small tree plants and the taste of the fruit is acidic [1]. The typical starfruit sour taste strengthens the taste of a dish [2]. The parts used for treatment are fruits, flowers, stems and leaves [3]. Flowers are used for the treatment of cough and canker sores, the leaves are used to treat abdominal pain, rheumatism and high blood pressure, the fruits are used for the treatment of bleeding gums, zits, tinea versicolor and high blood pressure [1] and the stem bark is used to treat fever and kidney medicine [4]. The chemical content of starfruit stem bark is saponin, tannin, sulfur, formic acid and peroxidase [3] and methanol extract of Starfruit stem bark contains alkaloid, saponin, and flavonoid compounds [5]. Sangihe people treat fever how to peel the stem bark and then boil it and drink the decoction [4].

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Previous studies have shown that fruit can provide antipyretic effects [6]. Other studies have shown that starfruit leaves can provide antipyretic effects [7]. According to Yapien [8], flavonoids may be a chemical content in plants that produce antipyretic effects through inhibition of prostaglandin synthesis. Flavonoids are compounds that can dissolve in water [9].

Fever is a useful agile reaction from the body against infection [10]. Fever is also a physiological response where body temperature increases due to bone regulation at the set point in the hypothalamus [11]. Fever is characterized by an increase in body temperature 1.5 °C above the normal body temperature of 36-37 °C [12]. This study aimed to examine the antipyretic effect of Starfruit stem bark infusion (*Averrhoa bilimbi* L) in rats (*Rattus norvegicus*).

2 Methodology

The sample used in this study was the stem bark of the starfruit plant (*Averrhoa bilimbi L.*) taken from Singkil region of Manado city.

Ingredients: Pepton, Paracetamol tablets, Na CMC, distilled water, water for injection.

Test animals: The test animals used were male rats (*Rattus norvegicus*) from the Pharmacology Laboratory Manado Health Polytechnic, aged 3-5 months with a weight of 150 g - 250 g.

2.1 Procedure

2.1.1 Sample Processing [13]

Starfruit stem bark was taken from the main stem and branches, peeled with a length of 5 cm and a width of 5 cm. The stem bark was cleaned and then chopped.

2.1.2 Preparation of Paracetamol suspension

Paracetamol tablet powder was weighed equivalent to 180 mg of paracetamol and then suspended with 1% Na CMC solution to a volume of 50 mL.

2.1.3 Preparation of starfruit bark stem infusion [14]

The starfruit stem bark weighed as much as 10 g, then put it in an infusion pan then water was added. Heated for 15 minutes was calculated when the temperature reaches 90 °C while occasionally stirring. After 15 minutes, the infusion filtered and squeezed using a flannel cloth while hot then hot water added through the remaining juice of the starfruit stem bark infusion to 100 mL.

2.1.4 Preparation and selection of test animals

Rats (*Rattus norvegicus*) were adapted for 7 days. Rats were fasted for \pm 8 hours before treatment and weighed. The body temperature measured and recorded as the initial temperature (tn). Rats were made fever by injecting peptone solution 20% at a dose 2 mL/200 g rats BW intraperitoneally [15]. Body temperature was measured 1 hour after induction. Rats were declared fever when the temperature increased $>1.5^{\circ}\text{C}$ from the initial temperature [12].

2.1.5 Testing

A total of 15 rats were divided into 3 treatment groups, namely a group of starfruit stem bark infusion, a positive control group and a negative control group. Group I negative control was given distilled water. The positive control group was given paracetamol suspension orally at a dose of 9 mg / 200 g rats BW.

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Treatment group was given 10% starfruit stem bark infusion orally with a dose of 2.5 mL/200 g rats BW. The body temperature was measured every hour for 4 hours and recorded as temperature after treatment (t1, t2, t3, t4).

2.1.6 Data analysis

Data was presented in table form analyzed descriptively presented in graphical form and analyzed statistically by One-Way Anova test at the 95% confidence level.

3 Result and Discussion

The observation results in the form of body temperature data of rats can be seen in table 1. One of the chemical constituents contained in the Starfruit stem bark is flavonoids. Flavonoids can provide antipyretic effects by inhibiting prostaglandin synthesis. The solution test was made in the form of infusion because flavonoids in the Starfruit stem bark are polar compounds that are soluble in water [10].

This test was carried out on male rats which were divided into 3 treatment groups where each group consisted of 5 white rats namely 10% starfruit bark infusion, positive control group and negative control group. Rats were induced with fever by injecting 20% peptone solution intraperitoneally and declared fever when the temperature increased 1.5°C from the initial temperature. Pepton can increase rat body temperature because peptone is like pyrogens which triggers prostaglandin biosynthesis. The results of starfruit stem bark infusion group showed a decrease of body temperature in the first hour to the fourth hour after treatment. The decline in rat body temperature is thought to be caused by the presence of flavonoid compounds whose mechanism of action is the same as paracetamol which inhibits the formation of prostaglandins which are mediators of fever [11].

The results of positive control group that given paracetamol suspension experienced a decrease of body temperature in the first hour to the fourth hour after treatment. This shows that the decrease in temperature caused by paracetamol as an antipyretic drug with a mechanism of action inhibits prostaglandin synthesis and has a half-life of 1 to 4 hours [11].

The results of the negative control group showed a decrease of body temperature at t1 but there was a rise in temperature at t2 then began to decrease at t3 to t4. The decrease in temperature in the negative group was not as big as the temperature decrease in the starfruit stem bark infusion group and the positive control group. These results indicate that the decrease in body temperature of white mice at t3 and t4 occurs because of the feedback mechanism in the hypothalamus to

maintain temperature by reducing heat production and increasing heat dissipation so that the temperature returns to normal temperature [11].

Descriptive analysis showed that a decrease in body temperature of white rats given a 10% starfruit stem

bark infusion was greater than the negative control but the results of statistics test with one-way ANOVA with a significant level of 0.05 obtained p value = 0.105 > 0.05, which means there is no different effects of all treatment groups.

Table 1. Results of measurements of body temperature of white rats before and after treatment

Treatment Groups	No	Rats body temperature (°C)					
		Before treatment		After treatment			
		t _n	t ₀	t ₁	t ₂	t ₃	t ₄
Negative control (Distilled water)	1	35.5	37.0	36.6	37.4	37.3	36.9
	2	34.1	37.4	37.2	37.3	37.2	36.7
	3	35.0	37.2	36.7	37.8	37.9	37.3
	4	35.4	37.9	37.1	36.9	37.4	37.1
	5	35.9	37.1	38.1	37.7	36.2	36.1
	Average	35.18	37.32	37.14	37.42	36.42	35.82
Positive control (Paracetamol)	1	35.8	37.9	35.6	35.2	35.2	35.2
	2	35.6	38.6	37.5	37.2	36.0	36.5
	3	34.9	36.6	36.3	36.2	36.3	35.8
	4	36.1	38.2	36.9	36.3	35.7	36.1
	5	35.1	36.8	37.7	36.5	36.7	36.2
	Average	35.50	37.62	36.80	36.28	35.98	35.96
10% starfruit stem bark infusion	1	36.2	37.7	36.7	37.1	36.3	36.2
	2	37.0	38.7	36.8	37.8	36.8	36.1
	3	36.6	38.7	36.6	35.5	36.2	35.7
	4	35.5	37.4	37.2	37.0	36.5	35.9
	5	36.0	37.4	37.0	35.8	36.9	35.4
	Average	36.26	37.98	36.86	36.64	36.54	35.86

Conclusion

1 Based on the results of the study, it can be concluded that the Starfruit stem bark infusion (*Averrhoa bilimbi* L.) has an antipyretic effect on rats (*Rattus norvegicus*) although not statistically significant.

Suggestion

Further testing needed to determine and isolate the content of the starfruit stem bark which has antipyretic effects.

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PAGE 1

PAGE 2

PAGE 3

PAGE 4
