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Ahmad Shobrun Jamil
SI FARMASI
University of Muhammadiyah Malang

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Ergogenic Activities of Some Plants of Family Araliaceae on *Mus musculus*

M. Artabah Muchlisin[1] Firasti Agung Nugrahening Sumadi[2] Angga Wahyu Hidayat[3]
Nehru Marino Awal[4] Ahmad Shobrun Jamil[5,*]

[1,2,3,4,5] *Department of Pharmacy, University of Muhammadiyah Malang, Malang, Indonesia*
[*] *Corresponding author. Email: shobrun@umm.ac.id*

ABSTRACT
Ergogenic is defined as the equipment, techniques and substances used to enhance sports performance. Ergogenic aid is classified into various forms, such as nutritional, pharmacological and physiological. One of the most well-known natural ingredients as an ergogenic substance is ginseng (*Panax ginseng*). The price of ginseng is high, and its availability is limited. Hence, it is important to trigger research to get plants which can substitute P. ginseng as a tonic. In Indonesia, which has high biodiversity potential, there are at least two popular plants in one family (*Araliaceae*) with P. ginseng, which are *mangkokan* (*Nothopanax scutellarium*) and *kedondong laut* (*Polyscias fruticosa*). The objective of this study is to determine the effectiveness of the leaves of *N. scutellarium* and *P. fruticosa* as an ergogenic substance. This type of research was an experimental laboratory. The method used was Forced Swimming Test method, a test to identify how long mice (*Mus musculus*) were swimming. Mice used in this study were divided into eleven groups in which each group had four mice. Group I (negative control) was given 0.5% CMC-Na, group II (positive control) was given caffeine, and group III-XI was given *P. ginseng*, *N. scutellarium* and *P. fruticosa* at different doses of 0.49 g/20 g BW, 0.98 g/20 g BW, and 1.96 g/20 g BW. The swimming test was performed three times on the first, third, and fifth day. The duration of struggling for mice was then analyzed using Honestly Significant Different and showed that *P. ginseng* and *P. fruticosa* could increase mice's stamina. However, *N. scutellarium* could not increase the stamina of the mice.

Keywords: *Ergogenic, Araliaceae, Forced Swimming Test, Endurance*

1. INTRODUCTION

Ergogenic is defined as the equipment, techniques and substances used to enhance sports performance. Ergogenic aids are classified into various forms, such as nutritional, pharmacological and physiological aids [1]. Ergogenic also means tonic which is an ingredient used to increase stamina, endurance, and to minimize fatigue [2].

Currently, people start to realize the importance of body vitality in work productivity. Regular exercise and a balanced diet are the most effective strategies to maintain health. However, due to business, work fatigue and laziness, some people tend to use vitality-enhancing supplements to enhance their activities. Many widely circulation in the community of synthetic chemical drugs increase physical resistance from fatigue. Nevertheless, many of them have harmful side effects to health if they are applied for a relatively long time with a high frequency of use [3]. Therefore, it is necessary to discover alternative drugs which can increase a person's physical workforce with minimal or even no side effects.

One of the most well-known natural ingredients as an ergogenic substance is ginseng (*Panax ginseng*) [4]. Ginseng's high price and its limited availability triggered research to discover plants which can substitute ginseng as a tonic. In several studies, plant metabolite compounds correspond to their taxonomic characters [5,6]. Indonesia is a country with abundant natural resource which owns the potential for high biodiversity. There are at least two popular plants of the same family (*Araliaceae*) in Indonesia which is abundant, that is *P. ginseng* involving the *mangkokan* (*Nothopanax scutellarium*) and *kedondong laut* (*Polyscias fruticosa*).

Based on chemotaxonomic studies, plants with close family ties have the same possible pharmacological potential [7]. Thus, the two relatively abundant plant species were examined for their ergogenic activity. The objective of this study is to determine the effectiveness of leaf extract of *N. scutellarium* and *P. fruticosa* as an ergogenic substance. Caffeine was used as a positive control because it is known to have good activity delaying fatigue [8].

2. MATERIALS AND METHODS

2.1. Materials

P. ginseng, *N. scutellarium*, *P. fruticosa*, caffeine, carboxymethylcellulose sodium (CMC Na), ethanol 70%, transparent cylindrical pool, and male mice (*Mus musculus*).

2.2. Extraction Method

Simplicia was cleaned and dried in indirect sunlight, then grind and stored in a dark-closed bottle. The extract was made

by maceration using 70% ethanol. Five hundred grams of dry powder was put into a stainless steel pan and add 1.5 liters of 70% ethanol then soaked for 24 hours and stirring occasionally. The macerate is separated and reprocessed three times with the same type and amount of solvent. All macerate was collected and in a rotary evaporator until a thick extract was obtained, then weighed, and the yield was recorded.

2.3. Suspension Preparation Method

CMC sodium was weighed as much as 250 mg and added hot water while stirring until it was formed mucilage, then added water up to 50 mL. 250 mg CMC sodium 0.5% is added with hot water then stir until it forms mucilage, then added with 250 mg caffeine (positive control), as well as 490 mg, 980 mg, and 1960 mg extract (test compound) and stirred until homogeneous and add aqua to 50 mL.

2.4. Forced Swimming Test

As many as fourty *M. musculus* were used, each was weighed and grouped into 11 treatment groups (negative control, positive control, and nine test groups [0.49; 0.98; and 1.96 g/20 g BW for each extract). Each test animal was treated orally with a volume of 0.5 mL/20 g BW.

Before the mice's stamina was tested, it adapted in a standard cage with lighting from 06:00 AM – 06:00 PM at room temperature (25-26 °C) with a humidity of 72-82% [9]. Furthermore, mice will get the same treatment for five consecutive days. The stamina test on mice will be carried out using the forced swimming test method between 10:00 AM - 01:00 PM following the circadian rhythm of mice [10]. The test was carried out three times on the first, third, and fifth days. A transparent cylindrical pool with a 20 cm diameter and a height of 20 cm was prepared and filled with water with a temperature of 24-25 °C as high as 10 cm. Then between each cylindrical pond is given a divider to limit the mice from one another [10].

Mice will do a swimming test for 15 minutes, then observed the duration of the first time the mice did not show any activity to fight for themselves to get out of the vessel other than efforts to keep their heads above the water. The mice that have been tested are then towel-dried and warmed.The template is used to format your paper and style the text.

3. RESULT AND DISCUSSION

To induce fatigue, the method used was a swimming test to assess the struggling ability of mice. Struggling is a condition which shows mice swimming as hard as possible as an instinct to survive in water because as mice are not aquatic animals. Mice are known to have fatigue experience if they do not make significant movements with their body parts to get out of the vessel other than keeping themselves floating on the water surface.

The working principle of swimming test was testing the effect of stimulant preparations on the tested animals based on increased activity, as seen from the immediate increase in work in the form of increasing the fatigue time of the tested animals while being immersed in a tank which was filled with water. The method advantages used were it could determine the stimulant effect influenced by the physical condition of mice to increase activity. The stimulant effect could be seen spontaneously from the increase in working capacity. The time used for observation was relatively short. The series of tools was quite simple. In comparison, the shortcomings obtained by using this method were only able to know the increase in physical activity, which was in the form of an increase in mice's work capacity during activity.

Struggling parameters were used by some researchers [11] to induce the physical activity in mice. Even though mice are not aquatic animals, they would swim as hard as possible to survive if they are put into a water bath. Swimming is a strenuous activity requiring significant energy. With the availability of adequate ATP, contract muscles' ability could be maintained at a specific time. Swimming is a physical activity which can consume±500 calories/hour of energy in adult humans [12]. Muscles perform a very vigorous activity for several seconds which require extra energy. Most of the extra energy required during strenuous work took up to 5 to 10 seconds, but less than 1 to 2 minutes was obtained from anaerobic glycolysis. In a state of strenuous activity, the energy required per unit of time increased up to 100 times when compared to a resting state and then activated anaerobic metabolism in muscle cells to produce energy and increase intracellular lactic acid levels [12].

Apart from inducing fatigue, this method was frequently used to measure the anti-depressant activity of a compound/drug. Mice which do the swimming test tends to experience depression because mice are not aquatic animals. Depression may reduce the mental stamina of mice. Mice which are depressed feel exhausted more quickly than mice which are not. Thus, the incidence of depression in mice should be minimized. A screen was given between each vessel. Thus, it cannot be seen from each other. This method could reduce the depressive effect of this study. Meanwhile, the test was administered with water and room temperatures ranging from 24 ± 0.5 °C. The water temperature was too low to trigger the occurrence of hypothermia and increased depression threshold in mice. The swimming test was performed at 10:00-11:00 AM. The timing referred to the mice's circadian rhythm. Previous research explained that the circadian variation of mice would be minimal at 10:00 AM - 01:00 PM. The circadian rhythm was a 24-hour cycle in the physiological processes of living things including plants, animals, fungi, and cyanobacteria. Circadian rhythms are essential to determine the sleep and dietary patterns of all animals including humans. There is a clear brain wave activity pattern, hormone production, cell regeneration, and other biological activities which are associated with the daily cycle [10].

This research was conducted for five days to determine the impact of consuming *P. ginseng*, *P. fruticosa* and *N. Scutellarium*. Moreover, the test was administered on the first, third and fifth (Table 1) day to determine whether there was a difference in stamina of mice consuming extract while on the third and fifth day before (Fig. 1).

From the ANOVA analysis using the Honestly Significant Different (HSD) method, it was identified that *P. ginseng* could increase the mice's stamina at a dose of 0.98 g/20 g BW and 1.96 g/20 g BW on the first day to the fifth day because there were significant differences with negative controls. Meanwhile, at low doses (0.49 g/20 g BW), there was no significant difference. All of *c* groups had no significant difference with negative controls except for the 1.96 g/20 g BW group on the fifth day. Therefore, it could be stated that *P. fruticosa* was only able to increase the stamina of the mice with a dose of 1.96 g/20 g BW on the fifth day of the experiment. Meanwhile, all groups of *N. Scutellarium* had no significant difference with negative controls. Thus, it could be implied that *N. scutellarium* at the dosage of the tested compounds failed to increase the mice's stamina.To induce fatigue, the method used was a swimming test to assess the struggling ability of mice. Struggling is a condition which shows mice swimming as hard as possible as an instinct to survive in water because as mice are not aquatic animals. Mice are known to have fatigue experience if they do not make significant movements with their body parts to get out of the vessel other than keeping themselves floating on the water surface.

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Table 1. The results of forced swimming test from extracts (*P. Ginseng*, *P. Fruticosa*, and *N. Scutellarium*) in mice (*M. Musculus*)

Test Group	Swimming Duration (minutes)		
	First Day	Third Day	Fifth Day
Positive control (caffeine)	8.79 ± 0.96	8.82 ± 0.94	8.98 ± 0.90
Negative control (CMC sodium)	6.43 ± 1.60	5.30 ± 1.09	5.36 ± 0.97
P. ginseng 0.49 g/20 g BW	6.15 ± 0.69	6.50 ± 0.45	6.61 ± 0.43
P. ginseng 0.98 g/20 g BW	8.68 ± 1.16	8.69 ± 1.13	8.77 ± 1.14
P. ginseng 1.96 g/20 g BW	10.20 ± 1.09	9.79 ± 0.73	9.69 ± 0.52
P. fruticosa 0.49 g/20 g BW	3.75 ± 0.59	5.18 ± 0.76	6.05 ± 0.82
P. fruticosa 0.98 g/20 g BW	5.23 ± 0.79	6.56 ± 0.49	7.27 ± 0.6923
P. fruticosa 1.96 g/20 g BW	5.33 ± 0.19	7.25 ± 0.73	7.87 ± 0.56
N. Scutellarium 0.49 g/20 g BW	5.14 ± 0.92	6.17 ± 1.10	6.58 ± 0.62
N. Scutellarium 0.98 g/20 g BW	5.21 ± 0.87	6.36 ± 1.26	6.72 ± 0.70
N. Scutellarium 1.96 g/20 g BW	5.03 ± 0.68	6.74 ± 0.95	7.19 ± 0.66

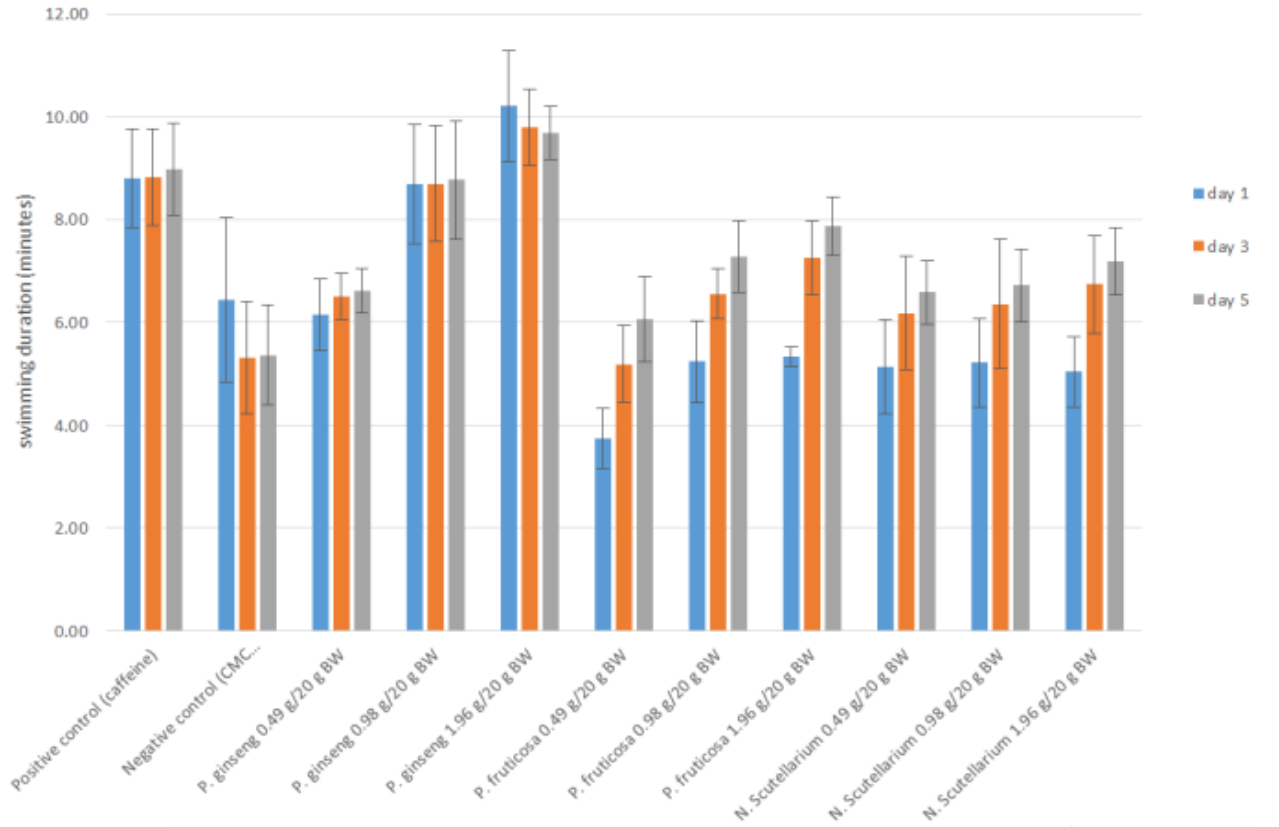

Figure 1 Forced Swimming Test duration

Therefore, it could be stated that *P. fruticosa* was only able to increase the stamina of the mice with a dose of 1.96 g/20 g BW on the fifth day of the experiment. Meanwhile, all groups of *N. Scutellarium* had no significant difference with negative controls. Thus, it could be implied that *N. scutellarium* at the dosage of the tested compounds failed to increase the mice's stamina.To induce fatigue, the method used was a swimming test to assess the struggling ability of mice. Struggling is a condition which shows mice swimming as hard as possible as an instinct to survive in water because as mice are not aquatic animals. Mice are known to have fatigue experience if they do not make significant movements with their body parts to get out of the vessel other than keeping themselves floating on the water surface.

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3. CONCLUSION

P. ginseng and *P. fruticosa* could increase the stamina of the mice at a dose of 0.98 g/20 g BW and 1.96 g/20 g BW on all day (P. ginseng) and a dose of 1.96 g/20 g BW on the fifth day (*P. fruticosa*). In comparison, *N. scutellarium* could not increase the stamina of the mice.

REFERENCES

[1] N. H. Lee, H. C. Jung, S. Lee, "Red ginseng as an ergogenic aid: a systematic review of clinical trials," J. Exerc. Nutrition. Biochem., vol. 20, pp. 13-19, December 2016.

[2] A. M. Metwaly, Z. Lianlian, H. Luqi, D. Deqiang, "Black ginseng and its saponins: preparation, phytochemistry and pharmacological effects," Molecules, 24, 1856, May 2019.

[3] C. P. Curran, C. A. Marczinski, "Taurine, caffeine, and energy drinks: reviewing the risks to the adolescent

brain," Birth Defects Research, vol 109, pp. 1640-1648, December 2017.

[4] L. K. Caldwell, et al. "The effects of a korean ginseng, GINST15, on perceptual effort, psychomotor performance, and physical performance in men and women," J. Sports Sci. Med., 17, pp. 92-100, December 2017.

[5] N. M. Lima, V. N. C. Santos, A. P. Chali, C. P. Soares, "Genus Deguelia: chemistry, chemotaxonomy, ethnopharmacology and pharmacological characteristics – a review," The Pharmaceutical and Chemical Journal, 4.5, pp. 13-26, October 2017.

[6] S. L. Crockett, N. K. B. Robson, "Taxonomy and chemotaxonomy of the genus Hypericum," Med. Arom. Plant. Sci. Biotechnol., 5, pp. 1-13, January 2011.

[7] M. M. Cascaes, G. M. S. P. Guilhon, E. H. A, Andrade, M. D. G. B, Zoghbi, L. D. S. Santos, "Constituents and pharmacological activities of Myrcia (Myrtaceae): a review of an aromatic and medicinal group of plants," Int. J. Mol. Sci., 16, pp. 23881-23904, October 2015.

[8] C. K. Chen, A. S. Muhamad, F. K. Ooi, "Herbs in exercise and sports," J. Physiol. Anthropol., 31, 4, March 2012.

[9] A. Fawcett, "Guidelines 22: Guidelines for the housing of mice in scientific institutions," https://www.animalethics.org.au/, April 2012.

[10] H. J. Ahn, et al. "Antifatigue effect of Chlorella vulgaris in mice," Korean J. Food & Nutr., 19, pp. 169-195, June 2006.

[11] S. Shin, et al. "Silk amino acids improve physical stamina and male reproductive function of mice," Biol. Pharm. Bull., 33, pp. 273-278, February 2010.

[12] I. M. Jawi, D. N. Suprapta, I. N. Arcana, A. W. Indrayani, A. A. N. Subawa, "Efek antioksidan ekstrak air umbi ubi jalar ungu (Ipomoea batatas l) terhadap darah dan berbagai organ pada mencit yang diberikan beban aktivitas fisik maksimal," JurnalFarmakologi, 2010.