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THE EFFECT OF DAYAK ONION EXTRACT ON LACTIC ACID LEVELS IN MICE WITH FST MODEL

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ABSTRACT

Intense physical exercise can increase lactic acid levels in the blood as a result of the anaerobic metabolism that occurs at that time. The impact of increased levels of lactic acid includes the occurrence of acidosis, damage to body cells, and fatigue which reduces muscle performance. Antioxidants can play a role in preventing body fatigue caused by oxidative stress. Onion Dayak (Eleutherine palmifolia) is a type of medicinal plant that is useful for health. The high content of antioxidants in Dayak onions can be used as an alternative anti-fatigue ingredient. This study aimed to look at the effect of the dose and duration of Dayak onion extract on lactic acid levels and physical activity in mice forced swimming test models. Type of Research Randomized Pre and Post-Test Control Group Design. Male White Mice (Sprague Dawley) 2 months old (weight 150-200g). Divided into 5 groups K- (the experimental group was not given Dayak onion extract, they were still given FST), K+ (the experimental group was given xanthine and FST), P1 (given Dayak onion extract at a dose of 50mg/200gBW), P2 (given the extract onion Dayak dose of 100mg/200gBB), P3 (given onion extract dose of 200mg/200gBW). Dayak onion extract was given for 28 days and given the forced swimming test, then the changes in lactic acid and physical activity endurance in swimming were observed.

Keywords: antioxidant; fatigue; lactic acid; onion dayak

INTRODUCTION

We already know the magnitude of the benefits caused by physical exercise. Everyone who exercises properly will get benefits including: being healthy, fit, and able to improve performance (Gay et al., 2016). Exercises that are carried out regularly, systematically, and continuously, as well as outlined in an exercise program will significantly improve physical abilities (Ambrose & Golightly, 2015). Besides the positive benefits, exercise also has negative impacts, for example, the formation of lactic acid and free radicals, because exercise is a stressor for the body that can affect all systems (Kruk et al., 2022). Lactic acid formation results from high-intensity training activities and prolonged exercise (Nanang et al., 2018). An anaerobic physical exercise is a form of physical exercise, which in the metabolic process of energy formation does not use oxygen (Flora, 2015). Energy is produced from the formation of ATP through energy sources derived from creatine, phosphate, and glycogen (Nugraha & Berawi, 2017). Anaerobic physical exercise is carried out for a short duration and with high intensity. In high-intensity physical exercise, muscles contract in an anaerobic state, so that the supply of ATP occurs through the process of anaerobic glycolysis. This results in an increase in lactic acid levels in the blood and muscles (Hargreaves & Spriet, 2020).

Increasing the concentration of lactic acid will lower the pH inside the cell (Eş et al., 2018; Kottmann et al., 2012). Decreasing the pH causes a decrease in the reaction rate of the enzymes in the cell, thereby reducing the ability of metabolism and ATP production (Zhao et al., 2013). In addition, the presence of acid in the muscles will interfere with various muscle cell mechanisms, including inhibiting the release of Ca++ ions in troponin C (Gehlert et al., 2015). Inhibition of the release of ++ Ca ions results in interruption or cessation of muscle fiber contractions. The heart muscle is an organ that works hard during physical exercise (Pedersen et al., 2016). The heart must pump blood throughout the body to meet energy needs during physical exercise. In an anaerobic atmosphere, the heart muscle will use the lactic acid produced as an alternative energy source (Glancy et al., 2021).

Lactic acid levels can increase when swimming, especially if you do high-intensity training or competition (Herlan & Komarudin, 2020). When swimming, the muscles work to produce the energy needed to maintain the movement (Matthews et al., 2017). This process produces lactic acid as a by-product of glucose metabolism without oxygen (anaerobic) (Sibagariang & Simatupang, 2021). If swimming training or competition is carried out at high intensity and continuously, the muscles will produce more lactic acid than can be removed from the body. This can lead to a buildup of lactic acid in the muscles and blood, which can impair muscle function and result in a feeling of soreness, fatigue and muscle cramps (Mota et al., 2017). Antioxidants are compounds that help protect body cells from damage by free radicals. Free radicals are unstable molecules and can cause cellular damage in the body. Some common sources of natural antioxidants include vitamin C, vitamin E, beta-carotene, selenium, and flavanoids. Antioxidants can help reduce the number of free radicals in the body and reduce cell damage, so they can help reduce changes in lactic acid in the body (Yudapratama & Novianry, 2018).

Indonesia has around 30,000 types of plants, of which around 7,500 have medicinal properties. As many as 1,000-1,200 types of plants are used by the community, while around 300 species are used in the traditional medicine industry (Sudarma & Hasyati, 2018). There are various natural ingredients native to Indonesia that contain antioxidants with various active ingredients that are not widely known by the public. One of the active ingredients that have a positive effect on health but has not been widely used is Dayak onion (Eleutherine palmifolia) (Wijayanti & Hasyati, 2018). Onion Dayak is a type of medicinal plant that can be found on the island of Borneo and has been used by local residents as a traditional medicine. The tuber of this plant is the usable part. Empirically, this plant is known to have anti-inflammatory and anti-cancer properties (Ha et al., 2013). Phytochemical tests by Wigati (2018) show that Dayak onions contain flavonoids, saponins, tannins, alkaloids, quinones, provitamins, saponins, and various other important minerals which are useful as central nervous stimulants, antioxidants, anti-inflammatories, and improve blood circulation (Wigati & Rahardian, 2018). Ginsenosides as derivatives of saponin compounds which are useful as tonics can increase resistance to stress, fatigue, and various other diseases.

The content of flavonoids can reduce swelling and has antihistamine, bactericidal and antiviral properties, while tannins can protect nerve cells from harmful external stimuli. Dayak onion extract test showed that this plant has inhibitory or antioxidant activity against free radicals using the DPPH method. The IC50 value of the Dayak onion bulb ethanol extract reached 52.38 ppm (Claudea et al., 2017). The antioxidant content in Dayak onions is much higher compared to other

types of onions, such as shallots which have an IC50 value of 173.68 ppm (Nugraha & Berawi, 2017). Antioxidant activity in Dayak onions can help prevent the oxidation of body cells due to free radicals such as hydrogen peroxide, superoxide, hydroxyl radicals, and other free radicals. One of the diseases that can be caused by free radical activity is Ulcerative Colitis (UC) (Febrinda, 2014). This study aims to determine the effect of Dayak onion extract on lactic acid levels in Sprague Dawley male white rats with the Forced Swimming Test Model. The effect of Dayak onion extract on lactic acid levels has not been studied much, especially with the forced swimming test rat model, so further research is needed.

METHOD

The type of research used is experimental research with the Randomized Pre and Post Test Control Group Design. Using male white rats (Sprague Dawley) rats aged 2 months (weight 150-200g) as the experimental population. The research was conducted for 28 days during March 2023 at the Laboratory of the Center for Food and Nutrition Studies, Gadjah Mada University. The experimental animals were divided into 5 groups K- (the experimental animal group was not given Dayak onion extract but was given FST), K+ (the experimental animal group was given xanthine and FST), P1 (given Dayak onion extract at a dose of 50 mg/200 gBB), P2 (given Dayak onion extract at a dose of 100 mg/200 gBB), P3 (given Dayak onion extract at a dose of 200 mg/200 gBB). Rats were acclimated for 7 days, after which blood samples were taken to measure lactic acid levels before treatment. For 28 days white rats were given Dayak onions according to the treatment group. Then on the 1st and 28th day after administration of the Dayak onion extract, the white rats were put into a plastic pool filled with water with a weight on their tails of about 5% of their body weight and then swam in a pool of water measuring 90cm x 45cm x 45 cm and the depth 35 cm with a water temperature of 25º ± 1ºC (Li et al., 2022). The rats swam until they showed a tired state, that is, there was no motion reaction to rise to the surface of the water for 10 seconds and the head was left below the surface of the water, the tail was stretched, the body was bent, and there was no movement on all four legs (Abbasi-Maleki et al., 2020)). After that, the rats were removed from the pool, dried with a towel and returned to the cage, then the blood sampling procedure was carried out to determine the lactic acid level. All data collected is presented as an average standard deviation. Before carrying out statistical analysis, homogeneity and normality data were analyzed using tests and statistical analysis with the Kruskall Wallis test and Post-hoc LSD with a p value of less than 0.05 which was considered significant.

RESULTS AND DISCUSSION

Table 1.
Test the content of Dayak onions

Kinds of Analysis	Analysis Method	Results Analysis
Antiokxidant IC-50	Dpph- Spektrofotometri	196,36
Vitamin C	Spektrofotometri	2182,15 mg/100g

Table 1 describes the content of Dayak onions, Dayak onions were obtained from the Buntok district, Central Kalimantan Province. The Dayak onion extraction process was carried out at the Laboratory of the Center for Food and Nutrition Studies, Gadjah Mada University. Dayak onions as much as 10 kg chopped and dried using an oven with a temperature of 60'c until the water content is ≤ 10%. The dried Simplicia was then crushed and sieved using mesh no. 40. Dayak onions are macerated using 96% ethanol solvent with a ratio of 1:7 for 3 days; where every 24 hours a stirring

process is carried out. The macerate obtained is then filtered and evaporated using a rotary evaporator at 50°C to obtain a thick extract of Dayak onion.

Table 2.
Effects of Dayak Onion Extract on Lactic Acid Levels of Sprague Dawley white rats by Forced Swimming test

Group	Mean±SD (Effect of EBD administration on Lactic Acid levels (nmol/ml)	Difference to K- (%)
	After 21 days of intervention	
K-	6,33±0,43[a]	0
K+	1,84±0,27[b]	70,93
P1	3,84±0,37[a]	39,33
P2	2,69±0,15[b]	57,50
P3	2,21±0,23[b]	65,08

Information: K- (control negative), K+ (control positif xantin), P1 (EBD dose 50 mg/200 gBW), P2 (EBD dose 100/200 gBW), P3 (EBD dose 200 mg/200 gBW).

Table 2 analysis of lactic acid levels in each treatment group showed significant results for the trial sample ($p < 0.05$). The test results in groups P1, P2, P3 showed significant differences in blood lactic acid levels in male Sprague Dawley rats between groups for each treatment given. In the P3 group, it had a very high reduction effect of 65.08% during the 21 days of intervention. It can be concluded that Dayak onion extract has a therapeutic effect that is equivalent to that of the xanthine group. So that Dayak onion extract can be used as a substitute for the medicinal function of xanthine. Xanthine class of drugs are drugs that work by inhibiting the action of the xanthine oxidase enzyme which can convert xanthine into uric acid which will build up supplies and cause fatigue (Arcinthya et al., 2021).

This study shows that antioxidants in Dayak onion extract can help reduce increased levels of lactic acid in the blood after carrying out forced swimming tests. Antioxidants help protect cells from damage by free radicals that are generated during excessive metabolic processes and can cause an increase in lactic acid levels (George & Abrahamse, 2020). Increased production of lactic acid during intense exercise can increase the production of free radicals, which can damage cells and tissues (Gomes et al., 2012). Antioxidants can help protect cells from damage caused by free radicals by taking unstable molecules and making them stable. Again, by protecting cells from damage caused by free radicals, antioxidants can help speed up muscle recovery and lower the risk of injury (Capasso, 2013).

Vitamin C, also known as ascorbic acid, is a type of antioxidant that can help fight cell damage caused by free radicals during metabolic processes and intense physical exercise (Gomes et al., 2012). In addition, several studies have shown that vitamin C supplementation can help reduce increased levels of lactic acid during and after exercise (Mardiana et al., 2022). A study published in the Journal of Strength and Conditioning Research found that giving vitamin C supplements for 14 days to participants who did intensive cardiovascular exercise could help reduce increased levels of lactic acid in the blood (Purnomo, 2011). The study shows that vitamin C supplementation can help protect muscle cells from damage due to oxidative stress during intense physical exercise,

thereby helping to reduce lactic acid production. Although research on rats cannot be directly applied to humans, these results indicate that antioxidants can play an important role in reducing the increase in lactic acid levels in humans who do high-intensity exercise.

CONCLUSION

This study is the first experiment to investigate the effect of Dayak onion extract on lactic acid levels in Sprague Dawley male white rats using the forced swimming test model. The administration of Dayak onion extract was proven to significantly reduce serum Lactic Acid levels and suppress oxidative stress conditions. According to existing data, the P3 treatment group with a dose of 200 mg/200 gBB is the optimal dose and has a better effect than other treatment groups.

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