Effect of Etahnolic Extract from *Sasa borealis* on Endurance Exercise Capacity in Mice

Performance Enhancing Effect of Sasa Borealis

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1 OBJECTIVES

Bamboo leaves have been used for thatching material, fodder, food wrapper, and traditional medicine. In medicinal protocols, they have been adopted for use as a common fever remedy, as well as for detoxification and to control irritability, insomnia, and diabetes. However, data supporting the performance enhancing effect of bamboo leaves are lacking. In the present study, we investigated the stimulatory effects of ethanolic extract from *Sasa borealis* (SBE), one of major bamboo species in Korea, on exercise endurance capacity.

2 METHODS

The leaves of *S. borealis* was refluxed with 20 L of 80% ethanol at 250°C for 3 h. The extract was then concentrated and lyophilized. Four-week-old male ICR mice (19±2 g b.w.) were housed in cages under automatically controlled air-conditions of temperature (22±2°C), humidity (about 50%), and lighting (12:12-h light-dark cycle). To determine the swimming capacity, the mice were divided by body weight and similar swimming time. The mice of each group (n=8) orally administered 0-, 100-, 250-, and 500-mg/kg/day of SBE (Control, SBE100, SBE250, and SBE500, respectively) for 21 days. The exhaustive swimming time was investigated in mice using an adjustable-current water pool. The mice were assessed to be exhausted when they failed to rise to the surface of the water to breathe. Blood lactate and non-esterified fatty acid (NEFA) were measured by commercial kit. Hepatic glycogen level was assayed by the spectrophotometric method. The level of lipid peroxidation was evaluated by thiobarbituric acid reactive substances (TBARS) quantities using malondialdehyde (MDA) as an external standard.

3 RESULTS

Compared to the control group, 1.6-fold increases in swimming time were observed in SBE250 and SBE500 (Fig. 1). The blood lactate levels of SBE250- and SBE500-mice were significantly lower than that of the control mice (Fig. 2). Also, a significant increase in the NEFA level was revealed in the ethanolic extract-administered groups (Fig. 3). The levels of glycogen in SBE250- and SBE500-mice were noticeably higher than that of the control group after exhaustive swimming (Fig. 4). The mice that received SBE250 and SBE500 showed the significant decreases in MDA level in comparison with the control group (Fig. 5).

4 DISCUSSION

The increased exhaustive swimming time by the administration of SBE250 and SBE500 indicates that ethanolic extract of *S. borealis* possessed the potential to increase the endurance exercise capacity. Lactate is an important indicator of fatigue (You *et al*, 2009), and NEFA during exercise is an indicator of fat utilization (Jung *et al*, 2004). The lactate level of the ethanolic extract-administered mice was reduced and the NEFA level was elevated compared to the control mice. The remaining hepatic glycogen after exhaustive exercise, an indicator of saving carbohydrate utilization (Kim *et al*, 2012), was also increased in the mice treated with the ethanolic extract from *S. borealis*. These suggest that SBE250 and SBE500 improved the energy metabolism.

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Exercise-induced oxidative stress is characterized by hepatic MDA level (You *et al*, 2009). The oral administered group with SBE250 and SBE500 alleviated the lipid peroxidation. Based upon these results, SBE250 and SBE500 could ameliorate the swimming capacity by improving energy metabolism and decreasing oxidative stress, indicating that leaves of *S. borealis* can be a useful performance-enhancing agent.

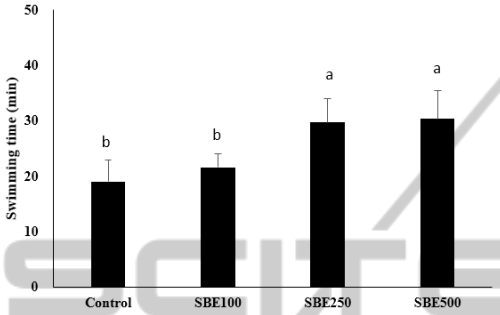

Figure 1: Effects of Ethanolic Extracts from *Sasa borealis* leaves on Swimming Capacity. Different letters above the bar are statistically different ($p<0.05$).

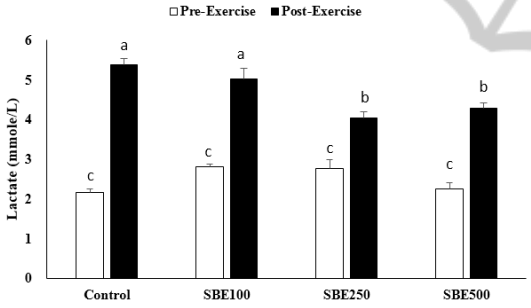

Figure 2: Effects of Ethanolic Extracts from *Sasa broealis* Leaves on Lactate Levels. Different letters above the bar are statistically different ($p<0.05$).

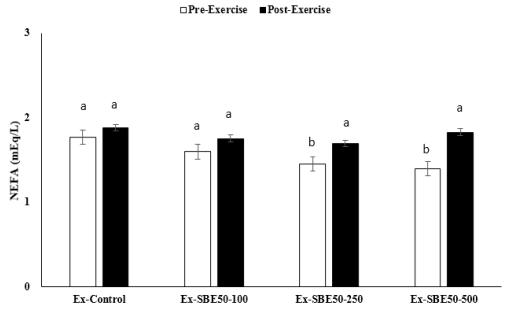

Figure 3: Effects of Ethanolic Extracts from *Sasa borealis* Leaves on NEFA Levels. Different letters above the bar are statistically different ($p<0.05$).

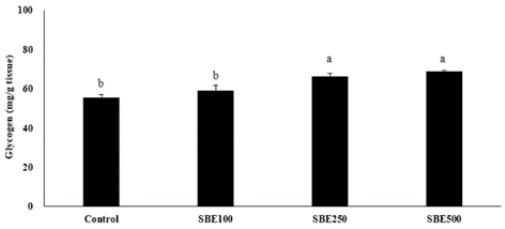

Figure 4: Effects of Ethanolic Extracts from *Sasa broealis* Leaves on Glycogen Levels. Different letters above the bar are statistically different ($p<0.05$).

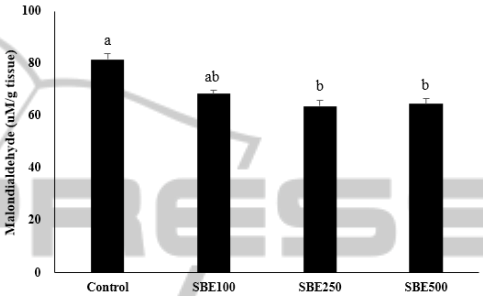

Figure 5: Effects of Ethanolic Extracts from *Sasa broealis* leaves on MDA Levels. Different letters above the bar are statistically different ($p<0.05$).

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