

Improving Effect of *Canavalia Gladiata* on Exercise Capability

Performance Enhancing Effect of *Canavalia Gladiata*

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1 OBJECTIVES

Canavalia gladiata is a perennial leguminous cultivated throughout the tropics and subtropics in Asia. *C. gladiata* is the excellent sources of starch and protein, with a good balance of amino acids. Also, *C. gladiata* contains the numerous phytochemicals, which leads to the potential uses as functional food. Therefore, in present study, the effects of *C. gladiata* extracts on endurance exercise capacity were investigated. The knowledge gained might aid in the development of effective performance enhancer.

2 METHODS

C. gladiata was refluxed with 20 L of water or 80% ethanol at 250°C for 3 h. The extract obtained after filtering was 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). The mice were separated into three groups (n=12 per group) with similar mean of exhaustive swimming time; exercised control group (CON), water extract from *C. gladiata* administered group (CGW), and ethanol extract from *C. gladiata* administered group (CGE). Samples were orally administered 1 g/kg b.w./day. The mice were forced to swim 1 h after the treatment, and the exhaustive swimming time was measured at 14th day. The swimming time of mice was determined in an adjustable-current swimming pool (90×45×45 cm) with 38 cm deep water at 34±1°C. After the experimental period, all mice were anaesthetized and sacrificed. The blood lactate level was measured, using the kit which was supplied by Arkray Inc. (Japan). The level of serum

non esterified fatty acid (NEFA) was evaluated spectrophotometrically, using commercially available diagnostic kit supplied by Wako (Japan). Glycogen measurement was performed using the anthrone method according to Gierus and Lopez (1997) and Fadamiro *et al.* (2005).

3 RESULTS

As shown in Fig. 1, CGE group exhibited approximately 1.6-fold increase in swimming time on day 14 (46.7 min) compared to CON group (29.6 min). Also, the endurance exercise capacity of mice treated with CGE was significantly larger than that of CGW (32.9 min). The glucose levels of each group revealed no difference (Fig. 2-A). However, blood lactate level of CGE was relatively lower than other groups (Fig. 2-B). Serum NEFA level of CGE group was significantly increased compared to CON and CGW groups (Fig. 2-C). Moreover, the amount of muscular glycogen in CGE group was higher than those of CON and CGW (Fig. 3).

4 DISCUSSION

In this study, exhaustive swimming time in CGE group showed a statistically significant increase compared to CGW group. These results imply that the organosoluble compounds rather than hydrosolubles in *C. gladiata* might be responsible for the performance enhancing effect. Fatigue happens when the blood lactate is overproduced. Therefore, the lactate level is an important indicator to judge the degree of fatigue (Ding *et al.*, 2011). The present study revealed that the administration of CGE decreased the lactate level, confirming that CGE possessed the performance enhancing

potential. The NEFA is one of major fuels for oxidative metabolism during exercise. Many researches demonstrated improved endurance capacity by increasing fat utilization during exercise and have shown increased serum level of NEFA during and/or after exercise with improved endurance (Kim *et al.*, 2012). In this study, blood NEFA level of CGE group was significantly increased compared to that of CON group. Also, CGE-administered mice showed the lower levels of muscular glycogen than CON group. Combined together, the administration of CGE could improve the endurance exercise capacity by increasing fat utilization, with sparing glycogen stores and reducing lactate production.

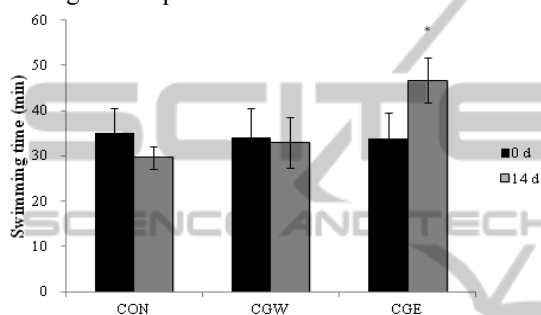


Figure 1: Effects of *C. gladiata* Extracts on Exhaustive Swimming Capacity in Mice. CGW is hot water extract of *C. gladiata*. CGE is 80% ethanol extract of *C. gladiata*. Data are expressed as the mean±SE for 12 mice in each group. The asterisk above the bar indicates a statistically significant difference compared to the control by Student's t-test ($p < 0.05$).

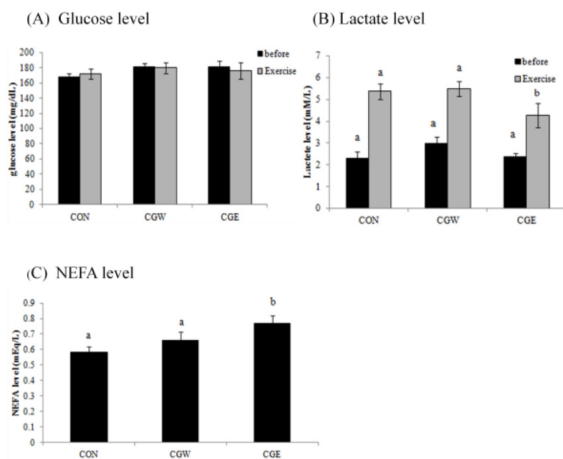


Figure 2: Effects of *C. gladiata* Extracts on the Levels of Blood Glucose, Lactate, and NEFA. CGW is hot water extract of *C. gladiata*. CGE is 80% ethanol extract of *C. gladiata*. Data are expressed as the mean±SE for 12 mice in each group. Different letters above the bar are statistically different by Duncan's multiple range test ($p < 0.05$).

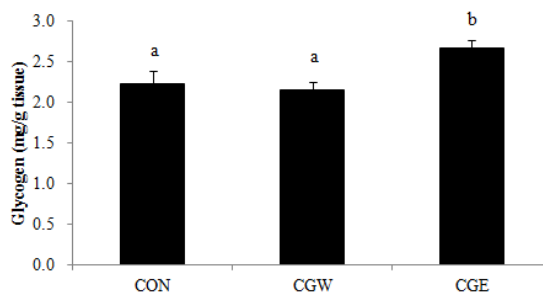


Figure 3: Effects of *C. gladiata* Extracts on Muscular Glycogen Level after Exhaustive Swimming. CGW is hot water extract of *C. gladiata*. CGE is 80% ethanol extract of *C. gladiata*. Data are expressed as the mean±SE for 12 mice in each group. Different letters above the bar are statistically different by Duncan's multiple range test ($p < 0.05$).

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