Ergothioneine Supplementation and the Prevention of Delayed Onset Muscle Soreness Following a Bout of Eccentric Exercise

Nolan Hale¹, Kristin VanHouten¹, Courtney Miller¹, Aaron Proefrock², Jessica Pieters¹, Leah Rothschild¹, Samantha Curtis¹ and Peter J. Horvath
¹ Department of Exercise and Nutrition Sciences, School of Public Health and Health Professions ² Department of Biomedical Sciences
University at Buffalo, Buffalo, New York

Abstract

Exercise has been proven to be an essential part of a healthy lifestyle and discourages the onset of disease. When a new physical activity regimen is implemented, compliance is key. Delayed onset muscle soreness (DOMS) is a major deterrent at the onset of a new exercise programs, especially among sedentary individuals. Ergothioneine, an antioxidant most notably recognized for its presence in mushrooms, may reduce muscle soreness. Ergothioneine is not synthesized in humans and is only available from the diet. This study will evaluate the effect of ergothioneine-rich mushroom supplementation on muscle soreness following a bout of eccentric exercise in middle-aged men and women. This randomized double blind parallel arm study requires participants to walk on a treadmill with a progressive decline in elevation and an increase in speed to induce eccentric muscle damage in the lower limbs before and after supplementation. Participants will be supplemented for ten days with either shitake mushroom powder (high ergothioneine,) or placebo - white button mushroom powder (low ergothioneine). DOMS will be measured by: physical fitness testing, pain questionnaires, urinary measures, and blood levels of creatine kinase, interleukin-6 and interleukin-2.

Background

The pain that occurs after exercise (Delayed Onset Muscle Soreness) is a major deterrent to maintaining an exercise training program. Many people begin their training with eccentric exercise, which causes the greatest muscle damage. If the pain caused by eccentric exercise can be decreased, then people will continue to train. One mechanism is to use antioxidants and anti-inflammatories such as ergothioneine found at high levels in mushrooms. It is not bioxynthesized by humans (1). Ergothioneine is concentrated in human tissues predisposed to high levels of oxidative stress and inflammation such as liver, kidney, and skeletal muscles (3-5). The antioxidant and anti-inflammatory properties of ergothioneine are related to its ability to neutralize free radicals and reduce inflammation. Shiitake mushrooms have a substantial amount of ergothioneine. Blood ergothioneine levels increase within two hours after mushroom consumption. The effects of ergothioneine supplementation on delayed onset muscle soreness have thus far only been tested on young, healthy individuals. As a result of this study, new exercise programs compliance rates may increase, as pain would no longer be a heavy deterrent.

To evaluate the effect of ergothioneine supplementation on muscle soreness following a bout of eccentric exercise in older men and women, participants will be required to intake 6 grams of powder per day over the course of 10 days.

Methods

The design of the study is a parallel design, where subjects will supplement with either Ergothioneine supplement or Placebo. Blood and urine samples will be collected pre and post-exercise to determine baseline creatine kinase, ergothioneine, and urine nitrogen levels. The first visit will be the screening including informed consent, health history, blood pressure and heart rate, PARQ physical activity questionnaire, 24 hour food recall administered in the lab by research personnel, functional fitness testing, and a sub max VO2 test. Functional fitness testing includes:

- 8 ft up and go, 30 second sit to stand, and 30 second 8 lb arm curl, and a 3 minute step test.
- Five days following participants will return for their second visit which will include a 24 hour food recall, pre blood and urine samples, and a pain questionnaire in relation to the eccentric exercise protocol which will also take place this day.

After 10 days of supplementation with either Placebo (White Button) or Ergothioneine, subjects will undergo the same functional fitness and aerobic exercise tests and follow up with DOMS measures (short form McGill Pain Questionnaire), creatine kinase, and ergothioneine levels, immediately post exercise and 24 hours post exercise. Shiitake powder will be provided to participants, they will be required to intake 0 grams of powder per day over the course of 10 days.

Methods – Functional Fitness Tests

- Eccentri Exercise
- 30 sec. Arm Curl
- 3 Minute Step Test

Visit One

Visit Two

Visit Three

Visit Four

Visit Five

Expected Results

Figure 1: Creatine Kinase levels vs Pain

Time Post Exercise (Hr)