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FILE: ▪ Green Tea (*Camellia sinensis*)
▪ Exercise
▪ Oxidative Stress

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RE: Green Tea Protects Against Exercise-Related Oxidative Stress

Panza VSP, Wazlawik E, Schütz GR, Comin L, Hecht KC, da Silva EL. Consumption of green tea favorably affects oxidative stress markers in weight-trained men. *Nutrition*. 2008;24:433-442.

Although resistance training can improve body composition, health, and quality of life, it can also increase free radical production beyond the tissues' antioxidant capacity, resulting in oxidation of cellular components, such as lipids and proteins.[1-3] Physical training along with a low intake of antioxidant nutrients may increase vulnerability to oxidative stress. Thus, say the authors, the intake of a diet rich in antioxidants may be the best recommendation to minimize the deleterious actions of free radicals resulting from exercise. The authors conducted a study to investigate the effects of green tea (GT; *Camellia sinensis*), a beverage rich in polyphenols, on the oxidative alterations induced by resistance exercise in healthy men.

The study, which took place in Santa Catarina, Brazil, included 14 healthy men aged 19 to 30 years who engaged in recreational weight training. All had been involved in a resistance training program for at least 1 year and met the following criteria: nonsmoker; free of any disease, infection, or inflammatory processes; and not using any medication, anabolic steroids, ergogenic aids, or antioxidant supplements.

A single group was constituted and served as its own control. In the baseline period, the participants were asked to drink 200 mL of water (control group) 3 times per day (morning, afternoon, and night) for 7 days. On the morning of the eighth day, they drank 200 mL of water 1 hour before the resistance exercise protocol. Blood samples were drawn before exercise and 1 and 15 minutes after exercise.

After this control period, the participants consumed 200 mL of GT prepared with 10 mg of dried leaves for every milliliter of hot water (GT group) 3 times per day (morning, afternoon, and night) for 7 days (6 g total GT leaves daily). Considering that the participants had a daily intake of 600 mL of GT infusion, the mean intake of GT phenolic compounds was determined by quantitative analysis

to be 4.6 μg/day. At the end of this period, on the morning of the eighth day, the participants took an additional dosage of 200 mL of GT 1 hour before a bench press session.

In both conditions (control and GT groups), the participants ate a standardized breakfast of skimmed milk, sugar, white bread, honey, and bananas 2 to 3 hours before they performed the bench press exercise.

The exercise protocol was performed using a bench press, bar, and free weights. According to the authors, each participant's 1-repetition maximum (1-RM) in the bench press exercise was determined 2 days before the beginning of the control treatment. The experimental exercise protocol on the bench press constituted initially of a warm-up, with 2 series of 20 repetitions, with an equivalent load of 30% of 1-RM. Then participants executed 4 series of 10, 8, 6, and 4 repetitions, with 75%, 80%, 85%, and 90% of 1-RM, respectively, with 1.5-minute intervals between repetitions.

In the week before the study, the participants answered a food-frequency questionnaire to assess their usual dietary antioxidant sources in the preceding month. They also provided 3-day food records during each of the 2 stages. In general, the participants presented a low-frequency intake of food and beverages with antioxidant properties. In addition, they had an unbalanced diet, particularly in relation to low intake of vitamin E and carotenoids, based on the 3-day food registers.

Blood samples were collected before the exercise and 1 and 15 minutes after exercise, and analyzed for total antioxidant capacity (ferric reducing ability of plasma [FRAP]); total polyphenols; reduced glutathione (GSH), lipid hydroperoxide (LH) and thiobarbituric acid-reactive substances; the enzymes creatine kinase (CK), aspartate aminotransferase (AST), xanthine oxidase (XO), and hypoxanthine; and uric acid (UA).

The authors report the following:

- Green tea reduced the postexercise concentration of LH. The LH levels in the GT group tended to be lower ($P=0.06$) than in the control group at 1 minute after exercise, reaching significantly lower values at 15 minutes after exercise. The GT group had significantly lower ($P<0.05$) pre-exercise LH concentrations than the control group. The significant reductions in plasma LH concentrations just before and at 15 minutes after exercise demonstrate the protective effects of GT.
- Plasma FRAP values were not affected by exercise at 1 and 15 minutes after exercise in the control group. However, in the GT group, FRAP was significantly greater at 1 and 15 minutes postexercise when compared with the respective controls ($P<0.05$). The FRAP values improved in the GT group, regardless of exercise, indicating the great antioxidant potential of GT, say the authors.
- Baseline levels of polyphenols increased 27% after consumption of GT ($P<0.001$). Those levels did not change with exercise in the control and GT groups.
- Blood GSH concentrations did not change significantly at 1 minute after exercise in the control group; however, it decreased significantly at 15 minutes after exercise. Compared with the control group, GSH concentrations were higher ($P<0.001$) in the GT group at all evaluated times.
- GT also prevented significant rises in CK and XO activities measured at 1 minute post-exercise in the control group ($P<0.05$).

- Serum AST activity showed a significant increase at 1 and 15 minutes postexercise in both the control and GT groups; however, in the GT group, AST activity was lower ($P<0.001$) than that in the control group at all times measured.
- Intake of GT decreased the levels of hypoxanthine before and 15 minutes after exercise compared to controls.
- Exercise did not modify serum UA values in the control and GT groups. GT intake during 1 week compared to controls did however reduce serum UA concentrations before and after exercise ($P<0.001$).

The authors conclude that the consumption of GT, rich in polyphenols, may offer protection against the oxidative damage caused by exercise, and sports participants should be given dietary advice accordingly. Further research to corroborate these findings and to study other foods and beverages rich in polyphenols should be considered, especially among physically active populations whose dietary antioxidant intake is inadequate.

—*Shari Henson*

References

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The American Botanical Council has chosen not to reprint the original article.