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Article

8-Week Supplementation of 2S-Hesperidin Modulates Antioxidant and Inflammatory Status after Exercise until Exhaustion in Amateur Cyclists

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Abstract: Both acute and chronic ingestion of 2S-hesperidin have shown antioxidant and anti-inflammatory effects in animal studies, but so far, no one has studied this effect of chronic ingestion in humans. The main objective was to evaluate whether an 8-week intake of 2S-hesperidin had the ability to modulate antioxidant-oxidant and inflammatory status in amateur cyclists. A parallel, randomized, double-blind, placebo-controlled trial study was carried out with two groups (500 mg/d 2S-hesperidin; n = 20 and 500 mg/d placebo; n = 20). An incremental test was performed to determine the working zones in a rectangular test, which was used to analyze for changes in antioxidant and inflammatory biomarkers. After 2S-hesperidin ingestion, we found in the rectangular test: (1) an increase in superoxide dismutase (SOD) after the exercise phase until exhaustion (p = 0.045) and the acute recovery phase (p = 0.004), (2) a decrease in the area under the oxidized glutathione curve (GSSG) (p = 0.016), and (3) a decrease in monocyte chemoattractant protein 1 (MCP1) after the acute recovery phase (p = 0.004), post-intervention. Chronic 2S-hesperidin supplementation increased endogenous antioxidant capacity (↑ SOD) after maximal effort and decreased oxidative stress (↓ AUC-GSSG) during the rectangular test, decreasing inflammation (↓ MCP1) after the acute recovery phase.

Keywords: polyphenols; flavonids; endogenous antioxidant enzymes; reduced glutathione; oxidized glutathione; catalase; superoxide dismutase; interleukin 6; tumor necrosis factor; endurance sports

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1. Introduction

Flavonoids are bioactive substances found mainly in fruits and vegetables, with more than 15,000 molecules identified within this family [1]. However, one of the most well-known is hesperidin, which is a flavonoid present at high concentrations in citrus fruits, being the main one in sweet orange (*Citrus sinensis*). Hesperidin may be found in two isomeric forms, 2S- and 2R-, where the 2S isomer is predominant in nature [2]. When hesperidin reaches the intestine, bacterial flora converts it into hesperetin (aglycon), which is effectively absorbed, being the main metabolite of hesperidin [3]. Previous studies have shown the positive effects of hesperidin on some diseases (neurological, cardiovascular, insulin sensitization) due to its antioxidant and anti-inflammatory properties [4,5]. Moreover, the intake of hesperidin (in orange juice) has been shown to modulate leukocyte gene expression, boosting its antioxidant and inflammatory profile, and therefore showing a nutrigenomic effect [6]. On the other hand, the ability of 2S-hesperidin to improve performance has been observed [7]. It should be noted that there are other important factors that can