



Article

Differences between Professional and Amateur Cyclists in Endogenous Antioxidant System Profile

Francisco Javier Martínez-Noguera ^{1,*}, Pedro E. Alcaraz ¹, Raquel Ortolano-Ríos ¹, Stéphane P. Dufour ^{2,3} and Cristian Marín-Pagán ¹

- ¹ Research Center for High Performance Sport, Catholic University of Murcia, Campus de los Jerónimos, 30107 Murcia, Spain; palcaraz@ucam.edu (P.E.A.); rortolano@ucam.edu (R.O.-R.) and cmarin@ucam.edu (C.M.-P.)
² Faculty of Medicine, Translational Medicine Federation (FMTS) UR 3072, University of Strasbourg, 67000 Strasbourg, France.; sdufour@unistra.fr
³ Faculty of Sport Sciences, University of Strasbourg, 67084 Strasbourg, France
* Correspondence: fjmartinez3@ucam.edu; Tel.: +34-96-827-8566.

Abstract: Currently, no studies have examined the differences in endogenous antioxidant enzymes in professional and amateur cyclists and how these can influence sports performance. The aim of this study was to identify differences in endogenous antioxidants enzymes and hemogram between competitive levels of cycling and to see if differences found in these parameters could explain differences in performance. A comparative trial was carried out with 11 professional (PRO) and 15 amateur (AMA) cyclists. All cyclists performed an endogenous antioxidants analysis in the fasted state (visit 1) and an incremental test until exhaustion (visit 2). Higher values in catalase (CAT), oxidized glutathione (GSSG) and GSSG/GSH ratio and lower values in superoxide dismutase (SOD) were found in PRO compared to AMA ($p < 0.05$). Furthermore, an inverse correlation was found between power produced at ventilation thresholds 1 and 2 and GSSG/GSH ($r = -0.657$ and $r = -0.635$; $p < 0.05$, respectively) in PRO. Therefore, there is no well-defined endogenous antioxidant enzyme profile between the two competitive levels of cyclists. However, there was a relationship between GSSG/GSH ratio levels and moderate and submaximal exercise performance in the PRO cohort.

Keywords: catalase; superoxide dismutase; oxidized glutathione; reduced glutathione; hemoglobin; power output

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1. Introduction

Competitive cycling is highly stressful on both aerobic and anaerobic metabolisms. Road cycling races require the riders to produce high relative power output (W/kg) for short duration (i.e., less than 1 min at the start, during steep climb and at the end of the race) while also sustain efforts that last for several minutes to several hours [1]. Overall, professional cyclists (PRO) perform high training volumes (~32,500 Km) during the competitive season, which include 90–100 race days [2]. On the other hand, amateur competitive cyclists (AMA) can be defined as cyclists that train 3–7 times per week, with daily training volumes of 60–120 min and that compete about 20 times in a year [3]. During training sessions and competitions (aerobic and anaerobic exercise), there is a rise in reactive oxygen species (ROS) and subsequent oxidative stress, which can lead to a favorable adaptation in the body's antioxidant defense system [4]. This improvement in the endogenous antioxidant system is generally associated with lower levels of oxidative stress biomarkers [5].

Within the endogenous antioxidant system, superoxide dismutase (SOD) is the first line of enzymatic defense that transforms the superoxide radical ($O_2^{\cdot-}$) into hydrogen peroxide (H_2O_2) [6]. Then, H_2O_2 , which is also harmful to cells, can be metabolized in a couple of