Marked differences in redox status of professional soccer players depending on training types

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Abstract

Objective: an intense physical activity cause inflammation and produces oxidizing molecules that physiologically "train" the body to restoring the homeostatic balance. Its alteration can lead to a sub-clinical pro-inflammatory state known as "oxinflammation". Aim of this study was to measure some inflammation and redox biomarkers in a team of soccer players during a competitive season to identify relationships between oxinflammation, nutrition, workloads and athletic performances.

Methods: thirty four players were evaluated every 2 months from pre- until end-season (visits V0-V4). At each time, a panel of oxinflammatory biomarkers were measured: interleukin-6 (IL-6), high-sensitivity C-reactive protein (hsCRP), total peroxides (dROMs), total antioxidant barrier (BAP), total (GSSG+GSH) and reduced (GSH) glutathione, vitamins A and E, beta carotene, lycopene, coenzyme Q10, 3-nitrotyrosine (3-NT) and 8-hydroxy-deoxyguanosine (8-OHdG).

The nutritional program was customized for each athlete to ensure adequate supply of micro- and macro-nutrients. Starting from V2, following the replacement of the coach, the training program was suddenly changed, and the high intensity work was significantly increased.

Results: until V2, the oxinflammation balance remained still in equilibrium, and total and reduced glutathione were favorably increased (+19% and +16% vs. V1, respectively, p<0.001). After the change of workloads, the inflammation had worsened decreasing GSH and sharply increasing 3-NT, marker of irreversible nitration (+ 1274% at V4, p<0.001).

Conclusions: above a threshold, the eccentric exercise has altered the oxinflammatory balance. The nutritional intervention was partially able to counteract the alteration but, the worsening of balance at the end of season, showed that probably, it was much more conditioned by the physical overload. A customized balancing between training, rest period and nutrition, is therefore crucial, and the measurement of some oxinflammation markers, as hsCRP, GSH and 3-NT, may be helpful to evaluate the state of fitness and recognize early the approaching of the over-training threshold.

Key words: oxidative stress markers, inflammation, T/C ratio, nutrition, high-intensity training