

Biomarkers of Cardiovascular Endurance of Athletes: Review

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Abstract

Aim: The aim of this review was to discuss the role of biomarkers of cardiovascular endurance of athletes. **Results:** The research in the field of exercise science and health fitness has identified various biomarkers for assessing athlete's health and performance. However, there are biomarkers which changes in individual's participating in physical activity and exercise training programs. In the present review an approach was to review the current literature of hematological and determined a set of validated biomarkers of cardiovascular endurance of athletes that could be used by coaches and trainers. **Conclusion:** The present review will help sport scientists, coaches, trainers, clinical sport professionals, researchers, and athletes to better understand how to monitor biomarkers of cardiovascular endurance, as they can better evaluate performance, modify training and identify nutritional deficiencies that elicit maximal improvements in athlete's performance.

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Introduction

The use of technology to monitor physical training load placed on athletes has become standard across many levels of sport. Using a panel of meaningful biomarkers has been proposed as a means of better evaluating an athlete's response to training (Hinrichs *et al.*, 2010; Meeusen *et al.*, 2006; Urhausen & Kindermann 2002). Research has shown that, depending on level of play and sport, biomarkers associated with stress (physical and physiological), nutrition, inflammation and recovery have the potential to change significantly over the course of a season (Baird *et al.*, 2012; Hinrichs *et al.*, 2010; Purvis *et al.*, 2010). Through understanding these changes, coaches and athletes can better evaluate performance, modify training, identify nutritional deficiencies, and advocate for rest. A biomarker is in general a substance used as an indicator of a biological state. More generally a biomarker is anything that can be used as an indicator of a particular disease state or some other physiological state of an organism. Biomarker levels represent a summation of the influence of acute and chronic comorbidities. Proteins, metabolites, electrolytes, and other small molecules may serve as biomarkers for athletes. Proteins, metabolites, electrolytes, and other small molecules may serve as biomarkers for athletes.

Iron (Fe)

The markers of oxygen binding and transport such as iron (Fe), hemoglobin (Hb), ferritin (FER), total iron binding capacity (TIBC), percent saturation (%Sat), hematocrit (HCT) and mean corpuscular hemoglobin concentration (MCHC) have been shown to vary with training and respond differently among genders (Heisterberg *et al.*, 2013; Di Santolo *et al.*, 2008). An athlete's capability to transport and make use of oxygen during exercise is a key to maintaining performance.