

ImmunoTools *special* Award 2018



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Validation and examination of the reliability of blood biomarkers for optimization training monitoring in endurance sport

Quantification of individual training bouts, induced fatigue and regeneration processes have an important impact on monitoring training in athletes. If training stimuli are incorrectly cyclized due to a lack of systematics and limited monitoring, there will be an inadequate balance in exercise/recovery processes. In addition to an increased risk of injury and overtraining, this leads to an inhibition of fundamental adaptation processes and can thus have a lasting adverse effect on training success (*Thorpe et al., 2017*). To avoid this, load-sensitive biomarkers from the blood plasma were established in endurance-oriented sports practice. These include markers such as creatine kinase (CK), lactate dehydrogenase (LDH), and Interleukin-6 (IL-6) (*Kellmann et al., 2018*). However, these enzymes and cytokines, as well as some other parameters, show a high variance and a highly inter- and intra-individual response to a standardized training program. Moreover, a lack of reliability of some parameters has a lasting negative effect on the application as well as the significance in sports practice (*Finsterer & Drory, 2016*). Therefore, the identification of alternative biomarkers has a great value for the examination of the internal load condition because of the meanwhile sensitive analysis methods and the good reproducibility by far automation of the processes. Thus, it seems to be desirable to make beyond the known markers further potential biomarkers usable for sports practice.

The current project aims to identify new biomarkers, which might allow an improved individualized stress- and regeneration monitoring in elite sports. In this regard, the reliability of selected load sensitive protein targets was tested in order to develop a biomarker panel providing an extensive and specific predictive value about an athlete's stress and recovery condition.

After a sports medical initial examination and performance diagnostics, 20-trained competitive athletes will be included in the study. After a minimum of one week, two identical, intensive running tasks will be performed at exactly four weeks' intervals under the control of nutrition and training. The two exercise bouts will be performed as continuous running programs over a period of 60 minutes at an intensity corresponding to 70% of their individual maximum oxygen consumption (VO_{2max}). Immediately after, 3 hours after and 24 hours after this exhaustive endurance exercise, 20 ml venous blood will be taken and centrifuged to get serum and plasma samples. Samples will be aliquoted stored at $-80^{\circ}C$. Next, serum and plasma samples

will be used to validate and examine the reliability of various blood biomarkers for optimization training monitoring in endurance sport.

For this purpose, we plan to test plasma proteins, which are measured by sensitive ELISA methods, for their reliability and validity in relation to exercise and recovery processes. Our previous studies proved that intensive exercise induces systemic pro- and anti-inflammatory responses which may be suitable for monitoring stress, fatigue and recovery (*Muders et al., 2016*). For this purpose, we will use the ELISA kits of inflammatory proteins provided by **ImmunoTools**, whose effect on an endurance-oriented athletic load in terms of their validity and reliability in the below-listed target parameters still has to be scientifically proven. Accordingly, this project will be an innovative approach to identify potential valid and reliable biomarkers for monitoring endurance athletes.

References:

Finsterer, J., Drory, V.E. (2016). Wet, volatile, and dry biomarkers of exercise-induced muscle fatigue. BMC Musculoskelet Disord 17:40.

Kellmann, M., et al. (2018). Recovery and Performance in Sport: Consensus Sport. Int J Sports Physiol Perform. Human Kinetics, Inc

Muders, K., et al. (2016). Effects of Traumeel (Tr14) on Exercise-Induced Muscle Damage Response in Healthy Subjects: A Double-Blind RCT. Mediators Inflamm.

Thorpe, R.T., Atkinson, G., Drust, B., Gregson, W. (2017). Monitoring Fatigue Status in Elite Team-Sport Athletes: Implications for Practice. Int J Sports Physiol Perform, S2-27 - S2-34.

ImmunoTools *special* Award for **Thomas Reichel** includes 20 reagents

human ELISA-set (for one 96 plate): human IL-1beta, human IL-12p40 total (IL-23), human IP-10 (CXCL10), human MCP-2 (CCL-8), human MIP-4 (PARC)

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