ImmunoTools *special* Award 2015

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Effect of a high-intensity interval exercise on activation, apoptosis and function of T cell subpopulations

High intensity interval training (HIIT) evoked a great interest as an effective training mode for over the past decade. It represents an exercise method which consists of alternating periods of high-intensity bouts of exercise and rest periods of low-intensity exercise. Originally used by athletes for training purposes, the rationale for its use is to increase training time spent at high intensities, thus producing a stronger stimulus for cardiovascular and muscular adaptations. The body of literature supporting the fitness benefits of high-intensity interval training is expanding. Data suggest that HIIT is superior to continuous training for improving maximum oxygen consumption (VO_{2max}) in athletes and young to middle-aged adults. Recent studies demonstrated that also patients benefit from interval training modes. In this regard, HIIT has been shown to improve peak oxygen uptake, quality of life, and cardiac remodelling in patients with cardiovascular and metabolic disease like chronic systolic heart failure and type II diabetes.

Since exercise is known to be a strong modulator of the immune system, it has to be ensured that both patients and athletes do not affect their immune competence after training. Acute intensive bouts of exercise alter number and function of circulating cells of both the non-adaptive and adaptive immune system as well as intracellular signalling by cytokines. A lymphocytosis is observed during and immediately after exercise with numbers of T cells falling below pre-exercise levels during the early stages of recovery, before returning to resting values normally within 24 h. It is believed that lymphopenia is the result of at least two different processes. On the one hand lymphocytes are redistributed into various tissues and organs. On the other hand cells die by apoptosis. While exercise of moderate intensities only marginally affects lymphocyte apoptosis, an increase of cell death was observed after several intensive types of exercise. Therefore, a role of apoptosis in regulation of lymphocytes after acute high intensity interval exercise (HIIE) is likely.

In order to investigate the effects of HIIE on regulation of T cells, healthy young men (n=15) will complete a HIIE session (5 intervals of 3 minutes, intensity of 90 % of PPO, 3 minutes active break)

and an isocaloric continuous exercise test (CONT, 30 minutes at 70% VO_{2max}) on a bicycle ergometer. Blood samples will be collected before, immediately after, as well as 3 h and 24 h post-exercise for flow cytometric assessment.

In order to analyze lymphocyte subpopulation, FITC and PE conjugated anti-human antibodies (CD3, CD4, CD8, CD45, CD25, CD57) will be used. Additionally, hematopoietic progenitor cells will be analysed by using antibodies labelled with CD45 and CD34 since these cells are assumed to replace apoptotic cells after cell death. In a second step T cell activation and apoptosis will be analysed by using additional labelling by CD62L CD69, and Annexin V. In order to analyse potential mechanisms of T cell function during exercise, several exercise sensitive cytokines will be analysed. Selected cytokines comprise IL-6, IL-8, and IL-10, which are known to increase in response to exercise. Cytokines will be measured by ELISA, and results correlated to the observed changes in cellular functions.

Summarized, it is known that HIIT represents and effective method for athlets and patients to improve performance, endurance capacity, and quality of life. The present study focusses on HIIT effects on numbers and functions of several T cell subsets to ensure that this type of intensive training is safe and not detrimental for patients and athletes immune competence.