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The Immune Imbalance is the Origin of Overtraining?

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Short Communication

Physical inactivity is one of the main causes attributed to the development of chronic non-communicable diseases [1]. However, strenuous exercise loads can impair performance and lead to health damage, such as cellular immune suppression, window of opportunity, and overtraining [2].

Overtraining is a neuroendocrine disorder resulting from the imbalance between a high stresses loads associated with insufficient recovery time for the body. The clinical manifestation of overtraining occurs through a series of signs and symptoms responsible for physiological, psychological and behavioral, neuroendocrine, biochemical, hormonal, immunological and performance-related changes [3].

Among these alterations, it is possible to emphasize the decrease of the muscular glycogen stores, the decrease of the performance and chronic fatigue, muscular pains, incapacity to complete the sessions of exercises, loss of the competitive stimulus and determination, appetite changes and loss of weight, sleep disturbances, mood disorders, increased anxiety, depression, irritability and nervousness, increased susceptibility to colds and flu, increased plasma levels of the hormone cortisol and reduced testosterone levels, for example [2-6]. There is no knowledge of a single, accurate and reliable objective marker, of practical and simplified application for the monitoring of training load distributions over time [7].

There is no consensus on the diagnosis of overtraining from classical physiological and biochemical parameters indicating abnormalities and tissue damage, such as variability in resting heart rate, plasma creatine kinase, myoglobin, lactate dehydrogenase and fragments of the myosin heavy chain, for example. It has been theorized that overtraining originates at the time when new strenuous exercise sessions are performed without due timing of recovery of cellular immuno suppression [8]. In this sense, a better understanding of the immune system, a promising subject in the exercise and sports sciences, can contribute to the elucidation of mechanisms for a safer prescription of physical exercise both in the context of sports performance and in public health.

Exhaustive exercise may lead to acute transient leukocytosis followed by partial suppression of cellular immunity, reduction in the number or function of leukocytes and other components of the immune system [9]. The period in which immune response agents are suppressed after exhaustion caused by a training session or competitive event is known as the "window of opportunity" [10,11]. One of the most frequent consequences of the window of opportunity is upper respiratory tract infection, which can occur within one to two weeks after the exhaustive exercise session, according to classical studies [12-14].

Data not yet published by the Laboratory of Protozoan Biochemistry and Immunophysiology of Exercise (Faculty of Medical Sciences, University of the State of Rio de Janeiro) show that although BALB/c mice at half of 10 weeks exhaustive swimming training period has presented the best physical capacity, performance was impaired after at the end of 10 weeks training period and cellular immunity was compromised. Macrophages infected with Leishmania major had the highest infection rate in comparison with "moderate" group. These data corroborate the hypothesis that the excess stress caused by exercise generates an increase in the susceptibility to injuries and infections, in addition to that the coherent distribution of training loads promotes performance and immunological balance.

While strenuous exercise causes cellular immunosuppression, the moderate seems to balance the humoral and cellular adaptive immune response. Another study published by our laboratory showed that cells isolated from lymph nodes of mice submitted to swimming activity of moderate intensity for twelve weeks present high interferon-γ (IFN-γ) and tumor necrosis factor-α (TNF) and IL -4 and IL-10 significantly decreased in relation to the sedentary group. In addition, isolated macrophages from the trained group, when stimulated by lipopolysaccharide, have an increased production of IL-12 and TNF. Oxide nitric production is also increased in relation to macrophages isolated from the sedentary group under the same conditions [15]. Chronic exhaustive training may cause the imbalance in Th1 and Th2 profile with predominance in Th2, resulting in cellular

immunosuppression, increased susceptibility to infections, inflammation, signs and symptoms of overtraining. On the other hand, the moderate training seems to promote the balance between Th1 and Th2 with predominance in Th1, generating a cellular immunoprotection [15,16].

The state of physical and mental exhaustion not only impairs performance. Its signs and symptoms are consistent with the development of damage to health similar to chronic non communicable diseases. We suggest more attention of researchers and policy makers not only to physical inactivity, but at the excessive exercise. The immune imbalance and cellular immune suppression represent a promising topic in sports science that can help broaden the understanding and discussion of the paradox of exercise.

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