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The comparison of endurance training with moderate intensity and overtraining on Th1/Th2 balance in wistar male rats

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ABSTRACT

Immune system has role in inflammatory and anti inflammatory function. Base of these activities is produce IL4 and IFNγ. This study is about effects of endurance training with moderate intensity and overtraining on balance these two cytokines. In this study 30 rats selected and divided to 3 groups control, moderate and overtraining exercise. Moderate training protocol was done for 12 weeks with speed 30 m/min in first week and 23m/min in last week. Overtraining protocol was done with speed 15 m/min in first week and 25 m/min in last week. All protocol of training was for 12 weeks. Speleenectomy where done after interval training protocol, and Eliza method used to, Interleukin 4 (IL4) and Interferon γ (IFNγ).The results of this study showed a increase in the amount of (IFNγ) and decrease in the levels of IL4 in moderate training group that difference was significant (p=0.01). The results also showed increase in levels of IL4 and decrease IFNγ levels in overtraining group difference was significant (p=0.01).Based on the results of this research, it can be concluded that doing moderate training lead to increase IFNγ and overtraining case to increase IL4.

Key words: endurance training, overtraining , IFNγ, IL4

INTRODUCTION

It has been reported that moderate or intermittent exercise enhances immune function but prolonged and sever exercise cause numerous changes in immunity, which possibly reflects physiological stress and suppression[1]. Athletes tolerating more intense levels of training may be at increased risk of upper respiratory tract infection [URTI] during periods of sever exercise and for the few weeks after race events. Interestingly, most of the studies used applied voluntary exercise, even though the effects of enforced physical exercise, especially with different loads, are unclear. There is little information regarding whether regular exercise above a certain intensity or duration could be harmful. It would be of interest to identify the optimum exercise loading which could improve certain physiological aspects, including immune function. According to the current findings of adaptation to physical exercise, until an overtraining syndrome appears, regular exercise has beneficial effects [2]. However, with overtraining, which is still a poorly understood process, the homeostatic balance involving a wide range of hormonal, metabolic, and immunologic factors is altered[3]. There is a dynamic equilibrium between pro and anti-inflammatory cytokines. The time course of cytokine release, the local cytokine milieu, the existence of stimulating and inhibiting factors and their receptor densities are determinants of the net cytokine effect[4].

T1/T2 balance [or Th1/Th2 balance, Tc1/Tc2 balance] has been used as an indicator of the changes in immune function and has become a research focus during the past decades[5] The T1/T2 imbalance has been reported in acute and chronic infections or several diseases in humans such as cancer and asthma [6]In theory, T1 cells are associated with cell-mediated immunity and play a more important role in clearing infections, whereas T2 cells are associated with humoral immunity and play a key role in preventing infections[7]. Thus, a severe depression of T1 cells caused by acute or chronic stress may lead to a failure in completely clearing viral infections, while an immune polarisation toward T1 phenotype may indicate an increased ability for clearing infections. the consensus is that the responses of T1 cells to infection are suppressed after high intensity exercises that may provide an explanation for the increased susceptibility to infection following prolonged high intensity exercise[8]. In contrast, the T1 cell responses are strengthened following moderate intensity exercises which may enhance the immune responses to infectious agents[9].However, these suggestions are based only on the results of a small number of experiments. There have been no systematic investigations on the alterations of T1/T2 balance in response to exercise of various types, intensities and durations.

Different kinds of exercise may have various effects on immune parameters based on the nature, intensity and time delay between exercise bouts and immune parameter. In addition, it is not clear what part of this multi factorial stress [psychological or physical] in those human studies effects components of the immune system[1]. Therefore, more evidence is needed to explain the nature and clinical feature of this immunomodulation. Consequently, in the present study we examined the effect of moderate and sever treadmill running on plasma concentrations of IL-4 and IFNγ cytokines.

MATERIALS AND METHODS

Animals

Thirty adult (6–8 weeks old) male Wistar rats, weighing 150–200 g were used. Animals were housed under environmentally controlled conditions (12 hr light/dark cycle; 22–24°C) and food and water were available throughout the experiment. Animals were allowed to adjust to new condition for two weeks. The protocols used conformed to guidelines of animal studies and were approved by the committee on the ethics of animal experiments.

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In this study 30 rats selected and divided to 3 groups control, moderate and overtraining exercise. Moderate training protocol was done for 12 weeks with speed 30 m/min in first week and 23m/min in last week. Overtraining protocol was done with speed 15 m/min in first week and 25 m/min in last week.

Statistical analysis

The results were presented as means ± SEM. Group-data comparisons were performed using one way analysis of variance (ANOVA) with Tukey- Kramer post-test

RESULTS

The results of this study showed a increase in the amount of (IFNγ) and decrease in the levels of IL4 in moderate training group that difference was significant (p=0.01). The results also showed increase in levels of IL4 and decrease IFNγ levels in overtraining group difference was significant (p=0.01). (Figure 1, 2)

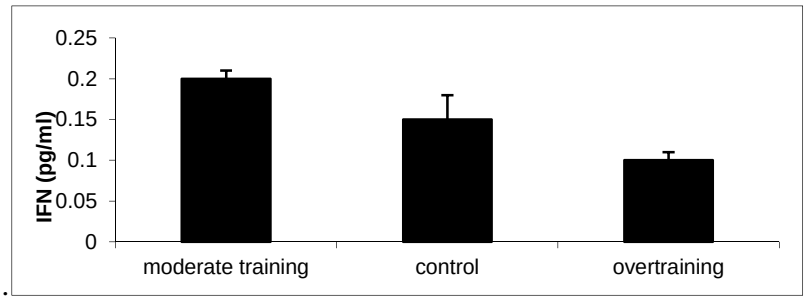

Figure1:levels of serum IFNγ In groups

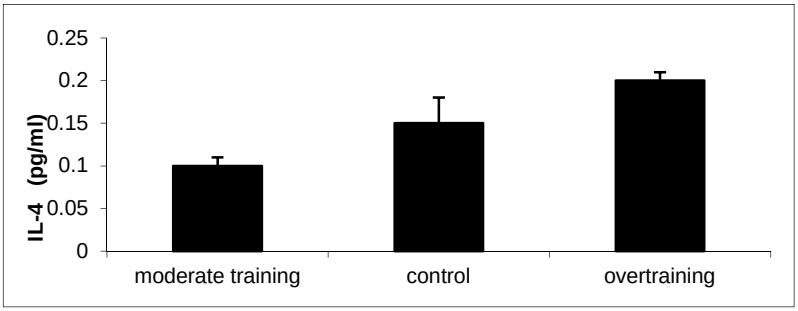

Figure2 : levels of serum IL4 in groups

DISCUSSION

Physiological basis of overtraining as a physical stressor remains poorly understood [10]. To our knowledge, this is the first animal study to investigate the cytokine kinetics after prolonged overtraining endurance treadmill exercise in comparison to the moderate intensity one. We used here a standard training protocol for overtraining with various time periods between exercise bouts and rest [11]. This protocol caused a decline in performance [data not shown], which is the only parameter stated in the literature to be obligatorily associated with overtraining [10].

Type 2 lymphocytes, monocytes and B cells are the main producers of IL-10 and together with IL-4 can inhibit type 1 T cell production[2]. In this study we showed a significant reduction in IL-4 and elevation in IFNγ concentration after moderate exercise, which confirmed the hypothesis that the T1 cell responses are strengthened following moderate intensity exercises[11].However, the mechanism of this immunomodulatory effect is not completely known to date. It has been suggested that sever over trained exercise may lead to tissue trauma, which would activate local cells to produce cytokines, stimulating the differentiation of Th2 cells, and also elevate circulating levels of stress hormones, including cortisol and catecholamines, which can inhibit the production of IL-12 [main inducer of Th1 cells] and would up-regulate Th2 lymphocyte responses[12]. However, in turn, moderate exercise training has been shown to induce down-regulation of the steady state level of B2- adrenergic receptor on macrophages. This effect was associated with decrease in the suppressive effects of catecholamines on IL-12 production, thereby resulting in the up-regulation of Th1 responses[13]. It seems that after regular exercise with adequate intensity and duration the body has the capability to cope with the exercise [stressor] and as a result adaptation takes place. This adaptive effect may mediate the health-beneficial effect and play an important role in protection against chronic non-communicable diseases which are associated with low-grade inflammation [14].

CONCLUSION

Evidence accumulated over the past two decades indicates that: 1) high intensity exercise is in favor of type 2 phenotype T cells, which is one of the mechanisms underlying the down-regulation of host protection against viral infection post exercise; 2) moderate intensity exercise induces a shift of the type 1/type 2 T cell balance toward type 1 in older adults that is in the reverse of age-associated reduction of T1 cells or T1 cell-derived cytokines, and improves T1 cell function in young adults, but the effect of moderate intensity exercise on T2 cell function hasn't been clarified through experimental studies; 3) the alteration in cytokines produced by T1/T2 cells is not consistent with that in the number of cells expressing corresponding cytokines, and that of the same cytokines in the circulation in a short period of time after exercise, while the relationships in a long recovery period has not been examined; and 4) Th1/Th2 and Tc1/Tc2 ratios may be used as an indicator for T1/T2 cells differentiation but might not always represent their functional changes. The IFN-γ/IL-4 ratio in culture supernatant of stimulated T cells or in the circulation might be an effective indicator for monitoring the balance between cell-mediated immunity and humoral immunity

REFERENCES

[1] .Zhao G, Zhou S, Davie A, Su Q. Effects of moderate and high intensity exercise on T1/T2 balance. Exercise immunology review. 2012;18:98-114. Epub 2012/08/11.
[2] Petibois C, Cazorla G, Poortmans JR, Deleris G. Biochemical aspects of overtraining in endurance sports : the metabolism alteration process syndrome. Sports medicine. 2003;33(2):83-94. Epub 2003/03/06.
[3] Ogonovszky H, Sasvari M, Dosek A, Berkes I, Kaneko T, Tahara S, et al. The effects of moderate, strenuous, and overtraining on oxidative stress markers and DNA repair in rat liver. Canadian journal of applied physiology = Revue canadienne de physiologieappliquee. 2005;30(2):186-95. Epub 2005/06/29.
[4] .Gleeson M. Immune function in sport and exercise. Journal of applied physiology. 2007;103(2 .9-693:(Epub 2007/02/17.

[5] Libetta C, Esposito P, Sepe V, Guastoni C, Zucchi M, Meloni F, et al. Effects of different peritoneal dialysis fluids on the TH1/TH2 balance. European cytokine network. 2011;22(1):24-31. Epub 2011/03/26.
[6] .Schroder WA, GardnerJ, Le TT, Duke M, Burke ML, Jones MK, et al. SerpinB2 deficiency modulates Th1Th2 responses after schistosome infection. Parasite immunology. 2010;32(11-12):764-8. Epub 2010/11/20.
[7] .Gleeson M. Mucosal immune responses and risk of respiratory illness inelite athletes. Exercise immunology review. 2000;6:5-42. Epub2000/08/05.
[8] .Kohut ML, Martin AE, Senchina DS, Lee W. Glucocorticoids produced during exercise may be necessary for optimal virus-induced IL-2 and cell proliferation whereas both catecholamines and glucocorticoids may be required for adequate immune defense to viral infection. Brain, behavior, and immunity. 2005;19(5):423-35. Epub2005/06/07.
[9] .Oldervoll LM, Kaasa S, Hjermstad MJ, Lund JA, Loge JH. Physical exercise results in the improvedsubjective well-being of a few or is effective rehabilitation for all cancer patients? European journal of cancer. 2004;40(7):951-62. Epub2004/04/20.
[10] Hohl R, Ferraresso RL, De Oliveira RB, Lucco R, Brenzikofer R, De Macedo DV. Development and characterization of an overtraining animal model. Medicine and science in sports and exercise. 2009;41(5):1155-63. Epub2009/04/07.
[11] Lira FS, Rosa JC, Pimentel GD, Tarini VA, Arida RM, Faloppa F, et al. Inflammation and adipose tissue: effects of progressiveload training in rats. Lipids in health and disease. 2010;9:109. Epub2010/10/06.
[12] .ancaster GI, Halson SL, Khan Q, Drysdale P, Wallace F, Jeukendrup AE, et al. Effects of acute exhaustive exercise and chronic exercise training on type 1 and type 2 T lymphocytes. Exercise immunology review. 2004;10:91-106. Epub2005/01/07.
[13] .Sher A, Fiorentino D, Caspar P, Pearce E, Mosmann T. Production of IL-10 by CD4+ T lymphocytes correlates with down-regulation of Th1 cytokine synthesis in helminth infection. Journal of immunology. 1991;147(8):2713-6. Epub1991/10/15.
[14] .Lancaster GI, Khan Q, Drysdale PT, Wallace F, Jeukendrup AE, Drayson MT, et al. Effect of prolonged exercise and carbohydrate ingestion on type 1 and type 2 T lymphocyte distribution and intracellular cytokine production in humans. Journal of applied physiology. 2005;98(2):565-71. Epub 2004/08/24.