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Letter to the Editor

Effects of Acute Endurance Exercise at 65% and 85% of VO_2max on Markers of Immune Function in Healthy Subjects

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Dear Editor-in-Chief

The sudden outbreak and global spread of Coronavirus disease-19 (COVID-19) is one of the most serious public health problems of today, raising interest in immunity research worldwide. Regarding factors that affect the human immune system, lifestyle features including mental stress, nutritional status, sleep, and exercise (physical activity), as well as diseases such as high blood pressure, diabetes, and obesity have been suggested (1). Among these, exercise has been reported as a modulator capable of inducing both negative and positive effects on the immune system (2). Specifically, positive effects of exercise on the immune system include cell-mediated immune responses that induce the activation of leukocytes, lymphocytes, and macrophages; and enhancement of the adaptive immune system, such as antibody-mediated immune responses that induce antibody production; these effects have been shown with regular exercise of moderate intensity (1,2).

On the other hand, prolonged acute exercise intensive at maximal intensity has been reported to inhibit the proliferative response of lymphocytes, having a negative effect on immune function through the induction of an excessive inflammatory response and reactive oxygen species (1-3). Leukocyte subtypes (neutrophil, lymphocyte), natural killer (NK) cells, and immunoglobulins (IgA, IgG, and IgM) have been proposed as blood markers that can verify changes in immune function due to exercise (3,4). The changes in immune function were examined according to acute exercise intensity, reporting that the immunosuppression period might appear longer after intense exercise in contrast to moderate exercise (4).

However, various factors such as age, nutritional status, and infection history as well as the intensity and duration of exercise bouts can act as factors that can affect the immune response following acute exercise (3). In particular, it is not clear what level of difference in exercise intensity results in a significant change in the immune response. The American College of Sports Medicine guidelines (5) classify 64-90% of maximal oxygen uptake (VO_2max) as vigorous intensity in cardiorespiratory exercise.

Accordingly, this study aimed to verify changes in circulating immune markers according to treadmill running by classifying exercise intensity as 65% of VO_2max, which is the initial level of vigorous intensity, and 85% of VO_2max, which is a relatively higher level of vigorous intensity.

Twenty-six healthy males (age=22.19±1.47 yr; height=177.35±5.80 cm; weight=77.42±10.96 kg; body mass index=24.65±3.51 kg/m^2; percent body fat=22.25± 6.90 %; and VO_2max=47.60±4.07 mL/kg/min) volunteered as subjects and were randomly assigned to the 65% group (n=13) or 85% group (n=13); treadmill running was performed at an exercise intensity of 65% and 85% VO_2max, respectively. All subjects performed treadmill running until 300 kcal was consumed at the corresponding exercise intensity. The study protocol was approved by the Ethics Committee of the Dong-A University (Approval No. 2-104709-AB-N-01-201710-HR-046-02). It conformed to the standards set by the latest revision of the Declaration of Helsinki.

Blood collection for analysis of circulating immune markers (leukocyte, lymphocyte, IgA) was performed at baseline, immediately post-exercise, and 1 h post-exercise. Whole blood leukocytes and lymphocytes were analyzed by complete blood cell count (CBC), and serum IgA levels were analyzed by turbidimetric immunoassay (TIA). Differences between the experimental groups and time points were verified through two-way repeated measured analysis of variance (ANOVA) using SPSS software (version 26.0; IBM Corp., Armonk, NY, USA), and data are presented as the mean ± standard deviation (SD). All statistical significance levels were set to α=0.05.

Changes in circulating immune markers after treadmill running at different exercise intensities are shown in Table 1. As a result of a two-way repeated measures ANOVA, there was a significant interaction effect between group and time on circulating leukocyte (F=5.678, P=0.006), lymphocyte (F=6.151, P=0.004), and IgA (F=3.629, P=0.034) levels. Specifically, circulating leukocyte, lymphocyte, and IgA levels were significantly increased immediately post-exercise compared to baseline (P<0.05). In addition, the lymphocyte level was significantly lower at 1 h post-exercise than at baseline (P<0.05). However, there were no significant differences between groups in all variables (P>0.05).

Table 1: The changes in circulating immune markers after treadmill running at different exercise intensities

Variables	***65% group***			***85% group***			***Interaction (Group × Time)***	
	Baseline	Immediately post-exercise	1 h post-exercise	Baseline	Immediately post-exercise	1 h post-exercise	F	P
Leukocyte (10^3/μL)	7.45±2.02	9.63±2.28†	7.63±2.53	6.93±1.43	10.68±2.39†	7.42±2.00	5.678	0.006**
Lymphocyte (%)	35.58±7.72	39.89±9.06†	31.66±6.90†	34.75±9.32	46.05±9.31†	29.65±6.52†	6.151	0.004**
IgA (mg/dL)	216.92±35.81	234.08±37.70†	216.38±41.76	214.38±56.74	250.38±49.34†	210.92±58.18	3.629	0.034*

Values are mean±SD., †Significant difference to with Baseline (P<0.05), **P<0.01, *P<0.05

Taken together, these results indicated that acute exercise may temporarily affect immune function in healthy subjects. However, it is suggested that there is no difference in the immune response according to the difference in exercise intensity (65% VO_2max vs. 85% VO_2max).

Conflict of Interest

The author declare that there is no conflict of interests.

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