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CYTOKINE RESPONSE TO EXERCISE AND ITS MODULATIONS

Katsuhiko Suzuki¹

KEY WORDS: systemic inflammation, heat stress, energy and fluid supply.

Exhaustive endurance exercise has been shown consistently to induce leukocytosis due to neutrophilia (systemic inflammation), muscle and organ damage and immune suppression⁽¹⁻⁵⁾. To determine the underlying mechanisms of these phenomena, much attention has been focused on cytokines released into the circulation following exercise, and indeed there has been a tremendous accumulation of research findings. Many studies have consistently shown that IL-6, IL-8, IL-1 receptor antagonist (IL-1ra) and IL-10 increased remarkably following endurance exercise longer than 2 h, such as marathon and triathlon^(2-5,10,15, 18,20), but the response of these cytokines is not so significant during short-duration intensive exercise and eccentric exercise^(7,9,14,19,32). These responses are not dependent on exercise-induced muscle damage (inflammation), but are related to exercise intensity (physiological load/stress)⁽⁶⁻⁸⁾. Indeed, it has been demonstrated that IL-6 response to exercise depends on energy crisis and heat stress, and are correlated with stress hormone responses, but are suppressed by increased energy supply and prior body-cooling interventions^(12,13,16,21, 22). IL-6 also enhances recruitment of energy substrates, such as free fatty acids, which contributes to endurance performance^(5,26). At the same time, IL-6 induces neutrophil mobilization and activation together with immunosuppressive cytokine release of IL-1ra and IL-10⁽¹⁻³⁾. Therefore, IL-6 might be good for athletes in optimizing fuel utilization for endurance performance on one hand, but may compromise the immune status of the athlete on the other hand in terms of systemic inflammation and increased susceptibility to infections. It is possible that appropriate countermeasures such as exercising in cool environments, and ensuring sufficient energy and fluid supply together with some functional food might help to maintain endurance performance without causing the harmful side effects on health^(11,17, 20-23,28). These countermeasures may lead to the introduction of new research findings.

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