Letter to editor

Exercise training improves metabolic crosstalk in lymphocytes: Does frequency or intensity matter?

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Dear Editor-in-Chief

Active lymphocytes under a burst during proliferation, biosynthesis, and secretory activity increase their metabolism. In order to achieve this dramatic increase in metabolism, they must obtain a metabolic substrate. Their insignificant nutrient stores force lymphocytes to have a significant increase in the consumption of the metabolic substrate around them. Although lymphocytes are able to utilize glucose, glutamine, ketones, and fatty acids, it has been confirmed that glucose and glutamine are the most important quantitative fuels for activated lymphocytes (Curi et al., 1999). The function of T cells is closely related to the metabolic program, meaning that a T cell fights antigens, invasive agents, and inhibits infection until the main fuels of this cell, glucose and glutamine, are consumed and metabolized in sufficient quantities. There are significant and growing techniques that target the metabolism of T cells for immunotherapy.

Degradation of lymphocyte metabolism and function has been observed in various inflammatory, metabolic and autoimmune diseases. Maximum activity and levels of HK, G6PDH, CS, GLUTase enzymes of lymphocytes are always reduced for patients with Graves (Werner et al., 1996). In vitro, it has been shown that thyroid hormone increases glucose and glutamine lymphocyte metabolism in these patients. Also, it has been reported to coexist with acute and chronic infection in several diseases such as cancer or asthma, and gradation of T1 and T2 metabolism (Zhao et al., 2012).

It has been suggested that a part of the safety effects of exercise is due to the ability of exercise to modulate lymphocyte cell metabolism, especially glucose and glutamine. It has also been observed that changes in lymphocyte function are associated with different effects of moderate exercise on T and B lymphocyte metabolism. In addition, T lymphocytes increase glutamine intake by altering the metabolism of this amino acid to the aerobic pathway. At the same time, these cells reduce glucose intake and lactate production levels. In contrast, B lymphocytes were shown to increase intake of both glucose and glutamine, while aerobic metabolism of glutamine increased (Navarro et al., 2013). All of these changes in lymphocytes are possible because key enzymes in glucose and glutamine metabolism are affected by chronic exercise. Thus, as the aerobic metabolism of glutamine increases, the maximum activity of GLUTase and CS in T lymphocytes increases in response to exercise. In addition to these two enzymes, maximal activity of HK and G6PDH increased in B lymphocytes in response to chronic exercise (Navarro et al., 2013). Most of these studies have examined the immune system and T lymphocyte response to exercise with moderate intensity. High intensity interval training (HIIT) usually consists of intermittent sets of exercise (Vo2max usually equal to or greater than 90%) accompanied by few minutes of active rest. Little is known about inflammatory and metabolic immune responses after HIIT.

Moderate-intensity exercise stimulates the immune system and increases resistance to infectious diseases. However, during prolonged and intense exercise or strenuous exercise and competition, an immune suppression often occurs during the recovery period. Immune responses after exercise are almost similar to those seen in infection and inflammation (e.g., neutrophilia and lymphocytopenia) (Tauler et al., 2006). Researchers have suggested that intense exercise induces these changes with oxidative stress, changes in neuroendocrine factors such as catecholamines, growth hormone, and cortisol (Fisher et al., 2011). Therefore, it is suggested that low-intensity, high-frequency, long-term exercise be effective in improving the lymphocyte metabolic crossover.

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