

Immunity, Sports Performance and Immunonutrition

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To Cite This Chapter

Eyipinar, C. D. (2024). Immunity, Sports Performance and Immunonutrition. In M. Özdal & F. Alıncak (Eds.), *Current Studies in Physical Education and Sports 2024* (pp. 1-7). ISRES Publishing

Introduction

Short-term exercise causes temporary suppression of numerous facets of immunity (lymphocyte proliferation, monocyte TLR). Postexercise immunity depression is most noticeable if the exercise is continual, prolonged (>1.5 hours), moderate to high intensity (55-75% VO₂max), and done without food. The times of intense exercise lasting one week or more can lead to long-term impaired immunity. Despite professional athletes are not in practice immune deficient, small changes in several immune-related factors may reduce their vulnerability to widespread infections. For that, this is clearly an issue since an infectious incident has the potential to impair performance while exercising (Gleeson, 2007).

Aim of the Study

The aim of this study is to convey the importance of immunity in terms of sportive performance and to investigate and summarize supplements that support the immune system.

Materials and Methods

To obtain the data for this study, Google Scholar, Pubmed and Sportdiscus databases were searched for the last 10 years with “Immunity AND Sport”, “Immunonutrients” and “Sports Immunonutrition” keywords. The data obtained were evaluated and summarized

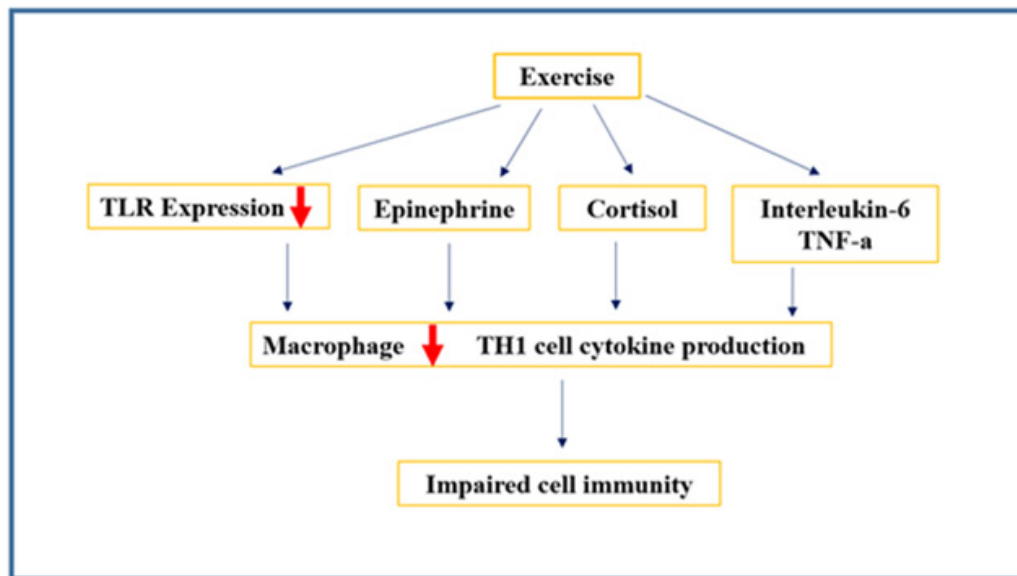
Immunity

An immunity is the result of an complicated relationship between organs and their surroundings. It is affected by the interaction of multiple gene sequences, antibodies, molecules, inflammatory mediators, hormones, antigens, cytokines and receptors all of which connect to and affect wellness. The immune system reaction of highly trained athletes mimics even more complicated circumstances, which are thought to follow J or S shape dynamics at times. High levels of training alter the immune system’s reaction, increasing biologic indicators of immune function and the human body’s vulnerable to disease (Cicchella et al., 2021). Maintaining of homeostasis throughout immune challenge entails activating the body’s defenses, resolving the obstacle, and protecting the host

from possible harmful inflammatory processes. An infection with parasites, bacteria or fungi are examples of immune difficulties, as are tissue damage and devastation, as well as unsuitable reactions to autoantigens, which can lead to the occurrence of conditions known as autoimmune disorders. When the immune system faces obstacles, it releases a large number of hormones known as cytokines. Cytokines such as Interleukin-6 (IL-6) Interleukine-1(IL-1) and Tumor necrosis factor- α (TNF- α) play a role in the immune system's natural defenses. In aside from aiding in the development of the immune system reaction, cytokines put out during the innate or adaptive immune system reaction may stimulate the Hypothalamic Pituitary Adrenal (HPA) Axis causing the secretion of a glucocorticoids (Tada et al., 1994). In then glucocorticoids have a negative feedback effect on the immune system, suppressing further cytokine synthesis and let go, preserving the host from the side effects of a hyperactive immunity. Furthermore, glucocorticoids shape defense by affecting immune cell transporting to inflammation areas and changing downward immune responses that are adaptive, leading to a change to cellular T-helper 1 (Th1/inflammatory) to humoral T-helper 2 (Th2/anti-inflammatory) immune systems responses. As a result, rather than being viewed as immunosuppressive chemicals, glucocorticoids are better understood as immune-modulating hormones that can both boost and suppresses immunity, according to the kind of immune response, immune compartment, and cell type (Chrousos, 2000).

Figure 1

Possible Mechanisms of Exercise and Immune Response (Gleeson, 2007)



Abbreviations: TLR:Toll-like receptor, TNF- α : Tumor necrosis factor- α

Exercise additionally triggers alterations in hormonal levels, such as raising the plasma concentrations of various hormones (cortisol, adrenaline (epinephrine), prolactin) all of which have impacts on immunity. Muscle-derived IL-6 seems to be maybe part accountable for the higher production of cortisol throughout intense physical activity. Physical activity reduces the percentage of circulatory type 1 T cells but does not affect the percentage of type 2 T cells. Cortisol and epinephrine inhibit the generation of type 1 T cell cytokines, whereas IL-6 inhibits the generation of TNF- α . When the production of all these cytokines and proteins increases, the immune system is negatively affected (Starkie et al., 2003). Cytokine binding sites were found at all HPA axis phases, indicating

that every stage can function as an integrating place for immune and neuroendocrine signaling (Silverman et al., 2005).

The HPA Axis and Immune Response

The HPA axis is widely recognized to regulate how the organism reacts to a stressful event, which can be described as any mentally or physically stimuli that affects an organism's homeostasis. Glucocorticoids, like catecholamines, organize the fight or flight effect, which includes the quick mobilizing of energy from places of storage to important muscles and the brain, as well as a raised blood pressure, breathing and heart rate in order to promote quick delivery of nutrients and oxygen to affected organs. In such critical circumstances, stimulating the HPA system also helps the body redirect metabolic assets such as growth, digestion, reproduction, and certain facets of the immune system to the quicker challenge at on hand (Dunn et al., 1989). The HPA axis exhibits different levels of activity in response to acute and chronic stress. Acute stress, whether or not ecological or mental in nature causes the secretion of Corticotropin-releasing factor (CRF), adrenocorticotrophic hormone (ACTH) from the anterior pituitary gland and glucocorticoids from the adrenal cortex. When acute stress triggers the HPA axis, plasma glucocorticoids (cortisol) rise momentarily and the body becomes partially resistant to the input that blocks glucocorticoid relief. This is sustained right after and during the acute stressful stimuli and is characterized by a quick desensitization of the brain's receptor for glucocorticoid. It has been demonstrated that acute stress reduces the quantity of glucocorticoid receptors in the hippocampus, which raises cortisol levels and causes obstacles to feedback suppression. The glucocorticoid level returns to its baseline level after the short-term stress response ends, corresponding with a reduction in central neuronal CRF relief. This results in a normalization of glucocorticoid receptor levels and a reset to normalcy for the feedback inhibiting system (Sapolsky & Plotsky, 1990). The accurate control of the HPA axis' action is crucial because both an excessive and insufficient release of glucocorticoids have negative effects on the immune system and metabolism. Because, monocyte and macrophage functions (it's survive or phenotype) are significantly influenced by glucocorticoids. It has long been known to enhance these vital effector cells' capacity to phagocytose, which in turn promotes the removal of inflammatory cells and other potentially dangerous substances. By a variety of harmonious genomic or non-genomic mechanisms, the steroid hormone also inhibits immunostimulatory acts and effectively prevents the generation of pro-inflammatory substances. By doing this, glucocorticoids increase the migrating activity and surviving of myeloid cells while also promoting an anti-inflammatory traits (Ehrchen et al., 2007). Ultimately, stressful situations (like intense exercise) cause the negative feedback system that controls the hypothalamic-pituitary-adrenal (HPA) axis to become less sensitive. A greater percentage of circulating glucocorticoids is the cause of a breakdown of this negative feedback system. The improper regulation of the HPA axis has biological knock-on effects and raises the risk of infection, immune system malfunction and metabolic disorders. Since impaired feedback of the HPA axis is related to decreased immune function, the best way to detect this is by examining the levels of IL-6 (Sheng et al., 2021).

Nutritional Strategies to Support Immunity

Nutritional strategies and supplements that have some supporting scientific evidence that they are effective in reducing immune perturbations or reducing the incidence of infection during exercise are as follows.

Antioxidants

Routine workouts may decrease inflammation and oxidative stress while improving immunity. even though strenuous exercise for endurance can increase the activity of antioxidant enzymes while decreasing indicators of workout-related oxidative stress, extremely intense exercise loads have been linked to an acute decrease in capacity for antioxidants and a rise in oxidative stress indicators (Neubauer et al., 2008). Antioxidants such as Vitamin-C, A and E (a-tocopherol form) shield the body from oxidative stress, avoiding harm to various parts of cells such as amino acids, lipids, and DNA. Supplements containing antioxidants are becoming more common in both the general and sporting populations, with countless promises of better immune and cardiovascular function, quicker recuperation from sport, and higher energy availability (Nieman et al., 2004).

Carbohydrate Beverage

Sport beverages may boost energy utilizes and make up for nutrients and fluid losses throughout exercise, so they have grown in popularity over the last twenty years. Carbohydrates are the main elements of sports drinks as they provide the greatest energy produce per mole of oxygen when versus proteins and fats, as well as improving athletic performance by preventing muscle glycogen decline (Jeukendrup, 2014). Consuming a high-carbohydrate (30-60 grams/hour) via carbohydrate beverages throughout prolonged workouts reduces stress hormones (adrenaline and cortisol) and anti-inflammatory cytokines (e.g., interleukins 6 and 10) responses to exercise, delaying the onset of overreaching symptoms throughout intense workout (Halsen et al., 2004). If exercises take place in a fasted or low-glycogen state, with no consumption of carbohydrates throughout exercise, a greater degree of immune suppression is likely to occur. If the train-low approach is to be used to maximize exercise adaptation, it should only be used for a few days a week or the immune system will be impaired (Hawley & Burke, 2010).

Protein Ingestion

There has been some proof that consuming proteins after intense training can alleviate a few elements of after a intense workout immune depression and decrease the risk of respiratory infections in overtrained athletes (Papacosta et al., 2015). It is believed that dairy product amino acids contain numerous bioactive substances that improve immunity. Milk and whey proteins include high levels of glutamine, which may have an immune-system impact, such as decreasing neutrophil and lymphocyte death. An sufficient levels of protein is unquestionably necessary for maintaining appropriate immunity (Lagranha et al., 2008).

Probiotics

In the past few decades, multiple studies have looked into the effectiveness of oral probiotics as supplements to decrease upper respiratory symptoms in athletes, and a few probiotic products, especially those including *Lactobacillus* types, demonstrate pledge. Probiotics, as also known as beneficial bacteria, are ‘live germs that, as given in sufficient quantities, provide beneficial effects on the host’. As this happens, the word ‘probiotic’ can only be used to describe products comprising a sufficient number of live cells from clear harmless microbial types, in addition to an acceptable amount of scientific proof of health benefits from a body of study that includes human trials (Gleeson et al., 2016). Numerous research investigations in athletes have shown that

regular probiotic ingestion reduces the number of days of respiratory illness (Cox et al., 2010; West et al., 2011; West et al., 2014), and a meta-analysis of information from both an athlete and recreational participants determined that there is a probable advantage of decreasing upper respiratory illness prevalence (Hao & Dong, 2015).

Conclusion

In conclusion, people who are active often face immunity obstacles such as prolonged physical activity, stress, insomnia, severe weather, and inadequate nutrition. In this direction, the following recommendations can be listed for athletes to support their immune system.

- Adjust training volume and intensity to control training load. Maintain weekly volume and intensity increments of 5-10%, especially during winter.
- Start exercises for recovery shortly following heavy workouts. Think about getting a wearable device for tracking your sleep duration and quality.
- Optimize your sleeping habits in the hour before nighttime by reducing psychological stress and going ‘screen-free’.
- In winter, vitamin D3 (cholecalciferol form-1000 IU) and vitamin C, probiotics and glutamine supplements should be taken, and zinc supplements can be included in the daily diet plan to minimize the risk of upper respiratory tract infections.
- Carbohydrate restriction should be avoided and nutrition plans should be periodized appropriately, as leaving an energy deficit during heavy training will reduce immunity (Walsh et al., 2018).

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