



Strategies and Solutions to Return to Training for Teams and Elite Athletes After Lifting COVID-19 Restrictions

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1. Introduction

In late December 2019, Wuhan China reported the spread of a severe respiratory syndrome, now known as coronavirus disease 2019 (COVID-19). The disease spread rapidly worldwide and became an unprecedented pandemic (1). Numerous countries have used restrictions and quarantines to control the disease that affected many educational, social, economic, and sports activities, including sports events. With the start of the new year and the months of January-March, all international sports events, including the 2020 Tokyo Olympics and domestic leagues, were postponed to keep spectators, athletes, and coaches healthy, and training for teams and athletes at all levels has been suspended (1, 2). Closing of sports events and canceled training of players causes some changes in the physiological, lifestyle, and psychological aspects of athletes (3). This phenomenon has a negative effect on the athlete's immune system, fitness, and performance. Because many competitions will be resumed after lifting the restrictions and considering many teams and athletes insist on starting training, the use of inappropriate training strategies and methods puts more pressure on athletes, increases the risk of injury, and even raises the risk of COVID-19 infection. Therefore, in this article, we will first take a look at the improper strategies and methods, then come up with the appropriate solutions and ways for returning to low-risk exercise programs.

2. Selecting the Appropriate Volume and Intensity of the Exercise

Based on the principle of reversibility, lack of training, as well as the reduction of training, cause some loss of training adaptations of athletes in quarantine. Based

on this principle, the neuromuscular function is significantly decreased after 5 weeks, cardio-respiratory readiness (VO_{2max}) after 2 - 4 weeks, and muscle strength after 4 weeks (3). Therefore, due to physiological alterations and a decrease in the level of physical fitness, it would not be feasible for athletes to start training with the previous volume and intensity. Research shows that exercise activity influences the immune system depending on the intensity, volume, and stress that it puts on physiological systems (4). For instance, long-term and high-intensity exercise increases the levels of cortisol, adrenaline, growth hormone, and prolactin, leading to the suppression of salivary immunoglobulin A (IgA), decreased natural killer cell (NK) activity, and reduced activity of B and T cells (4). Therefore, due to a decrease in the immune system's potency, starting high-intensity and long-term exercise could increase the risk of upper respiratory tract infections (URTIs) and even COVID-19 infection in athletes.

In contrast to high-intensity exercise, moderate-intensity exercise increases immune cells' function and anti-inflammatory cytokines (5). Therefore, it is recommended that athletes begin their activity moderately after quarantine and gradually increase the intensity of their activity after their immune system adapting to the activity (usually 5% - 10% per week) (6).

Moderate-intensity exercise is defined by each of the following criteria, a heart rate (HR) between 64% - 76% of the maximal heart rate (HR_{max}), a VO_2 between 46% - 63% of VO_{2max} in aerobic exercise, % repetition maximum between 50% - 70% in strength exercise and the Borg's scale between 12 - 13, metabolic equivalent between 3-6 in both aerobic and strength exercise. High-intensity exercise is defined by when each of the following parameters is met: Borg's scale > 13, HR_{max} > 76%, VO_{2max} > 64%, and MET > 6.0, and RM > 70% (7).

3. Proper Nutritional Status Before, During, and After Training

Nutritional levels play an essential role in activating and differentiating immune cells. In addition to reducing performance in exercise, initiation of training with poor nutritional status reduces the body's immune defenses against pathogens and predisposes athletes to infection (8). Athletes who consume a low-carbohydrate diet (less than 10 % of their daily energy) have increased cortisol and adrenaline and inflammatory cytokines such as IL-6, leading to the reduced rates of antibody production, lymphocyte proliferation, and NK cell activity (8, 9). Therefore, during the period of COVID-19, carbohydrate and calorie restriction diets would not be recommended for athletes whose sports career is weight dependent as it weakens the immune system and makes them susceptible to infection and viruses. Consumption of 30 - 60 grams of carbohydrates per hour or one liter of sports drinks containing 6% - 8% of carbohydrates per hour during exercise prevents the increase of cortisol, adrenaline, inflammatory cytokines, and subsequent weakening of the immune system (9). After training (0 - 2 hours), athletes are recommended to have an intake of 1.0 - 1.2 g/kg body mass depending on the type, intensity, and volume of the training session to limit the amount of exercise-induced immunosuppression (9). Also, it is now known that inadequate daily protein intake puts the immune system at risk. After mandatory quarantine, it is recommended that athletes increase their daily protein intake to 1.5 to 3 grams per kilogram of body weight (20 - 30 g at regular (~ 3 h) intervals throughout the day), depending on the volume and intensity of exercise (8). Another factor that should be controlled after lifting the restrictions and before initiating training programs is 25-hydroxy vitamin D (25(OH)D) levels in athletes. Vitamin D plays a significant role in the upregulation of the genes responsible for the expression of antimicrobial proteins, as well as the downregulation of inflammatory cytokines (10). Therefore, it is recommended that athletes check the levels of vitamin D (> 75 nmol/L) (10) after lifting the restrictions and before the initiation of training programs. Athletes who are at higher risk of vitamin D deficiency should consider taking 1000 IU/day vitamin D₃ supplements to maintain the circulating 25(OH)D within optimal levels (75 - 125 nmol/L) (10).

4. Controlling Psychological Stress in Athletes

Compulsory quarantine and its consequences, including fear of coronavirus infection, lack of access to gyms and clubs, changes in sleep/wake cycle, eating disorders, and family problems, threaten the mental health of athletes,

and failure to manage these problems can lead to mental diseases such as depression (2, 11). Psychological stress affects the function of the immune system and, along with high-intensity exercise and training, weakens the immune system function. Chronic and prolonged stress in athletes impairs the balance of cytokines, increases inflammation, and decreases the number and function of the immune system, making a person prone to infectious and viral agents (2). Hence, it is recommended that athletes be in contact with sports psychologists during the quarantine, and their mental health is measured by psychological examinations and questionnaires before the initiation of training programs. In the case of psychological problems and stress, they must be immediately subjected to treatment interventions. Mindfulness training can be one of the most effective interventions in this field. Mindfulness is defined as "a technique to increase an individual's ability to be in the present moment and paying attention on purpose nonjudgmentally, which raises emotional stability and reduces anxiety and stress in the most unpleasant moments (12). The mindfulness sessions are closely related to the athletes' tasks, with specific emphasis on targeting their techniques to stay focused during competition (12). Also, due to the effect of quantity and quality of sleep on athletes' activity and immune system, it is recommended that athletes sleep at least 7 hours per day and avoid activities that affect their sleep quality, such as looking at a mobile phone screen in bed (11).

5. Screening Coaches, Players, and Executives Before Training

Some studies have demonstrated that COVID-19 spreads rapidly, and each person infected transmits, on average, to four other persons (13, 14). Therefore, it is essential for the athlete to be screened for clinical symptoms and do valid diagnostic tests for COVID-19 before starting the training. The training can be started when no signs of COVID-19 infection (fever, cough, fatigue, dyspnea, sore throat, loss of taste or smell, pain in the extremities and diarrhea), no proof of COVID-19 infection and no contact with a person who tested positive for COVID-19 in the past 14 days are observed (13).

6. Training in a Suitable Environment While Maintaining Physical Distance

The best preventive strategy for COVID-19 infection is to maintain a physical distance of at least one meter or six feet away from others and the observance of personal hygiene (1). Athletes are advised not to come into close contact

with coaches or other teammates, not to use shared drinking bottles, not to be in a closed area with poor ventilation such as locker rooms, indoor gyms, shared toilets, and they are advised to continually disinfect hands and sports equipment to reduce the risk of viral infection. In addition to the proper training in health protocols, the medical team of sports teams must monitor the appropriate implementation of these protocols (6).

Finally, starting training without observing the appropriate intensity and duration, nutritional factors, psychological and health factors during the epidemic and after lifting the restrictions not only increases the risk of injury to athletes but also exposes them to infection with COVID-19 and other upper respiratory tract infections, which can cause irreversible damage to athletes and teams.

Footnotes

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