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Reducing the Negative Impact of the COVID-19 Pandemic on the Health and Physical Condition of Athletes through the Use of Restorative Medical Technologies

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ABSTRACT

The widespread coronavirus disease (COVID-19) has become a major public health problem worldwide. This epidemic with high morbidity and mortality rates has affected the world of sports, as well as other spheres of human life. In this situation, as a necessary measure, it was decided to cancel regular training in professional and amateur sports. However, it was impossible not to take into account that changes in training characteristics, including their frequency, volume and intensity, can lead to a deterioration in the physical condition of athletes, which definitely has a negative impact on their professional sports life, including changes in both physiological characteristics and performance.[1] In this regard, the goal was set in the work: to determine the ways to reduce the negative impact of the COVID-19 pandemic on the physical condition of athletes through the use of restorative medical technologies.

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INTRODUCTION

The coronavirus, also known as COVID-19, turned into a public health crisis and a global epidemic with high morbidity and mortality in December 2019 in Wuhan, China. Thus, quarantine is inevitable in order to prevent the spread of COVID-19, to slow down the pandemic and to protect people at high risk. As a result, since March 2020, not only major tournaments and sports leagues have been paused, but also most training sessions. These measures were taken even despite the fact that changes in training characteristics, including frequency, volume and intensity, could lead to a loss of physical condition (Carmody. et al, 2020)

A decrease in level of training is characterized as a complete or limited loss of training, which causes physiological, anatomical changes, as well as adaptation to performance. Since most physiological changes occur as a result of constant training, maintaining the achieved level and further improvements require intensive training incentives. When these incentives cease, the athlete becomes vulnerable to functional and mental disorders, which can be called detraining syndrome.

In this regard, it is very important to consider some medical technologies that will contribute to the rapid recovery of athletes' training functions. In particular, the use of traditional Chinese medicine techniques can give quite high results, since medical manipulations based on traditional Asian medicine will allow both the mental and physical health of athletes to be restored in a fairly short time.

The aim of the work is to determine the ways to reduce the negative impact of the COVID-19 pandemic on the physical condition of athletes through the use of restorative medical technologies.

KEYWORDS:
COVID-19,
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MATERIALS AND METHODS

The publications of a number of authors related to the violation of sports functions in professional athletes caused by forced self-isolation and refusal of regular training were selected as the material for the study. The main method of learning has become analytical.

RESULTS

During the isolation from COVID-19, regular training of athletes around the world was stopped. These unexpected breaks worsen the quality and quantity of training, distancing the athlete from everyday activities in ordinary sports facilities. The reversibility of training, also known as the reduction of training, is crucial for understanding many changes that athletes undergo during the cessation of training, which worsens their future results (Narici et al, 2020).

Detraining can be defined as a partial or complete cancellation of previously developed training adaptations. In professional athletes, regular dynamic endurance exercises cause various changes in the structure and function of the cardiovascular system and at the same time increase blood volume. In particular, the procedure of cardiac remodeling caused by physical exertion is described by increased or preserved diastolic function, small or moderate eccentric hypertrophy of both ventricles, dilation of the biatrial atria, as well as an increase in blood volume.

Exercise-induced cardiac remodeling has been reported among elite athletes and exercise practitioners who perform relatively less intensity and volume of exercise. Similarly, it was reported that endurance training in novice athletes caused a rapid increase in blood plasma volume, which precedes a gradual increase in the volume of red blood cells. The authors also indicate that an increase in the volume of red blood cells by 4% could be predicted after 15 weeks of endurance training during exercise (Eirale et al,2020).

Some studies have shown that a decrease in the size of the chamber and the thickness of the wall of the left ventricle is observed in elite athletes after periods of unloading. Another study conducted with recreational marathon runners showed that a sharp and steady decrease in exercise volume for 8 weeks causes a regression of exercise-induced heart remodeling and reduces plasma volume. This regression occurs after various structurally dependent time periods (early and late), described by an early decrease in the thickness and mass of the wall of the left ventricle, the size of the chamber of the right ventricle.

In addition, it was reported that the maximum heart rate increased by 5% during 84 days after stopping training in endurance-trained athletes. It was also suggested that the improvement of the submaximal heart rate, accompanied by a decrease in the duration of the isovolumetric phase of contraction at rest, could be associated with an increase in sympatho-adrenergic tone during the period of suspension from training (Halson, 2014).

It is noted in the literature that the refusal from training for two weeks or more reduces the maximum oxygen consumption ($VO_{2\ max}$). This initial rapid decrease in VO 2 max is probably associated with a corresponding drop in the maximum cardiac output, which, in turn, seems to be mediated by a decrease in stroke volume with or without a slight change in the maximum heart rate. The loss of blood volume appears to be at least partially due to a decrease in stroke volume and VO_{2MAX} during the first weeks of the rest period (Pedlar et al, 2018).

Moreover, it was noted that the absence of exercise for six weeks changed the flow of breath, but did not affect the time of breath, the overall respiratory cycle and the overall ventilation efficiency of the respiratory system.

On the other hand, recent studies have shown that the use of masks during short exercises with an intensity of about 6-8 METS increases CO_2 (20%) and reduces the concentration of O_2 (3.7%) and causes hypercapnic and hypoxic breathing (I. Mujika & S Padilla. 2000).

Skeletal muscles are able to adapt to the variable intensity of functional requirements. Muscle degradation occurs after a period of inadequate training stimulus, which is characterized by a decrease in capillary density, which can occur during 2 or 3 weeks of inactivity. A study conducted on semi-professional football players showed that the number of capillaries around slowly contracting fibers significantly decreased after 3 weeks of absence of training. It is assumed that muscle capillarization returns to the pre-workout level after having stopped training for four weeks, but still higher than the estimate in people who lead a sedentary lifestyle. In addition, after a long absence of training, the cross-sectional area of the muscles decreased, and the type of fibers returned to the genotype, and the population of oxidative fibers compared to glycolytic fibers increased in bodybuilders and elite powerlifters. In addition, the rejection of training caused a large conversion from rapidly declining IIa to IIb in cyclists and endurance runners.

Unloading and weakening of muscles reduces electromyographic activity and leads to muscle atrophy, which correlates with a decrease in muscle strength and power. Muscle endurance decreases only 2 weeks after training, which may be due to a deterioration in the blood supply to the muscles, the accumulation of glycogen in the muscles and the activity of oxidative enzymes, as well as a violation of the acid-based balance. The effect on agility and speed is small, but flexibility is quickly lost. Thus, the risk of vulnerability increases. To avoid injuries, athletes should participate in year-round flexibility training.

In addition, the cessation of training in highly qualified athletes affects the production of mitochondrial adenosine triphosphate (ATP). In this regard, the effect of detraining on the production of mitochondrial ATP in human skeletal muscles was studied. The data obtained showed that a 6-week endurance training followed by a 3-week protocol for stopping training caused a decrease in the production of mitochondrial ATP by 12-28% and a decrease in the functions of mitochondrial enzymes by 4-17% (Peña et al, 2021).

It has also been noted in the literature that stopping the trainings for twelve weeks leads to a less effective catecholamine response, which means an increased concentration of norepinephrine and adrenaline due to submaximal exercises with the same relative intensity. Simply put, the same exercise causes more stress after a period of inactivity.

On the contrary, a study of athletes engaged in strength sports showed some positive hormonal changes after 2 weeks of detraining, with an improvement in testosterone and growth hormone and a decrease in the amount of cortisol, which could be a compensatory reaction to limiting muscle atrophy. Having stopped the trainings, there is a comparative decrease in the energy obtained from fat tissue and an increase in the amount of carbohydrates used as fuel during submaximal and maximum exercises. In addition, immediately after several days of downtime, detraining led to an increase in blood lactate concentrations by a lower percentage of VO_{2MAX} in cyclists, swimmers, and endurance-trained runners.

The lack of regular trainings affects endurance. For example, the performance of swimmers decreases after the off-season. Due to the lack of training, the players' time to exhaustion was reduced by 24% in five weeks. In addition, prolonged inactivity can reduce or even completely reverse the performance improvement caused by training. Although a fairly short break is usually not so bad, and in the case that the previous training adaptation was achieved through long training sessions (6-12 weeks), two weeks of inactivity does not seem to cause a noticeable change in the time before exhaustion.

Isolation can doubt on an athlete's ability to maintain a level of performance, a healthy diet and get quality sleep. Athletes who are accustomed to high calorie intake can maintain the same nutrition programs, despite less exercise and the development of mood-related factors of comfortable eating that occur with boredom and stress.

A decrease in the quality of sleep is associated with loneliness. This can reduce the athlete's ability to recover and train. Returning to training and competitions after a bad sleep can reduce productivity. The practice of healthy sleep can be enhanced with the help of applications for the psychological and physical health of an athlete.

Isolation prevents the establishing of relationships as a result of the cancellation of social events, classes and sports competitions. Although people can keep in touch through social media platforms, they have fewer opportunities to establish closer friendships. Unsurprisingly, the use of online communication is associated with higher rates of loneliness and depression among the general population.

DISCUSSION

A common approach to preventing the consequences of physical inactivity is to use the WHO recommendations for adults over 18 years of age for at least 75 minutes of weekly high-intensity physical activity, including muscle strengthening exercises two or more days a week. Another recommendation is to aim for a 30-minute daily activity of moderate intensity and use changes in body weight as a measure to determine whether the volume and type of activity performed are sufficient to prevent the reversibility of the workout. However, these general recommendations may not be enough to maintain the physical condition of professional athletes during prolonged self-isolation. Athletes show predominant atrophy of type II muscle fibers after only two weeks of detraining, and concentric contractions are more affected by stopping the trainings than eccentric contractions, maximum strength or electromyographic activity during periods of inactivity up to three months (Karasyov et al,2020).

Recent evidence suggests that athletes may maintain or experience a limited decrease in muscle strength (bench press, squats, isometric and isokinetic concentric knee extension and vertical jump) after fourteen days of stopping training. However, transition periods in sports usually have a duration of no more than 6 weeks, and during this time, athletes do not have any restrictions regarding the type, quality and quantity of exercises they can perform, as if it happened during COVID - 19. For this reason, and given the exceptional nature of the training conditions during this period, it is even more important to adapt the training to the needs of athletes.

During the COVID-19 pandemic, not only mature athletes had appropriate restrictions on movement. Young athletes were also seriously affected, so it is necessary to understand whether the refusal of training follows the general behavior described in the literature in this population. The upper and lower explosive force can be maintained in adolescents during 16 weeks of reduced training, if sports loads are maintained (with jumps, frequent accelerations, decelerations and changes of direction). Young athletes (7 years old) maintained an increase in twisting and one-leg jump exercises during the 8-week unloading period, while the levels of long jumps and balance decreased to the initial level (Global recommendations on physical activity for health, 2020).

To restore the physical condition of athletes, as well as to prevent the occurrence of injuries during the transition to active training after a forced break, various technologies of traditional Chinese medicine can be used. Traditional Chinese medicine mainly includes Chinese herbs, acupuncture, moxibustion and massage. Chinese herbs are used as food additives for orthopedic injuries and fatigue caused by physical exertion. Therapeutic effects include increased endurance, accelerated elimination of vascular stiffness caused by centrifugal exercises, as well as improving the ability of skeletal muscles to accumulate adenosine triphosphate (ATP).

Acupuncture is a method in which practitioners stimulate certain points on the body, usually by inserting thin needles through the skin. This method is recommended by the American Pain Society, the National Institutes of Health and the World Health Organization, because acupuncture is an effective and inexpensive method of relieving pain, vomiting, respiratory diseases and CNS diseases. Acupuncture can also be used to treat sports injuries and improve the performance of athletes (Gu et al,2010).

Studies suggest that acupuncture stimulates the release of molecules produced by the body, affecting the areas of the brain involved in the processes of disease. Therefore, further well-planned studies are needed to confirm the effectiveness of acupuncture in sports medicine.

As one of the common treatments of traditional Chinese medicine, acupuncture can improve recovery, delay muscle fatigue, increase muscle excitability and improve endurance. Acupuncture can speed up recovery after a sports injury, improve motor patterns and relieve muscle fatigue. Electroacupuncture at the trigger points Lieque (LU7) and Hegu (LI4) or Jianzhi (PC5) and Neiguan (PC6) significantly improved blood pressure regulation, peak output power and the product of velocity pressure. However, when using combinations of trigger points Baihui (DU20), Sanjian (LI13), Yangxi (LI15), ST36, PC6, Sanyinjiao (SP6) or ST36, DU20, Quchi (LI11), Yanglingquan (GB34), LR-3, acupuncture had no effect on the performance of exercises.

Dry injection of needles into the subacute muscle improves muscle strength and thickness in case of muscle dysfunction in shoulder injuries. After acupuncture, the production of the external rotation force increased by 90 °C when withdrawn. In addition, acupuncture has also changed the functional patterns of movements. Dry insertion of a needle into the triceps muscle leads to both short-term and short-term changes in one of the functional movement patterns for example, the deep knee bend pattern.

Moxibustion is a common method of anesthesia, which consists of a burning moxa stick containing active ingredients that produces thermal stimulation and affects functions through the meridians and acupuncture points. In the field of sports medicine, moxibustion is mainly used to reduce fatigue, inflammation and improve performance. Moxibustion still needs high-quality tests to prove its safety, however, it can cause potential adverse reactions such as allergies, burns, infections, cough, nausea and vomiting (Lin et al,2011).[13,14]

Cupping is an external treatment method that uses burning and suction through a bowl with negative pressure, which has a stretching effect on the surface of the body. Cupping is also called cupping therapy. Cupping therapy can relieve muscle pain, accelerate muscle recovery after exercise fatigue, reduce inflammation and potentially prevent diseases. Some adverse reactions associated with cupping have also been reported in the literature, including burns, kebnerization and the development of discoid psiriase plaques.

Cupping is an important procedure and is useful for various health conditions. Cupping therapy helps to reduce pain, improves the elasticity of soft tissues, the functions of the shoulder and upper extremities in athletes.

Some studies show that cupping therapy in athletes accelerates the recovery of muscle fatigue after a period of intense exercise and, thus, helps to maintain athletic results.

Traditional Chinese massage is a mechanical manipulation by applying rhythmic pressure and stroking in order to improve the corresponding clinical symptoms." Based on experience and observations, coaches, athletes and specialists in the field of sports medicine believe that massage has complex benefits, such as increased blood flow, reduced muscle tension and neurological excitability. A survey of young male athletes showed that common sports injuries include acute muscle sprain, stress fractures, etc. The benefits of massage are that it helps athletes to improve athletic performance and reduce the risk of sports injuries. Local massage is also recommended in combination with a massage that activates the meridians, in order to have the best therapeutic effect for reducing pain, increasing muscle strength, improving the range of movements, etc. Massage plays an important role in restoring the physical form of athletes after a forced break in training, as it allows one to improve muscle elasticity, improve blood flow, etc. in a short period of time.

CONCLUSION

Thus, the lack of regular physical activity is associated with an increase in fat deposits and muscle atrophy, which leads to a decrease in muscle contractility. Aerobic ability is significantly reduced in professional athletes with serious injuries.

Physical activity and sports at all levels of competition provide an opportunity for social interaction between athletes, coaches and families. Social interaction during these workouts or sports can give an output to emotional stress. The Covid-19 pandemic has greatly affected young people around the world with forced isolation and varying degrees of restrictions, which has led to the postponement and cancellation of many sports competitions and social sports events, which can have a lasting impact on psychosocial functioning. In addition, the use of Chinese medicine technologies will contribute to the rapid recovery of athletes ‘ physical condition.

Author Contributions

All authors contributed in reviewing the final version of this paper.

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