EDITORIAL

ACCEPTED: March 2020
PUBLISHED ONLINE: April 2020
DOI: 10.5960/dzsm.2020.432
Bloch W, Halle M, Steinacker JM. Sport in Zeiten von Corona. Dtsch Z Sportmed. 2020; 71: 83-84.

Sport in Times of Corona

Sport in Zeiten von Corona

Prof. Dr. Wilhelm Bloch
Department Molecular and Cellular Sports Medicine, German Sport University Cologne, Germany

Prof. Dr. Martin Halle
Department Preventive and Rehabilitative Sports Medicine, Technical University Munich, Germany

Prof. Dr. Jürgen M. Steinacker
Division of Sports and Rehabilitation Medicine, University Hospital Ulm, Germany

The COVID-19 infection can hit any of us. This is a highly-infectious virus that is easily transmitted because it invades the upper respiratory tract where it proliferates. Measures like limitation of social contacts are important to reduce the wave of infections and prevent overloading the health system; they probably won't protect us against the risk of infection, but rather delay the time of occurrence. If we become infected despite all the measures, it is eminently important to be at the optimal level of health and physical fitness.

But what can we do ourselves? We should keep as "fit" as possible so that we can get through the infection with as little damage as possible. That's why – in addition to other factors related to lifestyle – it's important that we maintain our physical exercise capacity and the function of our organ systems and, if possible, increase them even in the current phase. Physical training is a basic requirement for this and should be maintained despite all limitations in order to preserve fitness. But now is also the time to encourage those who have been inactive to become physically active and improve their fitness status. In appropriately adapted form, the individual exercise capacity can be increased even in less active persons, as long as there are no symptoms of illness. This is especially important, since we cannot assume that the wave of infections will abate within a few weeks, but rather we have to reckon with the danger for months or even up to two years.

The measures taken now for social distancing in Germany still permit remaining physically active outdoors and engaging in individual sports. At the same time, they demonstrate that the politicians responsible for the decisions recognize the necessity of physical activity in this time and have acted accordingly.

Physical Training and the Immune System

But what good is physical training in concrete reference to the COVID-19 infection? It won't reduce the risk of infection: the virus doesn't differentiate – but our body can be better prepared to deal with the infection. The stabilizing effect of physical activity on the immune system plays a crucial role here. It has been well-documented that physical activity leads to changes in the immune system which can be demonstrated not only clinically but in basic science. In connection with the COVID-19 infection, strengthening of the body's regulation of the immune system could play a primary role along with other mechanisms. This self-regulation is important in adapting the immune reaction to a new pathogen (in this case the SARS-CoV-2 viruses or the cells they affect) and eliminate it, while keeping the reaction from becoming excessive. Such an excessive response is stress for the organism which may result in failure. It has been shown in recent years that the number and function of the inhibitory cells of the immune system, here especially the so-called T-regulatory cells, can be increased in dependence on physical exercise capacity and training. This is likely an important mechanism for the appropriate reaction of the body to the new virus.

But why are clinical problems and more frequent fatal course after infection with the SRS-CoV-2 virus especially observed in older people? Moreover, such people are especially affected by diseases of the cardiovascular system or cardiovascular risk factors like arterial hypertension and Type 2 diabetes in addition to pulmonary diseases and a history of smoking. There are as yet no scientific explanations, but it is observed among older people that they are less able to efficiently activate the inhibitory cells of the immune system. Thus, they react less appropriately to new pathogens, to which the immune system reacts rather unspecifically and violently. For this reason, it becomes even more important that we activate and "train" our immune system to keep it "fit." In particular, endurance activities at moderate intensity are of central importance, since increased circulation of the immune cells and activation of the immune system occur. Greater intensities have the disadvantage that they may suppress immunocompetence , resulting in increased danger of infection ("Open Window" Theory after extreme exercise). The optimal duration for untrained persons may be brief training units of just 10 minutes, which can be increased over time (similar training concepts are the basis of the "Lauf10"!-Program of the Department of Preventive Sports Medicine and Sports Cardiology at the TU Munich and Bavarian Television (https://www.br.de/br.fernsehen/sendungen/abendschau/lauf10/index.html).

Cardiovascular System and COVID-19

The immune system is not solely important to overcome infection. The heart, blood vessels and lungs are under stress to a high or even highest degree, which makes patients with corresponding prior diseases at great risk. Even though a definitive explanation ›

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KORRESPONDENZADRESSE:
Prof. Dr. med. Dr. h.c. Jürgen M. Steinacker
Division of Sports and Rehabilitation Medicine
University Hospital Ulm
Leimgrubenweg 14, 89075 Ulm, Germany
✉: juergen.steinacker@uniklinik-ulm.de

for this cannot yet be given, arterial hypertension, Type-2 diabetes mellitus and heart failure have the common feature that they all lead to increased stiffness or decreased diastolic relaxation and only later to systolic contractile impairment, and all these changes lead to functional impairment of the left ventricle (diastolic dysfunction, heart failure with preserved or reduced ejection fraction). Limitations of both the diastolic and systolic functions of the left ventricle promote regurgitation into the pulmonary circulation. This occurs to an even greater extent in the presence of fever and tachycardia. A person who has reached his limit as a cardiopulmonary patient and has only low compensation capacity by means of adaptation of the periphery, such as increased capacity of the oxidative muscle enzymes, is certainly at greater risk of not tolerating pulmonary infection, whether due to influenza or SARS-CoV-2 viruses. People with good cardiopulmonary fitness thus have an advantage which is in a way age-dependent. Of course, the diastolic function of the heart decreases with age and the function of the musculature decreases, so that age becomes a central risk factor for the poor prognosis of COVID-19 patients. It goes without question, however, that physical training preserves the exercise capacity of the cardiovascular system and promotes ventilation of the lungs. This in turn improves perfusion via the Euler-Liljestrand reflex and increases immunocompetence - capacities which are essential to successfully overcoming a COVID-19 infection, particularly for untrained and elderly people.

Physical Exercise Capacity is Important to Survive Serious Infection Diseases

While, for example, age as a risk factor cannot be influenced, medication treatment of classical risk factors is not the only important element in reducing mortality; it depends on the functional capability of organ systems. The role of physical fitness as a predictor of mortality in serious illnesses has more and more entered the scientific and clinical focus in recent years. The muscle mass decreases about 20% per week in long-term confinement to bed: people with low muscle mass and poor function are at particular risk.

When viral pneumonia occurs in COVID-19, it is not only a single lobe but usually affects all lung lobes, resulting in a marked increase in pulmonary immobility and thus increased breathing effort. New findings show that non-invasive support of respiration with classical continuous positive airway pressure (CPAP) generates the greatest level of mean respiratory tract pressure among the primary measures in COVID-19 patients and thus may offer the most effective recruitment of lung segments. Respiratory pressures up to 18 cm H_2O are needed, which correspondingly require great effort for the respiratory musculature. Italian experience has shown: when metabolic rate increases threefold due to the infection itself and, increased respiratory work due to CPAP will add another load on metabolism, all together means that the maximum metabolic capacity is reached and metabolic failure results. The immediate conclusion is that performance capacity and toleration of CPAP take on a special importance when there are not sufficient beds with respirators.

Recommendations for Physical Training

- Daily repeated breathing exercises with deep in- and exhalation to aerate the lungs
- Daily exercises at home with endurance, strength and coordination exercises (e.g. 7-minute workout: https://www.sport.mri.tum.de or https://www.uni-ulm.de/sportmedizin)
- Exercises adapted for seniors or patients (downloads under: (https://www.sport.mri.tum.de/de/downloads.html)
- Daily physical and athletic activity at moderate intensity ("Laufen ohne zu Schnaufen", Nordic walking, Lauf 10!-training plans: www.sport.mri.tum.de/lauf10 Suggestions also under https:twitter.com/SportmedizinU
- Trained people should continue their normal program
- No additional physical activity when symptoms of disease are present, since this would mean additional stress for the immune system and the cardiopulmonary system
- Give the body regeneration phases after exercise in which the training stimulus can be used for adaptation and the immune system can "recover". One should keep physically active or become more active, without overloading the body.
- Follow the rules: keep a distance of several meters from others engaging in sports, avoid indoor sports, except in one's own fitness rooms at home, wherever possible, stay away from park benches and childrens' playgrounds, wash hands often or use hand disinfectants, where appropriate wear a mouth/nose mask.

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