

Possible benefits of stretching for post-COVID-19

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Abstract

Background: COVID-19 is a new disease that causes severe health problems and is responsible for significant complications even after recovery, including disabilities that lead to motor impairment. In this sense, there is currently no protocol for physical exercises for people with physical disabilities caused by the disease. Therefore, it is necessary to find ways for individuals affected by this condition and experiencing motor difficulties to engage in physical activities, preventing their condition from deteriorating further after COVID-19. **Objective:** To present evidence that stretching improves strength, respiratory and vascular system function, enabling the return of individuals with physical deficits who are hindered from performing activities of daily living. **Methods:** This study is a literature review that analyzes the correlation between the benefits of active static stretching in individuals with physical disabilities post-COVID-19. The study collected data through accumulated scientific knowledge in the fields of clinical health and physical activity. The literature search was conducted using digital scientific databases, including SciELO, ScienceDirect, Bireme, and Google Scholar. **Results:** Muscle stretching is a physical activity that has shown promising benefits for post-COVID patients, however, further research in this field is needed. **Conclusion:** Through the presented studies, it can be concluded that stretching is a type of exercise that potentially can counterbalance various sequels caused by COVID-19, enabling the affected person to return to their daily routines.

Keywords: Muscle stretching exercise; physical activity; COVID-19.

BACKGROUND

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, emerged in December 2019 in Wuhan, Hubei province, China¹. The rapid spread of SARS-CoV-2 led the World Health Organization (WHO) to proclaim a global pandemic on March 11, 2020². COVID-19 is characterized as a pathogenesis disease complex and has been a major public health challenge worldwide¹. After remission, apparently healthy individuals may present various clinical manifestations and peripheral and central inflammatory responses that generally lead to long-lasting musculoskeletal changes and functional impairment, characterizing the term "Long COVID"³. Among the symptoms reported in "Long COVID," an intriguing and increasingly observed manifestation is the persistence of post-COVID-19 pain, associated with persistent fatigue or mood changes, cognitive changes, or persistent respiratory disorders⁴. The Severe Acute Respiratory Syndrome caused by the coronavirus 2 (SARS-CoV-2) is caused by a virus with high inflammatory potential¹ and is currently known by the name Coronavirus-19 (COVID-19)¹⁻³.

COVID-19 is a disease with multisystemic impairments¹⁻⁴ that affects the quality of life of those affected, both during the presence of the virus and after recovery¹⁻³. Among all the systems the virus affects, the respiratory (Al-Jahdhami 2022) and cardiovascular³ systems are the most severely impacted, both acutely and chronically¹⁻³. In the respiratory system, COVID-19 in the early stage causes dyspnea, which can range from

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mild to severe¹. After recovering from COVID-19, the virus can cause some symptoms that may persist for some time, such as cough, fatigue, and muscle weakness, especially in the lower limbs. There is a significant possibility of pulmonary fibrosis after treatment and recovery from the virus⁵. In the cardiovascular system, the virus causes cellular damage due to high concentrations of pro-inflammatory cytokines. Moreover, these cytokines increase thrombotic potential by damaging blood vessels. As a result, symptoms such as tachycardia and heart palpitations can be observed^{6,7}.

Most patients are discharged from the hospital with stable vital signs at rest; however, when there is physical exertion beyond rest, they experience difficulties due to suppressed oxygen saturation, increased heart rate, and low conditioning¹. Both respiratory and cardiovascular system changes after recovering from COVID-19 make it challenging to perform basic activities of daily life and restrict physical activity due to systemic physical impairment^{8,9}. The physical activity is crucial for post-COVID-19 recovery, offering significant anti-inflammatory potential by reducing pulmonary inflammation, restoring endothelial function through nitric oxide release, promoting vasodilation, and strengthening the immune system¹⁻⁹. However, as mentioned above, there is a physical challenge in performing some activities due to physical impairment resulting from post-COVID-19 sequelae¹⁻¹⁰. The difficulties in mobility, such as carrying equipment or oxygen cylinders, create significant resistance to initiating physical activity for a substantial portion of those affected, primarily the elderly, sedentary individuals, and those with chronic illnesses¹⁻⁹. Despite the challenges in performing physical activity, it is necessary for improving physical conditioning, which is essential for physical recovery, an anti-inflammatory response, and the stabilization of vital signs resulting in short-term improvement in physical conditioning and endurance¹. COVID is a known virus, but the variation 19 represents a new disease in terms of its characteristics¹⁰. Therefore, there is a need for further research on the virus and the development of a post-COVID-19 training protocol. In this case, it is essential to propose an efficient and easy-to-administer prescription, involving low-intensity and adaptable physical activity for the patient. Static stretching is a suitable suggestion for this purpose¹. Active static stretching is an acceptable option under such conditions because it is a straightforward and easily adaptable physical activity. It is safe, low-intensity, and can be performed virtually anywhere. This type of physical activity is comprehensive, as it can engage and work on various muscle groups throughout the body².

METHODOLOGY

This study can be classified in terms of research type as a literature review, as it collects data through accumulated scientific knowledge, which encompasses the clinical health and physical activity field, to analyze a correlation between the benefits of active static stretching in individuals with physical disabilities after COVID-19. The literature search was conducted through digital sources of scientific databases, including SciELO, ScienceDirect, Bireme, and Google Scholar. The literature search was conducted through digital sources of scientific databases, including SciELO, ScienceDirect, Bireme, and Google Scholar.

RESULTS AND DISCUSSION

COVID-19 is a new disease that arises from growing studies and requires multidisciplinary attention, including the field of sports and physical activity. Active static stretching has been gaining prominence and strength in the scientific community due to its simplicity, as it is an activity that can be applied at both high and low intensity, promoting adherence to physical exercise. COVID-19 has a high inflammatory burden, so we need an activity with a low inflammatory load. When applied at low intensity, stretching elicits minimal pro-inflammatory response and, in fact, triggers an anti-inflammatory response¹¹. In addition to its anti-inflammatory effect, stretching also promotes a positive impact on balance, increasing flexibility and mobility, reducing stiffness in the ankles, knees, and hips, thus enabling improved mobility¹², as highlighted by Behm and colleagues in 2021, as well as Reddy and Alahmari in 2016 (mobility being one of the challenges faced by COVID-19 patients)¹³.

Stretching provides a modest improvement in lower limb strength¹⁴. Such improvement may be sufficient for post-COVID-19 individuals to maintain bipedal stance and mobility alongside the enhanced mobility and balance they will gain. Stretching also promotes a positive response in oxygen saturation. Saturação is a marker of blood oxygenation that is affected by the disease, causing negative stability changes, which can be mitigated by stretching, which has the potential to increase capillary extensibility, reduce muscular stiffness of the thoracic walls, and improve respiratory patterns¹⁻¹⁵. Another positive aspect of stretching is that this activity not only activates muscles and tendons but also engages the peripheral nervous system by elongating the nerves, facilitating nerve communication, thus justifying the improvement in balance response¹⁵. The peripheral circulation is also benefited by stretching. Stretching has the ability to reduce peripheral capillary tortuosity, facilitating oxygen delivery and reducing cardiac effort, thus lowering blood pressure^{16,17}. The vascular benefit provided by stretching appears to be more potent than that promoted by walking¹⁸. In addition to stimulating angiogenesis, increasing capillarity, and improving oxygenated blood flow. In theory, there is a positive response in the major systems affected by COVID-19, minimizing the impacts of the disease after recovering from COVID-19.

Another study³ highlights the importance of engaging in physical activity for chronic diseases and underscores its significance. However, when it comes to COVID-19, there is indeed a shortage of studies with exercise protocols due to this being a new disease. The same authors³ also emphasize the need for a specific post-COVID-19 exercise protocol, suggesting that it should encompass training for frailty, interstitial lung disease, heart failure, and pulmonary hypertension. Another study¹¹ mentions that stretching can be of both low and high intensity, and that high-intensity stretching releases pro-inflammatory cytokines. In this case, such intensity is not favorable for post-COVID-19, considering that the virus has a high inflammatory potential. The same study states that anti-inflammatory activation occurs at low intensity, with low-intensity stretching being the most suitable for post-COVID-19, considering its low pro-inflammatory response and its anti-inflammatory activation¹⁹. A review study¹² from 2020 concludes that stretching has positive effects on balance, both acutely and chronically, improving the quality of life for individuals with low balance, with a

particular focus on the elderly. It reduces the incidence of falls and enhances flexibility and mobility. The same study from 2020 also states that the benefits of stretching go beyond balance, benefiting the cardiovascular system through the reduction of arterial stiffness, angiogenesis, improved vasodilation, enhanced parasympathetic function, and reduced chronic stress. These benefits are favorable for post-COVID-19, addressing both issues related to weakness and balance, as well as the cardiovascular system¹².

According to what has been presented in the studies¹⁻¹⁸, stretching possesses all the positive attributes required for initiating physical activity in extreme cases of post-COVID-19 when physical conditions are limited. The literature provides a wide range of time protocols for stretching training, which can vary between authors. Another study²⁰ presents a more comprehensive concept, working with durations of 15s, 60s, 90s, and 120 seconds. In contrast, a different study²¹ uses durations of 10s, 20s, 40s, and 60 seconds. employed a protocol with 30 seconds versus a control group. used a protocol of only 30 seconds^{22,23}. The majority of studies comparing time protocols primarily focus on analyzing the range of motion as the primary outcome, with some also complementing their analysis with other variables related to mobility, strength, and balance. As you mentioned, only a few of the cited authors considered other benefits.

An important point to note is that the 30-second protocol is one of the most commonly used because it doesn't show significant differences in results when compared to other protocols in terms of flexibility and is associated with a lower participant dropout rate. Additionally, it has been shown to contribute to increased strength, balance, improved oxygen saturation, cardiovascular response, and vascularization^{1,17-19}. Stretching, due to its simplicity and significance, has been gaining more and more attention in the literature and can be the most recommended activity to begin an exercise program. Since there are no specific models, our work has shown positive benefits in post-COVID-19 recovery. Here's a suggested training protocol¹.

Given that, the methodology of our work followed the following protocol: 5 stretching exercises targeting major muscle groups - triceps, shoulder adduction, hip, hamstring, and quadriceps, with one exercise for each muscle. Each exercise was performed as follows: 3 sets of 30 seconds of tension, followed by a 30-second rest, and 1 minute for transitioning to the next exercise.

CONCLUSION

We can conclude from the above that active static stretching is potentially the most suitable physical activity for individuals who have recovered from COVID-19 with physical impairment, considering its ease of use and safety of application. Despite COVID-19 being a new area of exploration with no specific protocol in place, stretching has proven to be effective in cases of physical impairment, potentially improving the quality of life for those affected. Moreover, as individuals achieve better physical condition, they can gradually transition to other exercise modalities.

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