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Review

Resistance Training before, during, and after COVID-19 Infection: What Have We Learned So Far?

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Abstract: By the end of 2019 a severe acute respiratory syndrome caused by the SARS-CoV-2 started a pandemic, leading to millions of deaths and many important political and social changes. Even in the absence of contamination, the mobility reduction, social distancing and closing of exercise facilities negatively affected physical activity and conditioning, which is associated to muscle atrophy, loss of muscle strength and reductions in functional capacity. In case of infection, it has been shown that increased physical capacity is associated with decreased hospitalization and mortality risk. Although millions of people died from COVID-19, most contaminated individuals survived from the infection, but carried different sequelae, like severe loss of physical function and reduced quality of life. Among different physical exercise models that might help to prevent and treat COVID-19 outcomes, resistance training (RT) might be particularly relevant. Among its benefits, RT can be adapted to be performed in many different situations, even with limited space and equipment, and it is easily adapted to individual characteristics and health status. The current narrative review aims to provide insights on how RT can be used in different scenarios to counteract the negative effects of COVID-19. By this, the authors expect to provide insights do deal with the current pandemic and also in case the World has to deal with similar events in the future.

Keywords: human physical conditioning; resistance training; coronavirus; muscle strength; musculoskeletal and neural physiological phenomena

1. Introduction

In December of 2019, there was an outbreak of a severe acute respiratory syndrome caused by a new coronavirus (SARS-CoV-2 or COVID-19). The virus was first noticed in China and rapidly spread across the country and then into the world [1]. As a consequence, many authorities imposed extreme measures such as quarantine, social distance

and isolation [2]. Measures included banning sport competition and closing exercise facilities, like health clubs, gyms and sport courts [3,4]. Restrictions were accompanied by reduction of mobility due to public transportation and gathering restriction, home office adoption and school closure. These measures had a negative impact on physical activity levels [5] and decreased the involvement with muscle strengthening exercises [6], which might induce muscle atrophy, loss of muscle strength and reductions in neuro and mechanical abilities [7,8].

Even when exercise facilities were reopened, many regulations were sustained, like social distancing, limited gathering, use of protection masks and hygiene measures [9,10], which, along with the fear of contamination might preclude regular exercise performance. Therefore, it is important to propose solutions to stimulate physical activity performance, especially considering that physical inactivity [11–15] and low physical capacity [16–18] are associated with worst outcomes and increased mortality risk in case of infection [19–21].

Moreover, although COVID-19 is commonly associated with the respiratory system, it is a multisystem disease [22]. Coronaviruses may also induce neurological damage by invading the central nervous system and result in severe muscle pain [23] and loss of muscle strength [24]. Although COVID-19 has relevant morbidity up to 6 months [25], COVID-19 survivors might develop psychological, physical and cognitive impairments that required rehabilitation and medical care for more than 12 months [26,27]. Among the secondary consequences of the disease and its treatment, physical function is unlikely to recover to normal values spontaneously, even under nutritional and physical exercise counselling [28]. Therefore, specific prescriptions are needed.

Considering physical exercise models that might help to prevent and treat different consequences of COVID-19, resistance training (RT) might be particularly relevant. RT has been consistently used to increase muscle mass and strength in many different populations, being considered an essential part of a physical exercise program to improve or restore physical functioning [29–31]. Its benefits, largely mediated by strength gains, culminate in reductions in mortality rates in different populations [32–36]. Therefore, this narrative review aimed to provide insights on how RT can be used in different scenarios to counteract the negative effects of COVID-19. By this, the authors expect to provide insights to help dealing with the current pandemic and provide information in case the World has to deal with similar events in the future.

2. Before: Considerations for Preventing COVID-19 Complications

Although it is not possible to attribute a direct cause-effect relationship between RT practice and mortality risk during COVID-19 pandemic, current evidence suggest that it might be important to perform RT to improve general health and help in a better prognostic in case of contamination [11–18,37]. Physical inactivity [11–15] and low muscle strength have been associated with increased risk of hospitalization and death [16–18,37]. The importance of muscle strength should not be underestimated, since it can explain the protective effect of physical activity against COVID-19 hospitalization [17].

Moreover, RT can modulate important risk factors associated with increased morbidity and mortality due to COVID-19, such as high blood glucose, arterial hypertension, obesity and dyslipidemia [38–42]. In this regard, previous evidence show that RT can help controlling blood pressure [43,44], blood glucose [45], body weight [46], and blood lipidis [47]; therefore, mitigating complications in case of contamination.

Other possible benefit of RT is its impact on the immune system. Physical exercise has been consistently shown to modulate immune function [48–51]. Higher levels of physical activity [52–54] and fitness [54] decrease the risk of respiratory symptoms and illness. In this regard, people involved with strength and power activities [55–58] usually have a better immunological profile than people involved with long duration aerobic activities [59], which might be a positive point to RT [60,61]. Strategies for RT prescription for im-

proving or maintaining immune function involve using low exercise volume, (4–6 exercises, with 1–2 sets per exercise) avoiding metabolic stress (perform ≤ 6 repetitions and ≥2 min of rest between sets and exercises) and prefer exercising during afternoon/evening [60].

Based on the aforementioned, it would be important to promote muscle strengthening activities during the current and future pandemics [9,61], specially, for those at higher risk of frailty such as elderly and people with chronic diseases [62,63]. Although many people might feel unsafe when practicing RT in exercise facilities, there are many possible measures that should be adopted [9], and previous studies have shown their relevance in modulating the contamination risk [64,65].

If one decides to avoid exercise facilities, RT can be adapted to be performed in many different situations, even with limited space and equipment, and it is easily adapted to individual characteristics and health status [61]. For example, previous studies have shown that bodyweight exercises [66–68], stationary bike [69], plyometric training[70], elastic bands [71–73] and even exercises with no external load [74–76] promote similar responses to traditional RT. These exercises might be performed as basic multi-joint exercises (i.e., squats, pushup, pullups, rows…) as this has been shown to be sufficient to promote gains in muscle strength and size in most muscles involved [77–81], such that the addition of isolated exercises, in general, does not seem to bring benefits [80,82,83]. This brings the possibility to exercise at parks, outdoor and even at home and still have relevant results [63,84]. Additionally, these training approaches can be also adjusted for intensifying or decreasing the intensity of the practice which can be interesting for those who want to vary the training stimulus across long-term periods of gym avoidance.

Considering that the respiratory system of infected people is the main source of SARS-CoV-2 contamination, one of the most recommended safety measures is to use protections masks [85,86]. However, it is important to consider that the use of any type of masks reduces air flow to the lungs and might increase respiratory stress, leading to dizziness, shortness of breath and decrease in performance [10,87–89]. Although this might be alleviated by familiarization [90], it might be recommend to control respiratory responses during exercise. Here, RT might be particularly advantageous due to the less pronounced cardiorespiratory demands in comparison to aerobic exercise [91–93].

A previous study suggested that wearing face mask (surgical or FFP2) during RT resulted in similar strength performance and physiological responses than training with no mask when exercise was not performed to muscle failure [94]. Rosa et al. reported that the effects of FFP2 masks in response to RT might be dependent on the load used; with increases in rating of perceived effort and decreases in oxygen saturation when training to failure using lower, but not higher loads [95]. However, there were no differences in total volume performed between mask or no mask conditions with any load. Therefore, although RT performance might not be particularly influenced by the use of masks, it would be suggested to train with higher loads, lower number of repetitions to avoid discomfort [60].

Previously studies suggested that the SARS-CoV-2 might be transmitted by solid surfaces, where it might stay active for several days [96,97]. However, later evidence suggested that the risks are negligible [98]. Therefore, one should not be excessively worried about equipment sharing or cleaning since regular hygiene practices might be enough to avoid transmission.

3. During: Resistance Training for People with COVID-19

COVID-19 involves an inflammatory response that affects different systems, including the neuromuscular system [99–101]. Its effects on muscle strength can be detected even in the absence of symptoms, with strength loss of as much as 30% in 2 weeks of asymptomatic contamination [24]. COVID-19 patients under intensive care can lose 30% of rectus femoris muscle cross sectional area in the first 10 days [100]; and 44% of them still have severely limited function for up to one-month after weaning [102].

Previous studies showed that reduced muscle strength is associated with physical inactivity in pulmonary patients [103] and is an important predictor of morbidity and mortality independent of the degree of respiratory limitation [104]. In agreement with this, muscle strength and mass are predictors of length of stay in patients with moderate to severe COVID-19 [105]. Consequently, it seems important to adopt strategies to maintain or increase muscle strength, from asymptomatic patients to those under intensive care, since exercise training during hospitalization due to acute respiratory conditions seems to be well tolerated and have infrequent adverse events [106–108]. In line with this, previous studies suggested rehabilitation programs starting within 30 days seem to bring the most benefits as early exercise prevents neuromuscular complications and improves functional status in critical illness, being considered effective, safe and feasible [27,109].

In this regard, RT has been shown to promote benefits during pulmonary rehabilitation due to improvement in functional capacity, either performed alone or combined with aerobic training, [110–112]. RT can be successfully performed as an stand-alone exercise strategy, without increasing adverse events in chronic obstructive pulmonary disease patients under pulmonary rehabilitation [112].

This might seem counterintuitive, since a popular recommendation for periods of sickness is to rest. However, physical exercise might bring health benefits even in case of viruses contamination. Davies et al. [113] studied the effects of exercise on susceptibility to respiratory infection by using a murine model. Mice received intranasal challenge with herpes simplex type 1 virus (HSV-1) and then were followed for three weeks under three situations: control, moderate short-term (30 min) exercise and prolonged strenuous exercise to voluntary fatigue (2.5–3.5 h). The results showed that prolonged and strenuous exercise reduced antiviral resistance of lung macrophages and increase both morbidity and mortality than either no exercise or short-term moderate exercise. However, in comparison to the control group, the groups that performed 30 min of moderate exercise showed a tendency to have a decreased morbidity (13 vs. 25%) and mortality (9 vs. 16%). Although human studies are lacking and assumptions based on animals should be made with great care, it is reasonable to suggest that RT sessions of short duration and moderate intensity of effort could be recommended even in case of infection, as previously suggested [60].

COVID-19 pathogenesis involves a delayed anti-viral response which is followed by an excessive proinflammatory state [114]. The systemic inflammation is associated with disease severity, as shown by higher serum levels of proinflammatory cytokine in the most affected patients [115]. This grants importance for intervention with anti-inflammatory properties, which is the case for RT [116–118]. It is also important to note that regulatory T lymphocyte (Treg) is associated with controlling inflammatory response and is reduced in severely ill patients [119,120], suggesting an important role in COVID-19 progression. In this regard, a previous study showed that RT can upregulate Treg [121] and regular practice of RT increases the levels of interleukin-10, an anti-inflammatory cytokine that is mainly produced by Treg cells [117,118].

Irisin might also have an important role in the benefits of RT on COVID-19 patients. A previous study indicated a positive effect of irisin on the expression genes related to viral infection by SARS-CoV-2 [122]. Previous studies showed that exercise sessions acutely elevate irisin levels with higher increases in physically fit subjects [123]; and that a RT chronically elevate Irisin levels [124].

4. After: Resistance Training after COVID-19 Treatment

Respiratory diseases are associated with impairments in muscle function and loss of lean body mass [125,126]. Survivors of severe acute respiratory diseases (SARS) might present functional disability for as much as one year after discharge [127,128] and muscle wasting and weakness are frequent extrapulmonary conditions [128]. The manifestations include limb muscle weakness, muscle atrophy and impairments in deep tendon reflexes [129].

COVID-19 patients show muscular disfunction similar to that observed in chronic obstructive pulmonary disease and IHD patients [130]. More than 80% of hospitalized COVID-19 patients, all without previous disability, showed reduced quadriceps muscle strength at discharge [131]. Studies in COVID-19 patients who recovered from mild and moderate disease showed handgrip and quadriceps weakness in 39.6% and 35.4% of the participants 12 weeks after discharge, respectively [132]. This might persist for a longer time, since persistent pulmonary function was impaired in up to 37% of the patients who suffered from SARS one year after discharge and their health status was also significantly decreased in comparison with healthy subjects [133,134] and exercise capacity was also remarkably lower than those found in normal population for many months [134]. Moreover, patients admitted in intensive care units commonly present persistent dyspnea, anxiety, depression, impaired physical function and poor quality of life for up to 12 months after discharge [135–137]. Among them, physical function is one of the least likely to recover to normal values over long-term [28].

Previous studies have suggested that muscle strength should be regularly assessed after discharge [138,139], since early diagnosis of sarcopenia therefore appears to be of paramount importance in the management of post-acute COVID-19 patients [140]. The high prevalence of impairment in skeletal muscle strength and physical performance in patients recovering from COVID-19 suggests the need for rehabilitation programs after discharge. However, reduced muscle strength has been identified six months after discharge in 1 in 6 COVID-19 survivors, even when they were admitted to post-care facilities or received dietary counseling, physical activity guidance or physiotherapy assistance [139]. Therefore, it is important to adopt specific strategies oriented for increasing muscle strength, like working at adequate intensities and using blood flow restriction[140]. In this regard, previous studies showed that the combination of aerobic and RT increased muscle strength, functional capacity and quality of life post COVID-19 infection [141–143].

It is important to consider possible risk factors when prescribing RT, as COVID-19 might associated with cardiac complications that persists after discharge, especially arrhythmias, heart failure, myocardial injury and increased risk of thromboembolism [144–147]. Nevertheless, RT has been shown to be safe and effective for several cardiac patients and have been recommended as a core component of cardiac rehabilitation for many decades [148–150]. However, it is important to consider proper program design to avoid complications, like working with lower number of repetitions, increase rest intervals and reduce training volume [60].

The aforementioned evidence reinforces the importance to propose a more oriented intervention to increase muscle function in COVID-19 survivors [60] and RT might be particularly interesting and has been shown to be a safe and feasible in acute and chronic respiratory conditions [106,107,111,112].

5. Practical Considerations

When considering the period "before", it is important to stimulate RT practice as it improves general health and physical capacity. It should be highlighted that being physically active and have higher levels of muscle strength are associated with lower risk of deleterious outcomes due to COVID-19. At this time, no specific care should be taken with RT design. However, special attention should be given to strategies for controlling contamination risk, like observing ventilation, social distancing and consider the use of masks.

"During" contamination or in the presence of relevant symptoms it is important to preserve the immune system while maintaining or increasing physical capacity. At this time, it is recommended to perform RT sessions no longer than 30 min, using low number of repetitions (≤6), longer rest between sets (≥2 min), and submaximal efforts (rate of perceive exertion ≤7). This recommendation can also help to reduce respiratory stress, particularly for participants returning to physical activity practices after new confinements due to Coronavirus 2 variants (e.g., Delta, Omicron). Special attention should be given to the

risk of contamination. Therefore, home-based training or training at places that allows for risk controlling are highly recommended. For patients under intensive care, the same recommendation can be adopted with special attention to the use of elastic bands, bodyweight exercises or exercise with no external load, as they can be performed inside the intensive care unit and even in the hospital bed.

RT should be performed immediately "after" recovery to increase functional capacity and allow the patient to return to normal life and regain quality of life. At this stage, RT should start progressing to traditional protocols. Training protocols should be tailored according to the clinical manifestations and considering the involvement of different symptoms. Our group have provided detailed recommendations in a previous article [60]; however, as general rule, the recommendations for "during" can be maintained and progress with the clinical evaluation.

6. Conclusions

The COVID-19 pandemic brought us many important lessons about heath attention. So far, we have learned that the importance of physical exercise should be highlighted. COVID-19 pandemic showed us that it is import to promote physical exercise and increase physical capacity for preventing complications in case of contamination (before), maintaining health and controlling morbidities after infection (during) and helping to rehabilitate patients after discharge (after). In all these stages RT might be a valuable tool, based both on previous knowledge and on the information obtained from the current pandemic. Among the characteristics that make RT a unique strategy, it can highlighted its adaptability for many spaces, equipment and individual clinical characteristics. Therefore, it is recommended that health professionals and the general public be aware of its potential benefits during this period and in case of similar events in the future.

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References

1. Zu, Z. Y.; Jiang, M. Di; Xu, P. P.; Chen, W.; Ni, Q. Q.; Lu, G. M.; Zhang, L. J. Coronavirus Disease 2019 (COVID-19): A Perspective from China. *Radiology* **2020**, 200490, doi:10.1148/radiol.2020200490.
2. Adhikari, S. P.; Meng, S.; Wu, Y. J.; Mao, Y. P.; Ye, R. X.; Wang, Q. Z.; Sun, C.; Sylvia, S.; Rozelle, S.; Raat, H.; Zhou, H. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: A scoping review. *Infect. Dis. Poverty* **2020**, *9*, 1–12, doi:10.1186/s40249-020-00646-x.
3. Corsini, A.; Bisciotti, G. N.; Eirale, C.; Volpi, P. Football cannot restart soon during the COVID-19 emergency! A critical perspective from the Italian experience and a call for action. *Br. J. Sports Med*. 2020.
4. Jukic, I.; Calleja-González, J.; Cos, F.; Cuzzolin, F.; Olmo, J.; Terrados, N.; Njaradi, N.; Sassi, R.; Requena, B.; Milanovic, L.; Krakan, I.; Chatzichristos, K.; Alcaraz, P. E. Strategies and Solutions for Team Sports Athletes in Isolation due to COVID-19. *Sports* **2020**, *8*, 56, doi:10.3390/sports8040056.
5. Tison, G. H.; Avram, R.; Kuhar, P.; Abreau, S.; Marcus, G. M.; Pletcher, M. J.; Olgin, J. E. Worldwide Effect of COVID-19 on Physical Activity: A Descriptive Study. *Ann. Intern. Med.* **2020**, *173*, 767–770, doi:10.7326/M20-2665.
6. Steele, J.; Androulakis-Korakakis, P.; Carlson, L.; Williams, D.; Phillips, S.; Smith, D.; Schoenfeld, B. J.; Loenneke, J. P.; Winett, R.; Abe, T.; Dufour, S.; Franchi, M. V.; Sarto, F.; Lundberg, T. R.; Gentil, P.; Kvorning, T.; Giessing, J.; Sedliak, M.; Paoli, A.; Spotswood, F.; Lucas, A.; Fisher, J. P. The Impact of Coronavirus (COVID-19) Related Public-Health Measures on Training Behaviours of Individuals Previously Participating in Resistance Training: A Cross-Sectional Survey Study. *Sports Med.* **2021**, *51*, 1561–1580, doi:10.1007/S40279-021-01438-5.

7. Krogh-Madsen, R.; Thyfault, J. P.; Broholm, C.; Mortensen, O. H.; Olsen, R. H.; Mounier, R.; Plomgaard, P.; Van Hall, G.; Booth, F. W.; Pedersen, B. K.; Harry, S. A 2-wk reduction of ambulatory activity attenuates peripheral insulin sensitivity. *J. Appl. Physiol.* **2010**, *108*, 1034–1040, doi:10.1152/japplphysiol.00977.2009.
8. Narici, M.; De Vito, G.; Franchi, M.; Paoli, A.; Moro, T.; Marcolin, G.; Grassi, B.; Baldassarre, G.; Zuccarelli, L.; Biolo, G.; di Girolamo, F. G.; Fiotti, N.; Dela, F.; Greenhaff, P.; Maganaris, C. Impact of sedentarism due to the COVID-19 home confinement on neuromuscular, cardiovascular and metabolic health: Physiological and pathophysiological implications and recommendations for physical and nutritional countermeasures. *Eur. J. Sport Sci.* **2020**, 1–22, doi:10.1080/17461391.2020.1761076.
9. Gentil, P.; de Lira, C. A. B.; Souza, D.; Jimenez, A.; Mayo, X.; de Fátima Pinho Lins Gryschek, A. L.; Pereira, E. G.; Alcaraz, P.; Bianco, A.; Paoli, A.; Papeschi, J.; Carnevali Junior, L. C. Resistance Training Safety during and after the SARS-Cov-2 Outbreak: Practical Recommendations. *Biomed Res. Int.* **2020**, *2020*, 1–7, doi:10.1155/2020/3292916.
10. Sortwell, A.; Ramirez-Campillo, R.; Knijnik, J.; Forte, P.; Marinho, D.; Ferraz, R.; Trimble, K. Commentary: Face masks in physical education classes during the COVID-19 delta variant wave: a call for awareness. *Ger. J. Exerc. Sport Res. 2021* **2021**, 1–4, doi:10.1007/S12662-021-00785-9.
11. de Souza, F. R.; Motta-Santos, D.; dos Santos Soares, D.; de Lima, J. B.; Cardozo, G. G.; Guimarães, L. S. P.; Negrão, C. E.; dos Santos, M. R. Association of physical activity levels and the prevalence of COVID-19-associated hospitalization. *J. Sci. Med. Sport* **2021**, *24*, 913, doi:10.1016/J.JSAMS.2021.05.011.
12. Salgado-Aranda, R.; Pérez-Castellano, N.; Núñez-Gil, I.; Orozco, A. J.; Torres-Esquivel, N.; Flores-Soler, J.; Chamaisse-Akari, A.; Mclnerney, A.; Vergara-Uzcategui, C.; Wang, L.; González-Ferrer, J. J.; Filgueiras-Rama, D.; Cañadas-Godoy, V.; Macaya-Miguel, C.; Pérez-Villacastín, J. Influence of Baseline Physical Activity as a Modifying Factor on COVID-19 Mortality: A Single-Center, Retrospective Study. *Infect. Dis. Ther.* **2021**, *10*, 801–814, doi:10.1007/S40121-021-00418-6.
13. Sallis, R.; Young, D. R.; Tartof, S. Y.; Sallis, J. F.; Sall, J.; Li, Q.; Smith, G. N.; Cohen, D. A. Physical inactivity is associated with a higher risk for severe COVID-19 outcomes: a study in 48 440 adult patients. *Br. J. Sports Med.* **2021**, *55*, 1099–1105, doi:10.1136/BJSPORTS-2021-104080.
14. Després, J. P. Severe COVID-19 outcomes — the role of physical activity. *Nat. Rev. Endocrinol.* **2021**, *17*, 451–452, doi:10.1038/s41574-021-00521-1.
15. Vancini, R. L.; Camargo-Neto, L.; de Lira, C. A. B.; Andrade, M. S.; Viana, R. B.; Nikolaidis, P. T.; Knechtle, B.; Gentil, P.; Piacezzi, L. H. V.; Lopes, M. C. B. T.; Batista, R. E. A.; Vancini-Campanharo, C. R. Physical activity and sociodemographic profile of brazilian people during COVID-19 outbreak: An online and cross-sectional survey. *Int. J. Environ. Res. Public Health* **2020**, *17*, 1–9, doi:10.3390/IJERPH17217964.
16. Cheval, B.; Sieber, S.; Maltagliati, S.; Millet, G. P.; Formánek, T.; Chalabaev, A.; Cullati, S.; Boisgontier, M. P. Muscle strength is associated with COVID-19 hospitalization in adults 50 years of age or older. *J. Cachexia. Sarcopenia Muscle* **2021**, *12*, 1136–1143, doi:10.1002/JCSM.12738.
17. Maltagliati, S.; Sieber, S.; Sarrazin, P.; Cullati, S.; Chalabaev, A.; Millet, G. P.; Boisgontier, M. P.; Cheval, B. Muscle strength explains the protective effect of physical activity against COVID-19 hospitalization among adults aged 50 years and older. *J. Sports Sci.* **2021**, *39*, 2796–2803, doi:10.1080/02640414.2021.1964721.
18. Kara, Ö.; Kara, M.; Akın, M. E.; Özçakar, L. Grip strength as a predictor of disease severity in hospitalized COVID-19 patients. **2021**, *50*, 743–747.
19. Peçanha, T.; Goessler, K. F.; Roschel, H.; Gualano, B. Social isolation during the covid-19 pandemic can increase physical inactivity and the global burden of cardiovascular disease. *Am. J. Physiol. Circ. Physiol.* **2020**, *318*, doi:10.1152/ajpheart.00268.2020.
20. Silva, L. R. B.; Seguro, C. S.; de Oliveira, C. G. A.; Santos, P. O. S.; de Oliveira, J. C. M.; de Souza Filho, L. F. M.; de Paula Júnior, C. A.; Gentil, P.; Rebelo, A. C. S. Physical Inactivity Is Associated With Increased Levels of Anxiety, Depression, and Stress in Brazilians During the COVID-19 Pandemic: A Cross-Sectional Study. *Front. Psychiatry* **2020**, *11*, 565291, doi:10.3389/fpsyt.2020.565291.
21. Kirwan, R.; McCullough, D.; Butler, T.; Perez de Heredia, F.; Davies, I. G.; Stewart, C. Sarcopenia during COVID-19 lockdown restrictions: long-term health effects of short-term muscle loss. *GeroScience* **2020**, *42*, 1547–1578, doi:10.1007/S11357-020-00272-3.
22. Kreutz, R.; Algharably, E. A. E. H.; Azizi, M.; Dobrowolski, P.; Guzik, T.; Januszewicz, A.; Persu, A.; Prejbisz, A.; Riemer, T. G.; Wang, J. G.; Burnier, M. Hypertension, the renin-angiotensin system, and the risk of lower respiratory tract infections and lung injury: Implications for covid-19. *Cardiovasc. Res.* **2020**, *116*, 1688–1699, doi:10.1093/cvr/cvaa097.
23. Li, Y. C.; Bai, W. Z.; Hashikawa, T. The neuroinvasive potential of SARS-CoV2 may play a role in the respiratory failure of COVID-19 patients. *J. Med. Virol.* 2020, *92*, 552–555.
24. Trinity, J. D.; Craig, J. C.; Fermoyle, C. C.; McKenzie, A. I.; Lewis, M. T.; Park, S. H.; Rondina, M. T.; Richardson, R. S. Impact of presymptomatic COVID-19 on vascular and skeletal muscle function: a case study. *J. Appl. Physiol.* **2021**, *130*, 1961–1970, doi:10.1152/JAPPLPHYSIOL.00236.2021.
25. Logue, J. K.; Franko, N. M.; McCulloch, D. J.; McConald, D.; Magedson, A.; Wolf, C. R.; Chu, H. Y. Sequelae in Adults at 6 Months after COVID-19 Infection. *JAMA Netw. Open* **2021**, *4*, 10–13, doi:10.1001/jamanetworkopen.2021.0830.

26. Bellan, M.; Baricich, A.; Patrucco, F.; Zeppegno, P.; Gramaglia, C.; Balbo, P. E.; Carriero, A.; Amico, C. S.; Avanzi, G. C.; Barini, M.; Battaglia, M.; Bor, S.; Cantaluppi, V.; Cappellano, G.; Ceruti, F.; Chiocchetti, A.; Clivati, E.; Giordano, M.; Cuneo, D.; Gambaro, E.; Gattoni, E.; Loro, A.; Manfredi, M.; Morosini, U.; Murano, F.; Paracchini, E.; Patti, G.; Pinato, D. J.; Raineri, D.; Rolla, R.; Sainaghi, P. P.; Tricca, S.; Pirisi, M. Long-term sequelae are highly prevalent one year after hospitalization for severe COVID-19. *Sci. Rep.* **2021**, *11*, 1–10, doi:10.1038/s41598-021-01215-4.
27. Barker-Davies, R. M.; O'Sullivan, O.; Senaratne, K. P. P.; Baker, P.; Cranley, M.; Dharm-Datta, S.; Ellis, H.; Goodall, D.; Gough, M.; Lewis, S.; Norman, J.; Papadopoulou, T.; Roscoe, D.; Sherwood, D.; Turner, P.; Walker, T.; Mistlin, A.; Phillip, R.; Nicol, A. M.; Bennett, A. N.; Bahadur, S. The Stanford Hall consensus statement for post-COVID-19 rehabilitation. *Br. J. Sports Med.* **2020**, *54*, 949–959, doi:10.1136/bjsports-2020-102596.
28. Gerth, A. M. J.; Hatch, R. A.; Young, J. D.; Watkinson, P. J. Changes in health-related quality of life after discharge from an intensive care unit: a systematic review. *Anaesthesia* 2019, *74*, 100–108.
29. Fragala, M. S.; Cadore, E. L.; Dorgo, S.; Izquierdo, M.; Kraemer, W. J.; Peterson, M. D.; Ryan, E. D. *Resistance Training for Older Adults: Position Statement From the National Strength and Conditioning Association*; NLM (Medline), 2019; Vol. 33, pp. 2019–2052;.
30. ACSM American College of Sports Medicine position stand. Progression models in resistance training for healthy adults. *Med Sci Sport. Exerc* **2009**, *41*, 687–708.
31. Garber, C. E.; Blissmer, B.; Deschenes, M. R.; Franklin, B. A.; Lamonte, M. J.; Lee, I. M.; Nieman, D. C.; Swain, D. P. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: Guidance for prescribing exercise. *Med. Sci. Sports Exerc.* **2011**, *43*, 1334–1359, doi:10.1249/MSS.0b013e318213fefb.
32. Artero, E. G.; Lee, D. C.; Ruiz, J. R.; Sui, X.; Ortega, F. B.; Church, T. S.; Lavie, C. J.; Castillo, M. J.; Blair, S. N. A prospective study of muscular strength and all-cause mortality in men with hypertension. *J Am Coll Cardiol* **2011**, *57*, 1831–1837, doi:10.1016/j.jacc.2010.12.025.
33. Ruiz, J. R.; Sui, X.; Lobelo, F.; Morrow, J. R.; Jackson, A. W.; Sjöström, M.; Blair, S. N. Association between muscular strength and mortality in men: prospective cohort study. *BMJ* **2008**, *337*, a439, doi:10.1136/bmj.a439.
34. Hardee, J. P.; Porter, R. R.; Sui, X.; Archer, E.; Lee, I. M.; Lavie, C. J.; Blair, S. N. The effect of resistance exercise on all-cause mortality in cancer survivors. *Mayo Clin. Proc.* **2014**, *89*, 1108–1115, doi:10.1016/j.mayocp.2014.03.018.
35. Dankel, S. J.; Loenneke, J. P.; Loprinzi, P. D. Determining the Importance of Meeting Muscle-Strengthening Activity Guidelines: Is the Behavior or the Outcome of the Behavior (Strength) a More Important Determinant of All-Cause Mortality? *Mayo Clin. Proc.* **2016**, *91*, 166–74, doi:10.1016/j.mayocp.2015.10.017.
36. Ortega, F. B.; Silventoinen, K.; Tynelius, P.; Rasmussen, F. Muscular strength in male adolescents and premature death: cohort study of one million participants. *BMJ* **2012**, *345*, e7279, doi:10.1136/bmj.e7279bmj.e7279 [pii].
37. Af Geijerstam, A.; Mehlig, K.; Börjesson, M.; Robertson, J.; Nyberg, J.; Adiels, M.; Rosengren, A.; Åberg, M.; Lissner, L. Fitness, strength and severity of COVID-19: a prospective register study of 1 559 187 Swedish conscripts. *BMJ Open* **2021**, *11*, doi:10.1136/BMJOPEN-2021-051316.
38. Shahid, Z.; Kalayanamitra, R.; McClafferty, B.; Kepko, D.; Ramgobin, D.; Patel, R.; Aggarwal, C. S.; Vunnam, R.; Sahu, N.; Bhatt, D.; Jones, K.; Golamari, R.; Jain, R. COVID -19 and Older Adults: What We Know . *J. Am. Geriatr. Soc.* **2020**, *68*, doi:10.1111/jgs.16472.
39. Muniyappa, R.; Gubbi, S. COVID-19 Pandemic, Corona Viruses, and Diabetes Mellitus. *Am. J. Physiol. Endocrinol. Metab.* 2020.
40. Singh, A. K.; Gupta, R.; Misra, A. Comorbidities in COVID-19: Outcomes in hypertensive cohort and controversies with renin angiotensin system blockers. *Diabetes Metab. Syndr. Clin. Res. Rev.* **2020**, *14*, 283–287, doi:10.1016/j.dsx.2020.03.016.
41. Zhou, F.; Yu, T.; Du, R.; Fan, G.; Liu, Y.; Liu, Z.; Xiang, J.; Wang, Y.; Song, B.; Gu, X.; Guan, L.; Wei, Y.; Li, H.; Wu, X.; Xu, J.; Tu, S.; Zhang, Y.; Chen, H.; Cao, B. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* **2020**, *395*, 1054–1062, doi:10.1016/S0140-6736(20)30566-3.
42. Salerno, M.; Sessa, F.; Piscopo, A.; Montana, A.; Torrisi, M.; Patanè, F.; Murabito, P.; Volti, G. L.; Pomara, C. No Autopsies on COVID-19 Deaths: A Missed Opportunity and the Lockdown of Science. *J. Clin. Med.* **2020**, *9*, doi:10.3390/jcm9051472.
43. MacDonald, H. V.; Johnson, B. T.; Huedo-Medina, T. B.; Livingston, J.; Forsyth, K. C.; Kraemer, W. J.; Farinatti, P. T. V.; Pescatello, L. S. Dynamic resistance training as stand-alone antihypertensive lifestyle therapy: A meta-analysis. *J. Am. Heart Assoc.* **2016**, *5*, doi:10.1161/JAHA.116.003231.
44. Seguro, C. S.; Rebelo, A. C. S.; Silva, A. G.; dos Santos, M. M. A.; Cardoso, J. S.; Apolinário, V.; Jardim, P. C. V.; Gentil, P. Use of low volume, high effort resistance training to manage blood pressure in hypertensive patients inside a public hospital: a proof of concept study. *Eur. J. Transl. Myol.* **2021**, *31*, 2021, doi:10.4081/EJTM.2021.9547.
45. Codella, R.; Ialacqua, M.; Terruzzi, I.; Luzi, L. May the force be with you: why resistance training is essential for subjects with type 2 diabetes mellitus without complications. *Endocrine* 2018, *62*, 14–25.
46. Paoli, A.; Moro, T.; Bianco, A. Lift weights to fight overweight. *Clin Physiol Funct Imaging* **2014**, doi:10.1111/cpf.12136.
47. Mann, S.; Beedie, C.; Jimenez, A. Differential Effects of Aerobic Exercise, Resistance Training and Combined Exercise Modalities on Cholesterol and the Lipid Profile: Review, Synthesis and Recommendations. *Sports Med.* **2014**, *44*, 211, doi:10.1007/S40279-013-0110-5.

48. Nieman, D. C.; Wentz, L. M. The compelling link between physical activity and the body's defense system. *J. Sport Heal. Sci.* **2019**, *8*, 201–217, doi:10.1016/j.jshs.2018.09.009.
49. Peake, J. M.; Neubauer, O.; Walsh, N. P.; Simpson, R. J. Recovery of the immune system after exercise. *J. Appl. Physiol.* 2017, *122*, 1077–1087.
50. Pedersen, B. K.; Rohde, T.; Ostrowski, K. Recovery of the immune system after exercise. In *Acta Physiologica Scandinavica*; 1998; Vol. 162, pp. 325–332.
51. Souza, D.; Vale, A. F.; Silva, A.; Araújo, M. A. S.; de Paula Júnior, C. A.; de Lira, C. A. B.; Ramirez-Campillo, R.; Martins, W.; Gentil, P. Acute and Chronic Effects of Interval Training on the Immune System: A Systematic Review with Meta-Analysis. *Biology (Basel).* **2021**, *10*, doi:10.3390/BIOLOGY10090868.
52. Matthews, C. E.; Ockene, I. S.; Freedson, P. S.; Rosal, M. C.; Merriam, P. A.; Hebert, J. R. Moderate to vigorous physical activity and risk of upper-respiratory tract infection. *Med. Sci. Sports Exerc.* **2002**, *34*, 1242–1248, doi:10.1097/00005768-200208000-00003.
53. Fondell, E.; Lagerros, Y. T.; Sundberg, C. J.; Lekander, M.; Bölter, O.; Rothman, K. J.; Bölter, K. Physical activity, stress, and self-reported upper respiratory tract infection. *Med. Sci. Sports Exerc.* **2011**, *43*, 272–279, doi:10.1249/MSS.0B013E3181EDF108.
54. Nieman, D. C.; Henson, D. A.; Austin, M. D.; Sha, W. Upper respiratory tract infection is reduced in physically fit and active adults. *Br. J. Sports Med.* **2011**, *45*, 987–992.
55. Horn, P. L.; Pyne, D. B.; Hopkins, W. G.; Barnes, C. J. Lower white blood cell counts in elite athletes training for highly aerobic sports. *Eur. J. Appl. Physiol.* **2010**, *110*, 925–932, doi:10.1007/s00421-010-1573-9.
56. Timpka, T.; Jacobsson, J.; Bargoria, V.; Périard, J. D.; Racinais, S.; Ronsen, O.; Halje, K.; Andersson, C.; Dahlström, Ö.; Spreco, A.; Edouard, P.; Alonso, J. M. Preparticipation predictors for championship injury and illness: Cohort study at the Beijing 2015 International Association of Athletics Federations World Championships. *Br. J. Sports Med.* **2017**, *51*, 272–277, doi:10.1136/bjsports-2016-096580.
57. Alonso, J. M.; Tscholl, P. M.; Engebretsen, L.; Mountjoy, M.; Dvorak, J.; Junge, A. Occurrence of injuries and illnesses during the 2009 IAAF World Athletics Championships. *Br. J. Sports Med.* **2010**, *44*, 1100–1105, doi:10.1136/bjsm.2010.078030.
58. Alonso, J. M.; Edouard, P.; Fischetto, G.; Adams, B.; Depiesse, F.; Mountjoy, M. Determination of future prevention strategies in elite track and field: Analysis of Daegu 2011 IAAF Championships injuries and illnesses surveillance. *Br. J. Sports Med.* **2012**, *46*, 505–514, doi:10.1136/bjsports-2012-091008.
59. Nieman, D. C. Marathon training and immune function. In *Sports Medicine*; Adis International Ltd., 2007; Vol. 37, pp. 412–415.
60. Gentil, P.; de Lira, C. A. B.; Coswig, V.; Barroso, W. K. S.; Vitorino, P. V. de O.; Ramirez-Campillo, R.; Martins, W.; Souza, D. Practical Recommendations Relevant to the Use of Resistance Training for COVID-19 Survivors. *Front. Physiol.* **2021**, *12*, doi:10.3389/FPHYS.2021.637590.
61. Gentil, P.; Ramirez-Campillo, R.; Souza, D. C. Resistance training in face of the coronavirus outbreak: time to think outside the box. *Front. Physiol.* **2020**, (in press).
62. Carraro, U.; Marcante, A.; Ravara, B.; Albertin, G.; Maccarone, M. C.; Piccione, F.; Kern, H.; Masiero, S. Skeletal muscle weakness in older adults home-restricted due to COVID-19 pandemic: a role for full-body in-bed gym and functional electrical stimulation. *Aging Clin. Exp. Res.* **2021**, *33*, 2053–2059, doi:10.1007/S40520-021-01885-0.
63. Chaabene, H.; Prieske, O.; Herz, M.; Moran, J.; Höhne, J.; Kliegl, R.; Ramirez-Campillo, R.; Behm, D. G.; Hortobágyi, T.; Granacher, U. Home-based exercise programmes improve physical fitness of healthy older adults: A PRISMA-compliant systematic review and meta-analysis with relevance for COVID-19. *Ageing Res. Rev.* **2021**, *67*, doi:10.1016/J.ARR.2021.101265.
64. Jang, S.; Han, S. H.; Rhee, J.-Y. Cluster of Coronavirus Disease Associated with Fitness Dance Classes, South Korea. *Emerg. Infect. Dis.* **2020**, *26*, doi:10.3201/eid2608.200633.
65. Helsingen, L. M.; Løberg, M.; Refsum, E.; Gjøstein, D. K.; Wieszczy, P.; Olsvik, Ø.; Juul, F. E.; Barua, I.; Jodal, H. C.; Herfindal, M.; Mori, Y.; Jore, S.; Lund-Johansen, F.; Fretheim, A.; Bretthauer, M.; Kalager, M.; Aalby, A.; Berli, M.; Furholm, S.; Horvli, A. L.; Norum, L.; Lauvstad, H.; Somogyi, J.; Myers, A.; Poulsson, T.; Evertsen, W.; Sandvoll, H.; Oppen, K. Covid-19 transmission in fitness centers in Norway - a randomized trial. *BMC Public Health* **2021**, *21*, 1–9, doi:10.1186/S12889-021-12073-0/FIGURES/3.
66. Kikuchi, N.; Nakazato, K. Low-load bench press and push-up induce similar muscle hypertrophy and strength gain. *J. Exerc. Sci. Fit.* **2017**, *15*, 37–42, doi:10.1016/j.jesf.2017.06.003.
67. Calatayud, J.; Borreani, S.; Colado, J. C.; Martin, F.; Tella, V.; Andersen, L. L. Bench press and push-up at comparable levels of muscle activity results in similar strength gains. *J. Strength Cond. Res.* **2015**, *29*, 246–253, doi:10.1519/JSC.0000000000000589.
68. Soligon, S. D.; da Silva, D. G.; Bergamasco, J. G. A.; Angleri, V.; Júnior, R. A. M.; Dias, N. F.; Nóbrega, S. R.; de Castro Cesar, M.; Libardi, C. A. Suspension training vs. traditional resistance training: effects on muscle mass, strength and functional performance in older adults. *Eur. J. Appl. Physiol.* **2020**, *120*, 2223–2232, doi:10.1007/s00421-020-04446-x.
69. Silva, M. H.; Andre Barbosa De Lira, C.; Steele, J.; Fisher, J. P.; Mota, J. F.; Gomes, A. C.; Gentil, P. Cycle ergometer training and resistance training similarly increase muscle strength in trained men. *J. Sports Sci.* **2021**, doi:10.1080/02640414.2021.2005282.

70. Morris, S. J.; Oliver, J. L.; Pedley, J. S.; Haff, G. G.; Lloyd, R. S. Comparison of Weightlifting, Traditional Resistance Training and Plyometrics on Strength, Power and Speed: A Systematic Review with Meta-Analysis. *Sports Med.* **2022**, doi:10.1007/S40279-021-01627-2.
71. Martins, W. R.; de Oliveira, R. J.; Carvalho, R. S.; de Oliveira Damasceno, V.; da Silva, V. Z. M.; Silva, M. S. Elastic resistance training to increase muscle strength in elderly: A systematic review with meta-analysis. *Arch. Gerontol. Geriatr.* **2013**, *57*, 8–15, doi:10.1016/j.archger.2013.03.002.
72. Souza, D.; Barbalho, M.; Vieira, C. A.; Martins, W. R.; Cadore, E. L.; Gentil, P. Minimal dose resistance training with elastic tubes promotes functional and cardiovascular benefits to older women. *Exp. Gerontol.* **2019**, *115*, 132–138, doi:10.1016/j.exger.2018.12.001.
73. Colado, J. C.; Garcia-Masso, X.; Pellicer, M.; Alakhdar, Y.; Benavent, J.; Cabeza-Ruiz, R. A comparison of elastic tubing and isotonic resistance exercises. *Int. J. Sports Med.* **2010**, *31*, 810–817, doi:10.1055/s-0030-1262808.
74. Gentil, P.; Bottaro, M.; Noll, M.; Werner, S.; Vasconcelos, J. C.; Seffrin, A.; Campos, M. H. Muscle activation during resistance training with no external load - effects of training status, movement velocity, dominance, and visual feedback. *Physiol. Behav.* **2017**, *179*, doi:10.1016/j.physbeh.2017.06.004.
75. Barbalho, M.; Coswig, V. S.; Bottaro, M.; De Lira, C. A. B.; Campos, M. H.; Vieira, C. A.; Gentil, P. "nO LOAD" resistance training increases functional capacity and muscle size in hospitalized female patients: A pilot study. *Eur. J. Transl. Myol.* **2019**, *29*, 302–306, doi:10.4081/ejtm.2019.8492.
76. Counts, B. R.; Buckner, S. L.; Dankel, S. J.; Jessee, M. B.; Mattocks, K. T.; Mouser, J. G.; Laurentino, G. C.; Loenneke, J. P. The acute and chronic effects of "NO LOAD" resistance training. *Physiol. Behav.* **2016**, *164*, 345–352, doi:10.1016/j.physbeh.2016.06.024.
77. Gentil, P.; Soares, S.; Bottaro, M. Single vs. Multi-Joint Resistance Exercises: Effects on Muscle Strength and Hypertrophy. *Asian J Sport. Med* **2015**, *6*, e24057, doi:10.5812/asjsm.24057.
78. Paoli, A.; Gentil, P.; Moro, T.; Marcolin, G.; Bianco, A. Resistance training with single vs. multi-joint exercises at equal total load volume: Effects on body composition, cardiorespiratory fitness, and muscle strength. *Front. Physiol.* **2017**, *8*, doi:10.3389/fphys.2017.01105.
79. Barbalho, M.; Coswig, V.; Souza, D.; Serrão, J. C.; Campos, M. H.; Gentil, P. Back Squat vs. Hip Thrust Resistance-training Programs in Well-trained Women. *Int. J. Sports Med.* **2020**, doi:10.1055/a-1082-1126.
80. Barbalho, M.; Souza, D.; Coswig, V.; Steele, J.; Fisher, J.; Abrahin, O.; Paoli, A.; Gentil, P. The Effects of Resistance Exercise Selection on Muscle Size and Strength in Trained Women. *Int. J. Sports Med.* **2020**, doi:10.1055/a-1121-7736.
81. Gentil, P.; Fisher, J.; Steele, J. A Review of the Acute Effects and Long-Term Adaptations of Single- and Multi-Joint Exercises during Resistance Training. *Sport. Med.* **2017**, *47*, 843–855, doi:10.1007/s40279-016-0627-5.
82. Gentil, P.; Soares, S. R.; Pereira, M. C.; Cunha, R. R.; Martorelli, S. S.; Martorelli, A. S.; Bottaro, M. Effect of adding single-joint exercises to a multi-joint exercise resistance-training program on strength and hypertrophy in untrained subjects. *Appl Physiol Nutr Metab* **2013**, *38*, 341–344, doi:10.1139/apnm-2012-0176.
83. de França, H. S.; Branco, P. A. N.; Guedes Junior, D. P.; Gentil, P.; Steele, J.; Teixeira, C. V. L. S. The Effects of Adding Single-Joint Exercises To a Multi-Joint Exercise Resistance Training Program on Upper Body Muscle Strength and Size in Trained Men. *Appl. Physiol. Nutr. Metab.* **2015**, *826*, 150409143403004, doi:10.1139/apnm-2015-0109.
84. Carneiro, L.; Rosenbaum, S.; Ward, P. B.; Clemente, F. M.; Ramirez-Campillo, R.; Monteiro-Júnior, R. S.; Martins, A.; Afonso, J. Web-based exercise interventions for patients with depressive and anxiety disorders: a systematic review of randomized controlled trials. *Rev. Bras. Psiquiatr.* **2021**, doi:10.1590/1516-4446-2021-2026.
85. WHO Considerations for public health and social measures in the workplace in the context of COVID-19 Available online: https://www.who.int/publications-detail/considerations-for-public-health-and-social-measures-in-the-workplace-in-the-context-of-covid-19 (accessed on May 22, 2020).
86. WHO Q&A on coronaviruses (COVID-19) Available online: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/q-a-coronaviruses (accessed on May 22, 2020).
87. Johnson, A. T. Respirator masks protect health but impact performance: A review. *J. Biol. Eng.* **2016**, *10*, doi:10.1186/s13036-016-0025-4.
88. Roberge, R. J.; Coca, A.; Williams, W. J.; Palmiero, A. J.; Powell, J. B. Surgical mask placement over N95 filtering facepiece respirators: physiological effects on healthcare workers. *Respirology* **2010**, *15*, 516–21, doi:10.1111/j.1440-1843.2010.01713.x.
89. Fikenzer, S.; Uhe, T.; Lavall, D.; Rudolph, U.; Falz, R.; Busse, M.; Hepp, P.; Laufs, U. Effects of surgical and FFP2/N95 face masks on cardiopulmonary exercise capacity. *Clin. Res. Cardiol.* **2020**, 1–9, doi:10.1007/s00392-020-01704-y.
90. Teodoro, C. L.; Gáspari, A. F.; Berton, R.; Barbieri, J. F.; Silva, M.; A A Castaño, L.; Guimarães, P.; Moraes, A. C. Familiarization With Airflow-Restriction Mask During Resistance Exercise: Effect on Tolerance and Total Volume. *J. strength Cond. Res.* **2019**, *33*, 1762–1765, doi:10.1519/JSC.0000000000002828.
91. Garnacho-Castaño, M. V.; Dominguez, R.; Maté-Muñoz, J. L. Understanding the meaning of lactate threshold in resistance exercises. *Int. J. Sports Med.* **2015**, *36*, 371–377, doi:10.1055/s-0034-1398495.
92. Albesa-Albiol, L.; Serra-Payá, N.; Garnacho-Castaño, M. A.; Cano, L. G.; Cobo, E. P.; Maté-Muñoz, J. L.; Garnacho-Castaño,

M. V. Ventilatory efficiency during constant-load test at lactate threshold intensity: Endurance versus resistance exercises. *PLoS One* **2019**, *14*, e0216824, doi:10.1371/journal.pone.0216824.

93. Houchen-Wolloff, L.; Sandland, C. J.; Harrison, S. L.; Menon, M. K.; Morgan, M. D.; Steiner, M. C.; Singh, S. J. Ventilatory requirements of quadriceps resistance training in people with COPD and healthy controls. *Int. J. COPD* **2014**, *9*, 589–595, doi:10.2147/COPD.S59164.
94. Ramos-Campo, D. J.; Pérez-Piñero, S.; Muñoz-Carrillo, J. C.; López-Román, F. J.; García-Sánchez, E.; Ávila-Gandía, V. Acute Effects of Surgical and FFP2 Face Masks on Physiological Responses and Strength Performance in Persons with Sarcopenia. *Biology (Basel).* **2021**, *10*, doi:10.3390/BIOLOGY10030213.
95. Rosa, B. V.; Rossi, F. E.; Moura, H. P. dos S. N. de; Santos, A. M. da S.; Véras-Silva, A. S.; Ribeiro, S. L. G.; Nakamura, F. Y.; Pereira dos Santos, M. A. Effects of FFP2/N95 face mask on low- and high-load resistance exercise performance in recreational weight lifters. *Eur. J. Sport Sci.* **2021**, doi:10.1080/17461391.2021.1953613.
96. Kampf, G.; Todt, D.; Pfaender, S.; Steinmann, E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. *J. Hosp. Infect.* 2020, *104*, 246–251.
97. van Doremalen, N.; Bushmaker, T.; Morris, D. H.; Holbrook, M. G.; Gamble, A.; Williamson, B. N.; Tamin, A.; Harcourt, J. L.; Thornburg, N. J.; Gerber, S. I.; Lloyd-Smith, J. O.; de Wit, E.; Munster, V. J. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *N. Engl. J. Med.* 2020, *382*.
98. Lewis, D. COVID-19 rarely spreads through surfaces. So why are we still deep cleaning? *Nature* **2021**, *590*, 26–28, doi:10.1038/D41586-021-00251-4.
99. Ali, A. M.; Kunugi, H. Skeletal Muscle Damage in COVID-19: A Call for Action. *Medicina (Kaunas).* **2021**, *57*, doi:10.3390/MEDICINA57040372.
100. Andrade-Junior, M. C. de; Salles, I. C. D. de; de Brito, C. M. M.; Pastore-Junior, L.; Righetti, R. F.; Yamaguti, W. P. Skeletal Muscle Wasting and Function Impairment in Intensive Care Patients With Severe COVID-19. *Front. Physiol.* **2021**, *12*, doi:10.3389/FPHYS.2021.640973.
101. Tuzun, S.; Keles, A.; Okutan, D.; Yildiran, T.; Palamar, D. Assessment of musculoskeletal pain, fatigue and grip strength in hospitalized patients with COVID-19. *Eur. J. Phys. Rehabil. Med.* **2021**, *57*, 653–662, doi:10.23736/S1973-9087.20.06563-6.
102. Medrinal, C.; Prieur, G.; Bonnevie, T.; Gravier, F. E.; Mayard, D.; Desmalles, E.; Smondack, P.; Lamia, B.; Combret, Y.; Fossat, G. Muscle weakness, functional capacities and recovery for COVID-19 ICU survivors. *BMC Anesthesiol.* **2021**, *21*, doi:10.1186/S12871-021-01274-0.
103. Osthoff, A. K. R.; Taeymans, J.; Kool, J.; Marcar, V.; Van Gestel, A. J. R. Association between peripheral muscle strength and daily physical activity in patients with COPD: A systematic literature review and meta-analysis. *J. Cardiopulm. Rehabil. Prev.* 2013, *33*, 351–359.
104. Swallow, E. B.; Reyes, D.; Hopkinson, N. S.; Man, W. D. C.; Porcher, R.; Cetti, E. J.; Moore, A. J.; Moxham, J.; Polkey, M. I. Quadriceps strength predicts mortality in patients with moderate to severe chronic obstructive pulmonary disease. *Thorax* **2007**, *62*, 115–120, doi:10.1136/thx.2006.062026.
105. Gil, S.; Jacob Filho, W.; Shinjo, S. K.; Ferriolli, E.; Busse, A. L.; Avelino-Silva, T. J.; Longobardi, I.; de Oliveira Júnior, G. N.; Swinton, P.; Gualano, B.; Roschel, H.; Bonfá, E.; Utiyama, E.; Segurado, A.; Perondi, B.; Morais, A. M.; Montal, A.; Letaif, L.; Fusco, S.; Rodrigues da Silva, M. F.; Rocha, M.; Marcilio, I.; Rios, I. C.; Ogihara Kawano, F. Y.; de Jesus, M. A.; Kallas, C. G.; Carmo, C.; Tanaka, C.; de Souza, H. P.; Marchini, J. F. M.; Carvalho, C.; Ferreira, J. C.; Levin, A. S. S.; de Oliveira, M. S.; Guimarães, T.; dos Santos Lázari, C.; da Silva Duarte, A. J.; Sabino, E.; Chaves Magri, M. M.; Barros-Filho, T. E. P.; Peres Braido Francisco, M. C. Muscle strength and muscle mass as predictors of hospital length of stay in patients with moderate to severe COVID-19: a prospective observational study. *J. Cachexia. Sarcopenia Muscle* **2021**, *12*, 1871–1878, doi:10.1002/JCSM.12789.
106. Rice, H.; Harrold, M.; Fowler, R.; Watson, C.; Waterer, G.; Hill, K. Exercise training for adults hospitalized with an acute respiratory condition: a systematic scoping review. *Clin. Rehabil.* 2020, *34*, 45–55.
107. Troosters, T.; Probst, V. S.; Crul, T.; Pitta, F.; Gayan-Ramirez, G.; Decramer, M.; Gosselink, R. Resistance training prevents deterioration in quadriceps muscle function during acute exacerbations of chronic obstructive pulmonary disease. *Am. J. Respir. Crit. Care Med.* **2010**, *181*, 1072–1077, doi:10.1164/rccm.200908-1203OC.
108. Ozyemisci Taskiran, O.; Turan, Z.; Tekin, S.; Senturk, E.; Topaloglu, M.; Yurdakul, F.; Ergonul, O.; Cakar, N. Physical rehabilitation in Intensive Care Unit in acute respiratory distress syndrome patients with COVID-19. *Eur. J. Phys. Rehabil. Med.* **2021**, *57*, 434–442, doi:10.23736/S1973-9087.21.06551-5.
109. Sosnowski, K.; Lin, F.; Mitchell, M. L.; White, H. Early rehabilitation in the intensive care unit: An integrative literature review. *Aust. Crit. Care* 2015, *28*, 216–225.
110. José, A.; Dal Corso, S. Inpatient rehabilitation improves functional capacity, peripheral muscle strength and quality of life in patients with community-acquired pneumonia: A randomised trial. *J. Physiother.* **2016**, *62*, 96–102, doi:10.1016/j.jphys.2016.02.014.
111. Li, N.; Li, P.; Lu, Y.; Wang, Z.; Li, J.; Liu, X.; Wu, W. Effects of resistance training on exercise capacity in elderly patients with chronic obstructive pulmonary disease: a meta-analysis and systematic review. *Aging Clin. Exp. Res.* 2019.

112. Liao, W. H.; Chen, J. W.; Chen, X.; Lin, L.; Yan, H. Y.; Zhou, Y. Q.; Chen, R. Impact of resistance training in subjects with COPD: A systematic review and meta-analysis. *Respir. Care* **2015**, *60*, 1130–1145, doi:10.4187/respcare.03598.
113. Davis, J. M.; Kohut, M. L.; Colbert, L. H.; Jackson, D. A.; Ghaffar, A.; Mayer, E. P. Exercise, alveolar macrophage function, and susceptibility to respiratory infection. *J. Appl. Physiol.* **1997**, *83*, 1461–1466, doi:10.1152/jappl.1997.83.5.1461.
114. Castelli, V.; Cimini, A.; Ferri, C. Cytokine Storm in COVID-19: "When You Come Out of the Storm, You Won't Be the Same Person Who Walked in." *Front. Immunol.* **2020**, *11*, 8–11, doi:10.3389/fimmu.2020.02132.
115. Chen, G.; Wu, D.; Guo, W.; Cao, Y.; Huang, D.; Wang, H.; Wang, T.; Zhang, X.; Chen, H.; Yu, H.; Zhang, X.; Zhang, M.; Wu, S.; Song, J.; Chen, T.; Han, M.; Li, S.; Luo, X.; Zhao, J.; Ning, Q. Clinical and immunological features of severe and moderate coronavirus disease 2019. *J. Clin. Invest.* **2020**, *130*, 2620–2629, doi:10.1172/JCI137244.
116. Santiago, L. Ăngelo M.; Neto, L. G. L.; Pereira, G. B.; Leite, R. D.; Mostarda, C. T.; De Oliveira Brito Monzani, J.; Sousa, W. R.; Pinheiro, A. J. M. R.; Navarro, F. Effects of resistance training on immunoinflammatory response, TNF-alpha gene expression, and body composition in elderly women. *J. Aging Res.* **2018**, *2018*, doi:10.1155/2018/1467025.
117. Lammers, M. D.; Anéli, N. M.; de Oliveira, G. G.; de Oliveira Maciel, S. F. V.; Zanini, D.; Mânica, A.; de Resende e Silva, D. T.; Bagatini, M. D.; Sévigny, J.; De Sá, C. A.; Manfredi, L. H.; Cardoso, A. M. The anti-inflammatory effect of resistance training in hypertensive women. *J. Hypertens.* **2020**, *Publish Ah*, 1–11, doi:10.1097/hjh.0000000000002578.
118. Chupel, M. U.; Direito, F.; Furtado, G. E.; Minuzzi, L. G.; Pedrosa, F. M.; Colado, J. C.; Ferreira, J. P.; Filaire, E.; Teixeira, A. M. Strength training decreases inflammation and increases cognition and physical fitness in older women with cognitive impairment. *Front. Physiol.* **2017**, *8*, 1–13, doi:10.3389/fphys.2017.00377.
119. Stephen-Victor, E.; Das, M.; Karnam, A.; Pitard, B.; Gautier, J. F.; Bayry, J. Potential of regulatory T-cell-based therapies in the management of severe COVID-19. *Eur. Respir. J.* **2020**, *56*, 3–6, doi:10.1183/13993003.02182-2020.
120. Gladstone, D. E.; Kim, B. S.; Mooney, K.; Karaba, A. H.; D'Alessio, F. R. Regulatory T Cells for Treating Patients With COVID-19 and Acute Respiratory Distress Syndrome: Two Case Reports. *Ann. Intern. Med.* **2020**, 1–2, doi:10.7326/l20-0681.
121. Souza, P. S.; Gonçalves, E. D.; Pedroso, G. S.; Farias, H. R.; Junqueira, S. C.; Marcon, R.; Tuon, T.; Cola, M.; Silveira, P. C. L.; Santos, A. R.; Calixto, J. B.; Souza, C. T.; de Pinho, R. A.; Dutra, R. C. Physical Exercise Attenuates Experimental Autoimmune Encephalomyelitis by Inhibiting Peripheral Immune Response and Blood-Brain Barrier Disruption. *Mol. Neurobiol.* **2017**, *54*, 4723–4737, doi:10.1007/s12035-016-0014-0.
122. de Oliveira, M.; De Sibio, M. T.; Mathias, L. S.; Rodrigues, B. M.; Sakalem, M. E.; Nogueira, C. R. Irisin modulates genes associated with severe coronavirus disease (COVID-19) outcome in human subcutaneous adipocytes cell culture. *Mol. Cell. Endocrinol.* **2020**, *515*, doi:10.1016/J.MCE.2020.110917.
123. Fox, J.; Rioux, B. V.; Goulet, E. D. B.; Johanssen, N. M.; Swift, D. L.; Bouchard, D. R.; Loewen, H.; Sénéchal, M. Effect of an acute exercise bout on immediate post-exercise irisin concentration in adults: A meta-analysis. *Scand. J. Med. Sci. Sports* **2018**, *28*, 16–28, doi:10.1111/SMS.12904.
124. Cosio, P. L.; Crespo-Posadas, M.; Velarde-Sotres, Á.; Pelaez, M. Effect of Chronic Resistance Training on Circulating Irisin: Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Int. J. Environ. Res. Public Health* **2021**, *18*, 1–16, doi:10.3390/IJERPH18052476.
125. Steiner, M. C. Sarcopaenia in chronic obstructive pulmonary disease. *Thorax* 2007, *62*, 101–103.
126. Bone, A. E.; Hepgul, N.; Kon, S.; Maddocks, M. Sarcopenia and frailty in chronic respiratory disease: Lessons from gerontology. *Chron. Respir. Dis.* 2017, *14*, 85–99.
127. Tansey, C. M.; Louie, M.; Loeb, M.; Gold, W. L.; Muller, M. P.; De Jager, J. A.; Cameron, J. I.; Tomlinson, G.; Mazzulli, T.; Walmsley, S. L.; Rachlis, A. R.; Mederski, B. D.; Silverman, M.; Shainhouse, Z.; Ephtimios, I. E.; Avendano, M.; Downey, J.; Styra, R.; Yamamura, D.; Gerson, M.; Stanbrook, M. B.; Marras, T. K.; Phillips, E. J.; Zamel, N.; Richardson, S. E.; Slutsky, A. S.; Herridge, M. S. One-year outcomes and health care utilization in survivors of severe acute respiratory syndrome. *Arch. Intern. Med.* **2007**, *167*, 1312–1320, doi:10.1001/archinte.167.12.1312.
128. Herridge, M. S.; Cheung, A. M.; Tansey, C. M.; Matte-Martyn, A.; Diaz-Granados, N.; Al-Saidi, F.; Cooper, A. B.; Guest, C. B.; Mazer, C. D.; Mehta, S.; Stewart, T. E.; Barr, A.; Cook, D.; Slutsky, A. S. One-year outcomes in survivors of the acute respiratory distress syndrome. *N. Engl. J. Med.* **2003**, *348*, 683–693, doi:10.1056/NEJMoa022450.
129. Li, Z.; Cai, Y.; Zhang, Q.; Zhang, P.; Sun, R.; Jiang, H.; Wan, J.; Wu, F.; Wang, X.; Tao, X. Intensive care unit acquired weakness. *Medicine (Baltimore).* **2020**, *99*, e21926, doi:10.1097/MD.0000000000021926.
130. Pleguezuelos, E.; Del Carmen, A.; Llorensi, G.; Carcole, J.; Casarramona, P.; Moreno, E.; Ortega, P.; Serra-Prat, M.; Palomera, E.; Miravitlles, M. M.; Yebenes, J. C.; Boixeda, R.; Campins, L.; Villelabeitia-Jaureguizar, K.; Garnacho-Castaño, M. V. Severe loss of mechanical efficiency in COVID-19 patients. *J. Cachexia. Sarcopenia Muscle* **2021**, *12*, 1056–1063, doi:10.1002/JCSM.12739.
131. Paneroni, M.; Simonelli, C.; Saleri, M.; Bertacchini, L.; Venturelli, M.; Troosters, T.; Ambrosino, N.; Vitacca, M. Muscle Strength and Physical Performance in Patients Without Previous Disabilities Recovering From COVID-19 Pneumonia. *Am. J. Phys. Med. Rehabil.* **2021**, *100*, 105–109, doi:10.1097/PHM.0000000000001641.
132. Tanriverdi, A.; Savci, S.; Kahraman, B. O.; Ozpelit, E. Extrapulmonary features of post-COVID-19 patients: muscle function, physical activity, mood, and sleep quality. *Ir. J. Med. Sci.* **2021**, doi:10.1007/S11845-021-02667-3.
133. Ong, K. C.; Ng, A. W. K.; Lee, L. S. U.; Kaw, G.; Kwek, S. K.; Leow, M. K. S.; Earnest, A. 1-Year pulmonary function and

health status in survivors of severe acute respiratory syndrome. *Chest* **2005**, *128*, 1393–1400, doi:10.1378/chest.128.3.1393.
134. Hui, D. S.; Wong, K. T.; Ko, F. W.; Tam, L. S.; Chan, D. P.; Woo, J.; Sung, J. J. Y. The 1-year impact of severe acute respiratory syndrome on pulmonary function, exercise capacity, and quality of life in a cohort of survivors. *Chest* **2005**, *128*, 2247–2261, doi:10.1378/chest.128.4.2247.
135. Denehy, L.; Elliott, D. Strategies for post ICU rehabilitation. *Curr. Opin. Crit. Care* 2012, *18*, 503–508.
136. Jackson, J. C.; Ely, E. W.; Morey, M. C.; Anderson, V. M.; Denne, L. B.; Clune, J.; Siebert, C. S.; Archer, K. R.; Torres, R.; Janz, D.; Schiro, E.; Jones, J.; Shintani, A. K.; Levine, B.; Pun, B. T.; Thompson, J.; Brummel, N. E.; Hoenig, H. Cognitive and physical rehabilitation of intensive care unit survivors: Results of the RETURN randomized controlled pilot investigation. *Crit. Care Med.* **2012**, *40*, 1088–1097, doi:10.1097/CCM.0b013e3182373115.
137. Oeyen, S. G.; Vandijck, D. M.; Benoit, D. D.; Annemans, L.; Decruyenaere, J. M. Quality of life after intensive care: A systematic review of the literature. *Crit. Care Med.* 2010, *38*, 2386–2400.
138. Vancini, R. L.; de Lira, C. A. B.; Gentil, P.; Andrade, M. S. Neurological features of COVID-19 and epilepsy: Could neuromuscular assessment be a physical and functional marker? *Epilepsy Behav.* **2021**, *114*, 107648, doi:10.1016/J.YEBEH.2020.107648.
139. Gérard, M.; Mahmutovic, M.; Malgras, A.; Michot, N.; Scheyer, N.; Jaussaud, R.; Nguyen-Thi, P. L.; Quilliot, D. Long-Term Evolution of Malnutrition and Loss of Muscle Strength after COVID-19: A Major and Neglected Component of Long COVID-19. *Nutrients* **2021**, *13*, doi:10.3390/NU13113964.
140. Gobbi, M.; Bezzoli, E.; Ismelli, F.; Trotti, G.; Cortellezzi, S.; Meneguzzo, F.; Arreghini, M.; Seitanidis, I.; Brunani, A.; Aspesi, V.; Cimolin, V.; Fanari, P.; Capodaglio, P. Skeletal Muscle Mass, Sarcopenia and Rehabilitation Outcomes in Post-Acute COVID-19 Patients. *J. Clin. Med.* **2021**, *10*, doi:10.3390/JCM10235623.
141. Shirado, K.; Furuno, Y.; Kanamaru, K.; Kawabata, N.; Okuno, S.; Yamashita, T. Effect of Rehabilitation Nutrition on a Post-Acute Severe COVID-19 Patient: A Case Report. *Healthc. (Basel, Switzerland)* **2021**, *9*, doi:10.3390/HEALTHCARE9081034.
142. Nambi, G.; Abdelbasset, W. K.; Alrawaili, S. M.; Elsayed, S. H.; Verma, A.; Vellaiyan, A.; Eid, M. M.; Aldhafian, O. R.; Nwihadh, N. A.; Saleh, A. K. Comparative effectiveness study of low versus high-intensity aerobic training with resistance training in community-dwelling older men with post-COVID 19 sarcopenia: A randomized controlled trial. *Clin. Rehabil.* **2021**, doi:10.1177/02692155211036956.
143. Ahmadi Hekmatikar, A. H.; Ferreira Júnior, J. B.; Shahrbanian, S.; Suzuki, K. Functional and Psychological Changes after Exercise Training in Post-COVID-19 Patients Discharged from the Hospital: A PRISMA-Compliant Systematic Review. *Int. J. Environ. Res. Public Health* **2022**, *19*, 2290, doi:10.3390/IJERPH19042290.
144. Wang, D.; Hu, B.; Hu, C.; Zhu, F.; Liu, X.; Zhang, J.; Wang, B.; Xiang, H.; Cheng, Z.; Xiong, Y.; Zhao, Y.; Li, Y.; Wang, X.; Peng, Z. Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA - J. Am. Med. Assoc.* **2020**, *323*, 1061–1069, doi:10.1001/jama.2020.1585.
145. Madjid, M.; Safavi-Naeini, P.; Solomon, S. D.; Vardeny, O. Potential Effects of Coronaviruses on the Cardiovascular System: A Review. *JAMA Cardiol.* 2020, *5*.
146. Kochi, A. N.; Tagliari, A. P.; Forleo, G. B.; Fassini, G. M.; Tondo, C. Cardiac and arrhythmic complications in patients with COVID-19. *J. Cardiovasc. Electrophysiol.* 2020, *31*, 1003–1008.
147. Goshua, G.; Pine, A. B.; Meizlish, M. L.; Chang, C.-H.; Zhang, H.; Bahel, P.; Baluha, A.; Bar, N.; Bona, R. D.; Burns, A. J.; Dela Cruz, C. S.; Dumont, A.; Halene, S.; Hwa, J.; Koff, J.; Menninger, H.; Neparidze, N.; Price, C.; Siner, J. M.; Tormey, C.; Rinder, H. M.; Chun, H. J.; Lee, A. I. Endotheliopathy in COVID-19-associated coagulopathy: evidence from a single-centre, cross-sectional study. *Lancet Haematol.* **2020**, *7*, e575–e582, doi:10.1016/S2352-3026(20)30216-7.
148. Yamamoto, S.; Hotta, K.; Ota, E.; Mori, R.; Matsunaga, A. Effects of resistance training on muscle strength, exercise capacity, and mobility in middle-aged and elderly patients with coronary artery disease: A meta-analysis. *J. Cardiol.* **2016**, *68*, 125–134, doi:10.1016/j.jjcc.2015.09.005.
149. McKelvie, R. S.; McCartney, N. Weightlifting Training in Cardiac Patients: Considerations. *Sport. Med.* 1990, *10*, 355–364.
150. Verrill, D.; Shoup, E.; McElveen, G.; Witt, K.; Bergey, D. Resistive Exercise Training in Cardiac Patients: Recommendations. *Sport. Med.* 1992, *13*, 171–193.