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COMMENTARY

Impact of Potential Physiological Changes due to COVID-19 Home Confinement on Athlete Health Protection in Elite Sports: a Call for Awareness in Sports Programming

F. Sarto[1] · F. M. Impellizzeri[2] · J. Spörri[3] · S. Porcelli[4,5] · J. Olmo[6] · B. Requena[6] · L. Suarez-Arrones[7] · A. Arundale[8] · J. Bilsborough[9] · M. Buchheit[10] · J. Clubb[11] · A. Coutts[2] · D. Nabhan[12] · L. Torres-Ronda[13] · A. Mendez-Villanueva[14] · I. Mujika[15,16] · N. A. Maffiuletti[17] · M. V. Franchi[1]

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A global emergency characterized by a respiratory illness called COVID-19 (coronavirus disease) has spread worldwide in early 2020. Preventive measures to reduce the risk of infection include social distancing and the closing of commercial activities to avoid social gatherings. Elite sport is also tremendously affected: ongoing championships have been suspended and the major international events have been postponed (e.g. Summer Olympics, UEFA European Football Championship). This is the first time since the Second World War that all elite athletes are forced to interrupt competitions. Further, most elite athletes are forced to train at home, on their own and mostly unsupervised. Some elite sports clubs have provided players with home-based training programs and/or organized video conferences for online training sessions lead by their fitness trainers. However, logistical constraints and the difficulty to implement sport-specific exercise strategies in the absence of official sports facilities/playgrounds, make it difficult to provide training solutions comparable to those adopted under normal circumstances. During COVID-19 home confinement, athletes are likely exposed to some level of detraining (i.e. the partial or complete loss of training-induced morphological and physiological adaptations), as a consequence of insufficient and/or inappropriate training stimuli [1]. Such changes may result in impaired performance and increased injury risk (e.g. ligament rupture and muscle injuries) if, upon restart, an appropriate sport-specific reconditioning cannot be granted. Moreover, athletes on their return to sports journey may suffer from inappropriate rehabilitation/reconditioning and, therefore, a higher risk of re-injury, when championships

✉ M. V. Franchi
martino.franchi@unipd.it

1 Department of Biomedical Sciences, Institute of Physiology, University of Padua, Padua, Italy

2 Human Performance Research Centre, Faculty of Health, University of Technology Sydney, Sydney, Australia

3 Sports Medical Research Group, Department of Orthopaedics, Balgrist University Hospital, University of Zurich, Zurich, Switzerland

4 Department of Molecular Medicine, University of Pavia, Pavia, Italy

5 Sports Medicine Physician Team, Alpine Ski and Snowboard Team, Italian Winter Sports Federation, Milan, Italy

6 Football Science Institute, Granada, Spain

7 FC Basel 1983, Basel, Switzerland

8 Brooklyn Nets, NBA, Brooklyn, NY, USA

9 New England Patriots, NFL, Foxborough, MA, USA

10 Myorobie Performance, Montvalezan, France

11 Buffalo Bills, NFL, Buffalo, NY, USA

12 US Olympic and Paralympic Committee, Colorado Springs, CO, USA

13 Philadelphia 76ers, NBA, Philadelphia, PA, USA

14 Qatar Football Association, Doha, Qatar

15 Department of Physiology, Faculty of Medicine and Nursing, University of the Basque Country, Leioa, Basque Country, Spain

16 Exercise Science Laboratory, School of Kinesiology, Faculty of Medicine, Universidad Finis Terrae, Santiago, Chile

17 Human Performance Lab, Schulthess Clinic, Zurich, Switzerland

would suddenly continue. Cardiorespiratory and neuromuscular adaptations are fundamental in different sports and substantial declines (e.g. 4–14% in maximal oxygen uptake) are known to occur after short-term (< 4 weeks) training cessation [1]. Further, injury occurrence seems to be regulated by a complex mechanical interplay between tissue stress, strain and loading [2]. Therefore, alterations in mechanical structures, such as muscles and tendons, are likely involved in the injury process.

Lessons from physiological studies on muscle and tendon adaptations to unloading (such as bed rest (BR) and unilateral lower limb suspension (ULLS), which can be considered as an extreme form of detraining) taught us that changes in muscle size (e.g. ~ 5 and ~ 10% reduction in knee extensors cross-sectional area after 14 and 23 days of ULSS) and architecture (e.g. ~ 6 and ~ 14% reduction in vastus lateralis fascicle length and pennation angle, respectively, after 5 weeks of BR) can occur in lower limb muscles even after the exposure to short-term unloading [3, 4]. The rate of muscle disuse atrophy may be even more accelerated in elite athletes since highly trained subjects with greater initial muscle mass exhibit accentuated muscle loss [5]. Besides, morphological changes, reductions in muscle strength (e.g. ~ 15% of the knee extensors maximum voluntary contraction torque in two weeks of ULLS), power (e.g. ~ 10% after two weeks of BR) and rate of force development (e.g. ~ 42% after two weeks of ULLS) have been observed after short-term disuse [3, 6] and training cessation (~ 7–14% in strength/power performance) [7, 8]. Moreover, significant deterioration in tendon mechanical properties also occurs (e.g. ~ 10% in tendon stiffness and Young's modulus after two weeks of ULLS) [3]. Unfortunately, there is limited literature allowing a direct translation of such observations to elite sport, as the available evidence has focused on postinjury conditions [9] or on the detrimental effects of the off-season [10]. Previous work can scarcely mimic the situation that athletes are experiencing now, with a sudden and longer than normal reduction in total training loads and the challenge to provide sport-specific stimuli. Nevertheless, we could rely on disuse-based studies to hypothesize that, in this period of activity reduction, muscles and tendons will undergo alterations of a similar nature. Accordingly, since factors, such as muscle strength and architecture, and tendon structure has been suggested to influence injury risk, after this period of detraining, athletes may be more susceptible to injury throughout an alteration of the tissue-specific mechanical properties after COVID-19 home confinement release [2]. There is a previous similar scenario after the National Football League (NFL) lockout in 2011, where during a period over 3 months players underwent an uncommon off-season without normal access to their facilities and training resources, where a higher rate of Achiles tendon injuries occurred over the first period of the training camp and the subsequent season [11]. Morover, in this scenario, teams must guarantee in the most objective way possible the physical status of the athletes, to bridge the potential gap between the athletes' perceived (and their urge to compete) versus actual sportreadiness [11].

To date, it is difficult to predict when elite sports will restart. Two different scenarios are possible. In the first one, the COVID-19 pandemic situation will improve relatively quickly and governance would permit to restart sports events behind closed doors. In this scenario, in order to conclude championships once the emergency will end, a lot of matches/events would be probably condensed (e.g. with mini tournaments) in a short time and athletes may be unprepared to cope with the elevated training and match demands. For this reason, a sport-specific reconditioning period would be necessary for the athletes to recover their in-season neuromuscular and cardiorespiratory qualities; thus, potentially reducing the risk of injury, similar to what generally happens during the pre-season after a transition period [12]. In the second scenario, the emergency will continue and championships will not be completed. This situation of insufficient and/or inadequate training would be protracted for several months and the associated physiological decline may be even more accentuated. In this case, a prolonged pre-season would be warranted to allow full resurgence of athletes' physiological and mental function and performance.

With this perspective, we aim to recommend extreme caution in sports programming after the COVID-19 emergency and we advise to involve all stakeholders in the decisions (e.g. medical staff, head of performance, coaches, fitness trainers and players). We are still unsure when and how to restart championships and events, but we advise to consider the impact that choices could have on injury risk in elite athletes.

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Compliance with ethical standards

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