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Medical recommendations for home-confined footballers' training during the COVID-19 pandemic: from evidence to practical application

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ABSTRACT: In early 2020, the world is facing a global emergency called COVID-19. Many professional footballers around the world are home confined. The maintenance of physical capacity is a fundamental requirement for the athlete, so the training sessions must be adapted to this unique situation. Specific recommendations must be followed concerning the type of training, its intensity, the precautions that have to be followed to avoid the possibility of contagion, and the restrictions in accordance with the presence of any symptoms. This article analyses the available scientific evidence in order to recommend a practical approach.

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INTRODUCTION

In early 2020, the world is facing a global emergency called COVID-19 (coronavirus disease 2019). Many governments have requested the population to stay home unless necessary for proven reasons. Professional footballers have found themselves in a unique situation in which they were not only obliged to stop their professional activity but also to be confined in their houses.

The effect of detraining

The maintenance of physical capacity is a fundamental requirement for the athlete. Specifically, for team sports athletes, maintaining a good level both of aerobic power and muscle strength is a fundamental prerequisite to preserve performance unchanged. The training physiological adaptation is a reversible process. Indeed, most aspects of physiological adaptation are lost during a prolonged period of inactivity [1]. The rate of loss is different for each physical capacity, being higher for endurance and strength endurance rather than speed and maximum strength. There is generally accepted to be an overall loss up to 10% of fitness for each week of total inactivity [2].

In professional football the annual season is subdivided into three periods: the pre-competition period (pre-season period), the competition period and the transition period (off-season) [3]. In professional football, the transition period rarely lasts more than one month [4]. In this period, there is an important reduction, or even a complete stop, in football activity; therefore this forced pause of football activity during the pandemic of coronavirus can be considered a transition period. Obviously, it is very important that the players keep a good fitness level in order to be able to endure the rapid increase in training frequency and intensity, while trying, at the same time, to minimize the injury risk [5]. Indeed, many studies show that a loss of lean mass and muscle strength represents an important risk factor for muscle injuries in football [6–9]. Unfortunately, the off-season period generally has a negative influence on football players' body composition, increasing the percentage of fat mass and decreasing the percentage of lean mass or fat-free mass [4,10–12]. Furthermore, as previously mentioned, a suspension or a substantial reduction of high-intensity aerobic activity for a period of 20 days or greater significantly decreases the VO_2max. For all these reasons, after the off-season period the players may show difficulty in tolerating high training volume and intensity in the first weeks of the pre-season period [4]. This is particularly evident in cases in which the changes in fat mass and free-fat mass are substantial [4]. With our current knowledge, it is impossible to predict what the real impact of the detraining period linked to the COVID-19 pandemic on the fitness status of athletes will be when they return to sport activity. There is no previous off-season period characterized by confinement. In any case, it is obvious that the level of fitness that players will

present when returning to normal training is closely linked to the following factors:

i. Whether the player has contracted COVID-19 or not and, in case of contagion, if he/she shows any sequelae;
ii. The duration of the detraining period and the confinement;
iii. The level of physical activity that the player maintained during the detraining period.

Therefore, in accordance with the above points, it is extremely important that:

- at the time of resuming sports activity, a battery of tests allowing objective evaluation of the player's physical condition is performed;
- there is a suitable pre-competition period with a training programme including both aerobic training and strength conditioning activities [10,12].

Training and the immune system

Indeed, physical activity may influence the response and the effectiveness of the immune system [13–18]. There is quite strong evidence that intense endurance sport activities, such as running, cycling, rowing or swimming, produce significant leukocytosis caused by an increase in numbers of B and T lymphocytes, neutrophils and NK cells in the systemic circulation [19,20]. Furthermore, acute severe exercise inducing an oxidative state results an acceleration of neutrophil apoptosis [21]. Therefore, at the end of demanding physical activity there is a drastic drop in circulating lymphocytes with consequent loss of efficiency of the immune system [17]. In exercise immunology a central dogma is that a strenuous exercise bout or a period of intense exercise impairs the effectiveness of the immune system leading to an "open window" of infection risk [22]. The concept that any kind of strenuous exercise can be considered 'immunosuppressive' has recently been challenged and the concept of an "open window" has been questioned [23,24]. However, the evidence provided for confuting the "open window" concept is not yet sufficiently convincing [25]. Thus, further relevant studies will be needed in the future. Therefore, considering both the high and dramatic specificity of the current pandemic period and the absence of evidence concerning sport activity during the COVID-19 pandemic [26], the training rules mentioned below are mainly based on the principle of "maximal caution" [27].

Training intensity

Excessively intense training can weaken the immune system [22] and increase the risk of being contaminated by COVID-19 or of developing a serious form of it affecting the heart [28], the lung [29], the liver, the kidneys and the immune system [30]. For these reasons, we recommend avoiding intense training during the epidemic period.

Training precautions

In countries where there are no limitations for outdoor sporting activities, outdoor running training is possible. The training must be done individually and keeping the distance from other people imposed by the current health regulations. It is highly advisable to carry out the training in places not frequented by other people, preferring the times in which there is little flow of people. It is important to remember that the droplets containing COVID-19 travel a distance of 1.8 metres in the air and the average life of COVID-19 is 2.7 hours in the air, 13 hours on steel and 16 hours on polypropylene [31]. Furthermore, currently there is no scientific evidence regarding wearing protective masks in public spaces for asymptomatic persons [32]. For these reasons, it is highly inadvisable to perform any form of physical activity in public or private gyms frequented by several people. On the other hand, since there is a consensus in several countries to restrict social gathering, including gyms and meeting places, and to limit population movements [32], this recommendation may also be superfluous. Indeed, there are some sport activities such as yoga, Tai Ji Quan, and Qigong that can be preferred in this specific period and should be proposed to the population as a valid alternative to more popular sports [26]. Moreover, some alternative training methods such as software-generated partners should be proposed in order to maintain motivation [33].

Cardio training

Suspension of high-intensity aerobic activity for 20 days or greater results in a significant decrease in VO_2max [34,35]. This obviously can be a problem for a team sports athlete [36]; therefore, cardio training should be commenced as soon as possible. However, in compliance with the principle of maximal caution [27], it is highly recommended to observe the following rules:

i. The duration of the cardio training sessions should not exceed 60 minutes [37]. It would be advisable to carry out two sessions of no more than 30 minutes during the day [38]. If the solution of two sessions is adopted, the latter must be interspersed with a recovery of at least three hours. It is very important to carry out suitable rehydration between the two training sessions [39].
ii. The intensity of the effort should be limited to 80% of the maximum heart rate, corresponding to approximately 75-80% of the subject's maximum aerobic speed (i.e. the speed at which VO_2max is reached) [40].
iii. The cardio training can be performed both in the form of continuous running [41] and intermittent [42] or interval training [43], if the intensity of the effort indicated above is respected.

An average of 3-4 cardio training sessions performed by observing the following parameters are sufficient to maintain satisfactory functionality of both the aerobic and anaerobic lactic acid system [41], minimizing at the same time the possible risks associated with the COVID-19 emergency [26,28,44].

Strength training

Strength training involves the use of equipment that usually is in public or private gyms. However, for the reasons of possible contagiousness explained above, attending public gyms is not recom-

mended. In the absence of suitable equipment, strength training can be carried out at home with elastic resistance [45] or body weight exercises, for example pull-ups, push-ups, sit-ups, dips, Nordic hamstring exercise, etc [46,47].

The strength training should respect the following rules:

i. The duration of the strength training sessions should not exceed 60 minutes [37,48].
ii. The use of maximum loads and exercises conducted at full muscle exhaustion (regardless of the load used) is not recommended [37,49]. Indeed, the lactate production typical of strength exercise conducted at complete muscle exhaustion promotes lymphocyte apoptosis [50].
iii. During cross-fit sessions the intensity of the effort should be limited to 80% of the maximum heart rate [40].

Two weekly strength training sessions respecting the above-mentioned points are sufficient to maintain the strength characteristics in a well-trained athlete [51].

In any case, we do not recommend strength training to be carried out at maximal levels as there is evidence of a reduction of up to 15% of isometric strength in infected subjects who do not fully recover until a month after the illness [52]. Since in athletes the infection by coronavirus is often asymptomatic, athletes may potentially suffer from this kind of strength reduction even without a confirmed diagnosis of COVID infection, and therefore it is safer to train at submaximal levels.

Stretching

Stretching exercise sufficient to maintain or to develop the range of motion should be included in the training sessions. The stretching exercises should involve the major muscle groups and be performed in a minimum of 2-3 sessions per week. Furthermore, stretching sessions should include both static and dynamic exercise [53].

Training in case of fever or suspected infection

Fever is a normal physiological reaction of the body to an illness or immune stimulus assisting the immune system with mounting a response [54]. In case of fever, any type of physical activity must be suspended [55]. There is evidence from animals that strenuous exercise during an ongoing febrile infection can be dangerous, leading to an increased rate of complications and lethality [56]. Moreover, dehydration can contribute to hyperthermia [57]. In cases of febrile infections with systemic symptoms, recommendations on resuming physical activity vary from recommencement of sport activity once fever has resolved to waiting until 14 days after the symptom's resolution [56,58]. Moreover, the proximity with others during sport activity performed with an active pulmonary COVID 19 infection may potentially lead to spreading of the virus. Despite the lack of direct evidence of that, considering the method of transmission [44], it cannot be excluded.

In addition, in case of absence of fever, it is necessary to avoid taking paracetamol as a preventive measure. Indeed, the effect of paracetamol could mask the onset of viral infection [59]. Some papers suggest a link between NSAIDs and both respiratory and cardiovascular adverse effects in several settings, but so far there is no evidence explicitly concerning COVID-19. Waiting for more robust evidence, we suggest a cautionary approach in their use [60]. Use of corticosteroids is also not advised because they increase the risk of infection, including viral infections [61].

For these reasons, we do not recommend any kind of training in case of fever following a COVID infection and, due to the lack of evidence, the principle of maximal prudence should be followed upon return to sport.

Return to football

The day will come (we all hope soon) when COVID-19 will be only a memory. Looking forward to that day, as a final recommendation, we encourage the football medicine community both to apply maximal caution on the decision when to restart sport activity and to adopt a specific protocol to check for cardiological, pulmonary and, in general, systemic sequelae of COVID-19 in the athletes [27]. Since the geographical distribution of COVID-19 is unequal and the evolution of the pandemic is different in each country, the return to activity and the consequent programme of prevention should be tailored to each situation [62].

Moreover, the return to normal activity will have to be progressive and programmed. It is highly recommended that players return to sporting activity progressively, applying [63]:

i) A preliminary phase normally performed during the confinement phase, during which the player restarts the training at home, with the training schedules sent and checked remotely by the club staff;
ii. An individual training phase in which a few club staff members may assist the player during the pitch or gym training. During this phase, it is recommended that a maximum of two players can train on the pitch at the same time, keeping a safe distance between them;
iii. A group training phase, with a maximum of 8 players at a time;
iv. A collective training phase with full resumption of training for the whole group.

Furthermore, during the aforementioned phases, it will be necessary to respect a series of rigorous medical and hygienic-sanitary rules [63].

To date, there is no scientific evidence to demonstrate an ability of the pneumococcal vaccine (or any other vaccination) to protect against coronavirus infection.

Finally, at return to play there will probably be a congested period with 2-3 games every 7 days, after a period of detraining. Since both match congested periods [64] and activity load variation [65] have been associated with an increased risk of injury, attention should be paid to organizing for each player a tailored schedule of training and matches in order to avoid sudden variation of the load. This will also

be necessary in order to avoid potential exercise-induced depression of the immune system [66–68].

CONCLUSION

During the 2020 COVID-19 pandemic, professional footballers are facing a unique situation. Maintaining physical fitness is important but the training should be modified accordingly in order to keep it safe and tailored to the new conditions. Therefore, it is important to maintain precise medical, hygienic-sanitary rules as well as to respect some physiological rules allowing, in this particular pandemic period, safe training. Last, but certainly not least, the international medical community should rapidly establish a specific clinical protocol aimed at checking the athletes' medical status and physical fitness after the pandemic period caused by COVID-19. Therefore further studies are recommended in order to establish the evidence behind these protocols.

Conflict of interest

All authors declare having NO conflict of interest

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