REAL FEDERACIÓN ESPAÑOLA DE FÚTBOL

RECOMMENDATIONS TO PREVENT HEALTH RISKS UPON THE RETURN OF COMPETITIVE FOOTBALL

COVID-19 WORKING GROUP

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1.- INTRODUCTION

On March 11, 2020, the World Health Organization declared COVID-19, an infection produced by the virus SARS-CoV2 with a wide range of symptoms ranging from mild symptoms to severe illness, as a pandemic.[1] The health authorities and governments of several countries declared confinement measures to decelerate the propagation of the disease which has resulted in the suspension of sport training and competition. This suspension affects all categories and modalities of sporting events, however, it may have a greater media and economic impact on professional and elite sport.[2] Professional athletes are amongst the most affected as they have been unable to train as usual during home confinement and it is thought that they will have to return to sports competition in most countries once the risk of infection has been adequately reduced.

The Royal Spanish Football Federation created on March 20 2020 a taskforce, composed of sport physicians, sport scientists, and strength and conditioning coaches to constitute guidelines in order to resume football activities after the COVID-19 pandemic. This taskforce has established a framework based on scientific evidences to reduce health risks on the return to competition whilst fostering players' fitness levels from the resumption of training activities for the teams prior to the first official competition. The framework encompasses guidelines at three levels: (a) clinical measures to assess player's health status after the confinement and procedures to reduce the probability of COVID-19 infection during training and competition, (b) training recommendations to develop strategies for injury prevention and physiological re-adaptation, and (c) proposal for the competition calendar and allowance of changes of in-game regulations. The aim of this Editorial is to make these recommendations public since they may be of utility for resuming training and competition in other countries, and even in other sports.

2.- BRIEF JUSTIFICATION

How does a specific training and competition stoppage affect footballers?

The stoppage of training and competitions will produce a progressive detraining in the players that will cause a decrease in their physical capacities (mainly strength, power, aerobic capacity, anaerobic balance, elasticity and range of motion) and their specific motor skills.[3–5] Specifically, detraining can produce a noticeable decrease in the ability to perform repeated sprints due to the reduced recovery capacity between exertions.[6,7] Furthermore, it can notably influence a decrease in the technical quality of specific skills and movements, both physical and technical skills, which are essential for the development of competitive football matches, meaning that confinement will be intrinsically linked with a lower possibility of performance levels.[4] Similarly, detraining will produce changes / or negative effects on body composition that result in a reduction in muscle mass and an increase in fat mass.[3] Finally, detraining and reduced exposure to sunlight could produce alterations in the bone structure due to a decrease in its density and mineralization,[8] amongst other considerations.[9]

Can training stoppages lead to a higher incidence of injury?

Players are at a greater risk to suffer muscle[10] and Achilles tendon injuries[10,11] after a period of detraining. Larger periods of retraining are associated with less injury risk during the competitive period.[12] To counteract injuries during matches is key as the incidence might be up to 10 times higher compared to training.[13] During matches, more injuries appear in the final third of the half in each of the game periods. The progressive accumulation of the load (games played, accumulated minutes in competition and training),[14] together with non-progressive, or somewhat uncontrolled increases in the physiological and psychological load, are risk factors for non-traumatic injuries.

Excessive or non-progressive loads can have a particularly negative effect when returning to training after a rest period, and even more so in players who have had a recent non-traumatic injury, in players who have asymmetric muscle strength values and in players with a limited range of motion.[15] Although a high proportion of footballing injuries are graded as "slight", since they are overcome in less than a week, muscle injuries take an average time of 4 weeks until reincorporation. Under current circumstances, footballers may face an increased risk of injury if return to activities is not suitable, safe or progressive in relation to the factors that may influence sporting injuries (possible effect or effect of infection, injury profile, age, training, etc., to which the competitive load is added),[16] if not programmed and adjusted, to avoid a certain "overdose" of exertion.

In the final part of this document, the recommendations for re-training are detailed, as well as a subsequent search for sports performance that reduces the risk of injury and fosters football at the highest standard post confinement.

Can a competition calendar be proposed that is suitable for the specific conditions produced by COVID-19?

Given the exceptional situation, upon resuming the 2019/20 professional football leagues (and several of the other football competitions and their specialties) footballers are exposed to an increased risk of injury, and certain organizational measures could be articulated to reduce this risk, for example:

1.- Minimum days between authorization to train in a group and the first official match

The minimum training period between the first day of training in the team's facilities and the first official match will depend on the length of the confinement period.

a) In the event that this is *less than 4 weeks*, guarantees must be in place of a minimum of 15 days between the first training session and the start of the competition.
b) In the event that confinement lasts between 4 and 6 weeks, the minimum period will increase to 21 days.
c) In the event that the isolation period is prolonged beyond 6 weeks, the minimum training period will stand at 30 days.

As per the current conditions in most countries, we have set our recommendations for the resumption of football activities after the COVID-19 pandemic with a potential duration of 21 days from the first day of training in the team's facilities to the first official match.

2. List of players eligible to play official matches and resumption of training

Upon the issuance of a report from the Medical Services of each Club, certain footballers from their "B" and / or youth teams should be allowed to join training sessions and official matches played by the professional squad, whenever they are legally engaged by the club (i.e. registered with footballers' insurance policies, social security, insurance against occupational accidents), until the situation returns to normal and all the team's full playing staff are available.

3. Organization of the competition through series of matches.

For health and sporting reasons, the distribution of official matches for each football league must be controlled, especially to avoid a high density of matches (matches / days) and therefore physical and competitive loads at the start of the competition.[17] Furthermore, the taskforce recommends resuming competition with a distribution of official matches that secure at least 72 h between matches.[17] This measure will produce a less congested football calendar that would potentially lead to a decreased injury rate.[18]

4. Adaptation of intra-match rules

In order to foster the competitiveness of the teams, while reducing the conditions that can cause injuries and excessive fatigue in the players, it is recommended that in addition to the 3 conventional player changes, up to 2 more exceptional changes can be made, for health reasons, proposed by the doctor, and authorised by the referee. This recommendation is based on the short period of retraining foreseen for after confinement, together with the high environmental temperatures that will occur if the competitions are resumed during the summer months. Furthermore, it is recommended to use the so-called refreshment and rest pauses already enabled for the 30 and 75 minute points during the game, in order to produce a pause in the game that allows players' fatigue to be reduced. With regard to the high temperatures that can occur in the summer season in many European regions, the proposal is made that during the summer months, when the ambient temperature is equal to or higher than 30ºC, no games should be playted between 12:00 noon and 7:00 p.m.

RECOMMENDATIONS TO REDUCE HEALTH RISKS ON RETURN TO COMPETITION

Football is a binding element of society, and as such, will play an important role in the recovery of society once the current global COVID-19 pandemic has ended. In this regard, it is important to stress that sporting competition must be resumed once the global healthcare situation has been stabilized, in order to ensure equality of competition.

The purpose of these recommendations is to ensure optimal health of the players, staff and all personnel close to the player, and to avoid subsequent infections. Training must be started without associated health-related issues so that the players can reach their maximum performance when required.

It should be noted that such recommendations will necessarily have to be adapted to the information on COVID-19 from ongoing scientific research.

1. Parameters to be controlled by Club medical staff, applicable to footballers:

a. **History and physical examination.**[19] Basic physical examination, including the recording of body temperature and completion of a brief epidemiological questionnaire on the relationship of the player with potentially infected people. It is advisable for the player to keep a daily record of their body temperature and should this be greater than 37.5º, for them to notify the club's doctor immediately. Check for recent episodes of dyspnoea, myalgia, diarrhoea, anosmia and asthenia[20,21]

b. **Blood analysis and full urine test.**[22]

- *Blood tests*, to rule out leukopenia, lymphopenia, neutrophilia.
- *Coagulation factors*, D-Dimer (fibrinolysis marker) and prothrombin time, which may be elevated.
- *Biochemistry*, to assess serum iron, ferritin, transferrin and transferrin saturation CPK, LDH, GOT, GGT, GPT. In the case of myalgia, cardiac troponin values as a cardiac muscle damage marker.
- *Inflammatory markers*, procalcitonin and Interleukins, regulators of inflammatory process and the immune system.
- *Assess Vit D*, which may be decreased due to the lack of hours of exposure to sunlight.

c. **Functional respiratory tests.**[23] Chest X-ray, to rule out the presence of pulmonary infiltration, Thoracic CT Scan for those that had COVID 19 positive and had symptoms, are recommended and whenever possible.

d. **Cardiovascular screening.**[24] Resting and stress ECG, Echo cardio, BP.

e. **Infection control screening.**

If possible, PCR testing for all players.[25,26] serology testing for those have previously tested positive but are recovered of the infection. In the event of a player testing positive for COVID-19 or who displays symptoms compatible with COVID-19, they must not resume training. Players with conclusive outcomes on all of the aforementioned testing might be allowed to resume training routines. These include players tested negative for COVID-19 in pre-training assessment and those players with immuno-protection (if IgM negative and IgG positive) for COVID-19. Serology testing is recommended each 7-day intervals for these players, particularly before competition. PCR is recommended for those players reporting new symptoms related to COVID-19.[27]

Players tested positive for COVID-19 (either symptomatic or asymptomatic), players negative for COVID-19 but with suspicious symptoms of the disease, players with IgM and IgG positive in the serology testing should be quarantined; PCR testing should be repeated 14 days after (for COVID-19 positives) and serology testing repeated 7 days after (for IgM and IgG positives).

Table 1. Screening to reduce health risks on return to football training after COVID-19 pandemic.

Examination	Specification
Physical Examination	Basic physical examination following precompetition medical assessment; a record of body temperature should be included, and it is advisable to keep a daily record of players' body temperature; check for recent episodes of anosmia, ageusia and myalgia.
Medical History	Completion of a short epidemiological questionnaire about possible relationships maintained in the previous weeks with potentially infected individuals; it is also recommended to

	include a psychosocial assessment to determine negative effect of confinement
Blood and urine analysis	Complete blood testing to assess white cell count; CPK, LDH, aminotransferases, cardiac troponin in the case of myalgia; Vitamin D in players with reduced exposure to sunlight
Respiratory screening	Chest X-ray to rule out pulmonary infiltration; thoracic CT scan is recommended for those players tested positive for COVID-19 or with recent or present symptoms of the disease
Cardiovascular screening	Resting and stress electrocardiogram, echocardiogram, blood pressure
Infection control screening	If possible, PCR testing for all players; serology testing for those have previously tested positive but are recovered of the infection In the event of a player testing positive for COVID-19 or who displays symptoms compatible with COVID-19, they must not resume training.
Clearance	YES: Players with conclusive outcomes on all of these testing might be allowed to resume training routines; these include players tested negative for COVID-19 in pre-training assessment and those players with immuno-protection (if IgM negative and IgG positive) for COVID-19. Serology testing is recommended each 7-day intervals for these players, particularly before competition. PCR is recommended for those players reporting new symptoms related to COVID-19 NO: Players tested positive for COVID-19 (either symptomatic or asymptomatic), players negative for COVID-19 but with suspicious symptoms of the disease; players with IgM and IgG positive in the serology testing; all these players should be quarantined; PCR testing should be repeated 14 days after (for COVID-19 positives) and serology testing repeated 7 days after (for IgM and IgG positives)

Table 2. Hygienic sporting measures

I.- Prevention for the athlete:
1.- It is the athlete's responsibility to report their illness.
2.- Keep away from the group at a distance of at least two metres inside the changing room.
3.- Wash hands regularly before training and after training, if there is competition, pre-match and afterwards. In all changing rooms and pitch access areas, there must be disinfectant gel dispensers.
4.- Avoid contact with people infected by COVID-19. Should this occur, please notify the club's medical staff immediately.
5.- Do not share beverage cans or sports equipment such as shirts, towels etc, with other players.
6.- In journeys to other countries with disease incidence, take extreme hygiene measures.
II.- Precautions for personnel and other athletes who maintain contact with an athlete infected with COVID-19:
1.- Educate staff on how to treat patients with COVID-19 infection.
2.- Ensure availability and provision of necessary personal protective equipment materials for all personnel in the athlete's environment, including gloves, masks, appropriate aprons and cleansing materials.
3.- Hands and all skin surfaces that have been in contact with an infected athlete must be washed immediately with soap or germicidal agents.
4.- Change gloves, gowns and other types of utensils once healthcare tasks are completed. Contaminated sporting and sanitary surfaces should be cleansed immediately with disinfecting solutions. All used healthcare material must be discarded.
III.- Attitudes to adopt prior to sporting competition:
1.- All facilities with equipment, common rooms, gyms, treatment rooms, dining rooms, hotels, etc., must be disinfected before the arrival of the players and staff, following the healthcare recommendations.
2.- After the end of the sporting event, utensils must be disinfected, used material disposed according to local policies, and changing rooms deep cleaned. Cleaning staff must have adequate personal protective equipment.

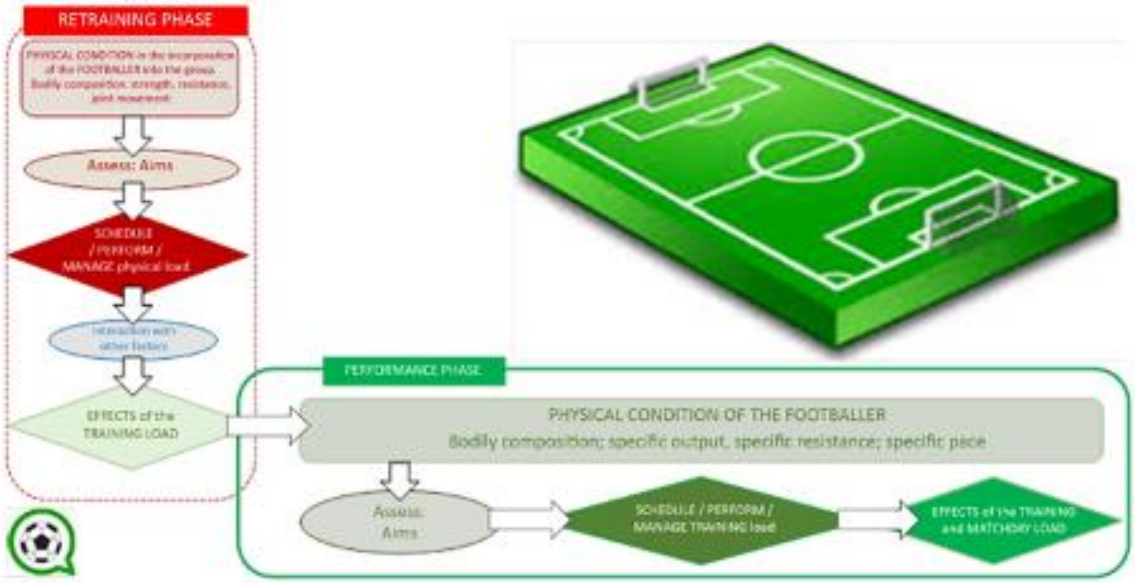
RECOMMENDATIONS TO FOSTER FOOTBALL PLAYERS' FITNESS LEVELS BY CONTROLLING HEALTH RISKS

In this exceptional end of the 2019/20 season, during the first training sessions post confinement, and until the first official match, the technical and healthcare staff (coach, physical trainer specializing in performance and / or sporting rehabilitation, club doctors and physiotherapists), alongside the actual players, must pay much greater attention than usual to the scheduled workload, its effects, and the adaptations to the exertion of each footballer.[28] For the reasons described in the introduction to this document, players will not be able to perform high-intensity exertions over time, nor will they be able to repeat them as frequently, in training, and even less so in games.

This document contains recommendations to support appointed coaches and footballers to organize workloads in training post confinement, during the first weeks of training. Specifically, guidelines are given for the first few weeks: first for a short re-training phase, and then to start the increasing of sports performance. Particularly, the re-training phase has the main aim of progressively incorporating the player into the standardised training, and the performance phase has the objective of reaching an optimal performance state at the earliest juncture, thus minimising the health risks to footballers during competition.

The re-training phase will begin with a basic assessment of physical condition (strength, endurance, joint mobility, and body composition), and will have as its main aim the development of strategies for injury prevention and physical re-adaptation of players who have experienced recent symptoms, with a short-term schedule (5-6 days). During this phase, it will be necessary to consider the incidences of other factors of personal and social life in the context of the footballer and the team (Graph 1).

Once it has been verified that the intended effects of the first phase of re-training have been achieved, training will begin with sports performance targets (i.e., performance phase), pursuing with special consideration the effects of the workload on the players. In this phase some specific objectives of power, resistance and speed will be included to adapt to the specific movements of the game (Graph 1).



Graph 1. Theoretical flow chart of the RE-TRAINING and PERFORMANCE phases to be carried out before the first official match

Listed below are the main aims, the organization, the types of exercises recommended for each of these phases, as well as the references for the optimum load management in each training phase, prior to the first official match.

RE-TRAINING PHASE (minimum duration of 5-6 days).

This phase's main aim will be to develop injury prevention and physical rehabilitation strategies for players who have been confined and for players who have suffered COVID-19 symptoms, whenever the player has been asymptomatic for more than four weeks. From a physical viewpoint, this phase will seek to adapt the player to the specific movements of the game. To achieve this, we will begin the development and improvement of specific abilities and skills for rehabilitation and subsequent retraining of defined game movements.

In the retraining phase, individual exercises, in pairs or in small groups (4-8 players, without contact) will be used. The duration of the most physically demanding part of the training will range between 35 and 50 minutes, as it would not seem advisable to hold more than one training session per day.

Overall, the frequency, volume and intensity of the physical exercise programme (PEF) will be progressively increased throughout this phase, which will last around 5-6 days. On a specific level, for all the selected tasks, we will start with shorter but numerous repetitions to gradually lengthen the duration of the repetitions and decrease their number. On the other hand, it will be necessary to focus on risk prevention with special attention to the progression of exercises for players who, having overcome COVID-19 and its quarantine, are on medical discharge to be able to leave home and train. The Physical Exercise Programmes (PEF) for these footballers, following the medical-clinical criteria and the symptomatic evolution, will be adapted to their components (physical capacities and specific motor skills) in the following elements: type of exercise, frequency, duration, intensity, progression, pause times, load control, post-exertion recovery, etc. In the case of players with previous injuries, and according to their injury profile (injury history;

degree of severity; mechanism; location), adaptation of individual strategies and PEFs will be made (for example, using the F-MARC 11+).

In players without COVID-19 symptoms and without recent injuries, the mean to develop abilities and skills for game-specific movements with individual exercises shall be sought, (displacements, jumps, passes, etc.), thus prioritising non-contact exercises, (e.g. starting with sequences pass, rather than reduced games). The introduction of the development of specific motor skills with the ball should be set aside for the final days of this retraining phase (2-3 days). Exercises are also recommended in small groups of players (4-8), progress in limiting the number of touches to the ball, from least to most demanding (free; 3; 2; 1) and progress in the number of decision-making processes to perform during exercises. Gradually, more exercises or tasks must be incorporated with an approach and orientation to the game actions, according to the demands of the specific positions. It is important, in all sessions held during this period, to avoid high-speed movements of more than 15 metres (e.g. sprints, highly intense changes of direction), to avoid striking the ball with excessive power (e.g. shots on goal, long passes).

In exercises that aim to improve anaerobic capacity and strength, tasks that require large joint range of motion should be avoided (for example, hitting long balls; powerful medium and long-distance shots), while the time of the breaks should be regulated (recovery) through the feedback of the players (subjective perception of exertion), prioritizing pauses that allow the exercise to be carried out without discomfort while maintaining work rate intensity. It is recommended to avoid large accumulations of work on consecutive days (especially during the first 2-3 days of training), distributing the type of emphasis of the stimuli of strength and / or resistance alternately throughout the week. For load management during this phase, it is suggested to use measures of subjective perception of exertion and muscle fatigue (Borg scale for perceived exertion; wellbeing

questionnaire; self-reported muscle pain scales, etc.). It is advisable to use the perceived load per session[29]:

> sRPE= training time * perceived exertion scale 30 minutes after the end of the last exercise (measured in arbitrary units).

The recommendation is made to control recovery on mechanical (muscular-articular-tendinous) and physiological levels (energy channels). vRecovery measures will be aimed at reducing muscle pain-stiffness; joint-tendon-nerve pain; bruising; fatigue perception; lack of sleep etc. It is advisable to develop an active recovery after the exertion (active-dynamic mobility exercises, flexibility). If the player displays fatigue, the mechanical and physiological load should be reduced in the following sessions. Other alternative and recommended strategies, if possible, would be to perform cold water baths in the first 12 hours post-session (10-15 minutes at a temperature of 10-14 degrees), and use muscle relaxation measures after intense training (for example, using a foam roller, or through manual therapy). To meet this goal, quality sleep, good nutrition, and restoration of joint range of motion should be ensured insofar as is possible.

PERFORMANCE PHASE (from 14 to 21 days).

The main aim will be to promote the adaptation of the footballer to the specific movements of the game, increasing match performance readiness. To achieve this, it is recommended to already introduce specific training for the game, combined with preventive exercises and tailor-made recovery procedures. In general, progressively incorporating tasks that require natural articular paths during game play is advocated (e.g. playing overly long balls; extensive control movements; high intensity and longer distance movements, etc.). Still in this performance phase, special attention will have to be paid to the progression of exercises for players who have overcome COVID-19 and its

quarantine. The aim is that at the end of this phase, all players are primed to face the first competition in a suitable state of physical fitness and recovery. The duration of the two phases (retraining + performance) cannot be less than 21 days until the first official match, therefore the performance phase will have a minimum duration of 14 days.

On a general level, exertion intensity will increase, the duration of each repetition increasing though with fewer tasks. It would also be advisable to regulate the recovery time through the feedback of the players, incorporating incomplete recoveries. To achieve the aim of this phase, it will be necessary to progressively insert exercises with opposition (e.g. reduced games before passing sequences), progressively increase both the number of players in shared space, as well as the size of the same, and the speed of the movements (from submaximal sprints to maximums). The duration of the part of the session with the greatest physical demand of the training will range between 35 and 55 minutes, and if a physical load session is combined with a recovery session. More than one training session could be performed per day.

On a specific level, exercises should be incorporated with opposition in small (up to 4 players), or medium (5-7 players), or large teams (more than 8 players). As work is performed on consecutive days, alternate sessions with large spaces and high numbers of players with work in smaller spaces. During the first 2-3 sessions, the run should be limited to maximum speed, high power shots with the ball. It would also be advisable to avoid accumulation of physical load before competitions recommence.

The technical team could schedule the arrangement of friendly matches in this phase, but individual participation should be limited to 45 minutes in the first of these. In the two days after any friendly match, the activity to be carried out by those who had played more than 40 minutes must be less intense. In this same sense, to control the load in this performance phase, it would be necessary to use the same measures recommended in the

recovery strategies, ensuring that the load of this performance phase does not exceed 350 arbitrary units of sRPE, regarding the retraining phase.[14]

Training criteria should be the same as under normal circumstances after completing both retraining and performance phase.

Table 3. Recommendations to foster football players' fitness levels by controlling health risks after COVID-19 pandemic

	Retraining phase	Performance phase
Main goal	Reconditioning and injury prevention	Adaptation to football-specific movements and running actions
Organisation	Individual exercises, in pairs or in small groups (up to 6 players)	Game specific workouts in small groups until the obtaining of brief simulated competitions with 11-players per side
Length	5-7 days	14-21 days
Frequency	5-6 sessions/week	5-6 sessions/week
Density	1 session/day	1 or 2 sessions/day, alternating demanding and recovery sessions
Duration	35-50 minutes/session	35-60 min/session
Location	Gymnasium and football pitch	Mostly in football pitch
Load management	Progressive increase in the frequency, volume and intensity	Increasing exercise intensity with intermittent activities Longer duration of each repetition while gradually decreasing the number of repetitions

Recovery	Complete or almost-complete recovery	Incorporate incomplete recovery during intermittent exercise in a progressive manner
Specific aims	Prioritisation of exercises without opposition-contact Progress in number of decision-making processes Alternate physical / motor skills Progress in design of specific agility exercises (reaction; changes of direction, etc) gradually increasing the distance of the movements Progress in the design of exercises with the ball, tending towards moderate number of contacts and low power kicking actions	Exercises in medium and large-sized groups, increasing playing spaces Incorporation of exercises with natural joint movements Increase speed of movements Increase distance of the running actions Inclusion of exercises with acceleration / deceleration Progress in exercises facing opposition In the design of ball exercises, tending towards the least number of contacts with the ball
Internal load	Measures of subjective perception of exertion (such as session rate of perceived exertion, *sRPE*) and muscle fatigue. Control of acute load	Measures of subjective perception of exertion (*sRPE*) and muscle fatigue Control of acute and chronic workloads
Limitations	Avoid tasks that require ample joint movements Avoid long distance sprint manoeuvres Avoid maximal acceleration/decelerations Avoid sizeable backlogs of work on consecutive days	During the initial sessions, avoid running at maximum speed for more than 20 metres During the initial sessions, avoid kicking the ball with maximum intensity Avoid accumulation of physical load before the first competitive match

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