Aspetar IP² NetWork

Prevention for Performance

Aspetar Sports Injury and Illness Prevention (ASPREV)
National Sports Medicine Programme (NSMP)

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COMMUNICATION

THE BACKGROUND

To give your injury prevention efforts the best chance of success, effective communication between medical staff (represented by the team physician) and coaching staff (represented by the head coach) is vital. All members of the medical staff, as well as the team's administrative manager, players and technical Staff must be included for communication to be effective. Player availability and injury burden are affected negatively when there is poor communication between the medical team and the head coach/manager (Ekstrand et al., 2019).

This document provides suggestions - primarily to the medical staff – senior members (team physician, head physiotherapist) on:

- How to structure an effective communication
- An outline of the skills required to be an effective communicator

THE FACTS

- In any communication, it is critical that you align your message with key stakeholders - such as the coach - ahead of the communication taking place. This avoids any disruption or dispute occurring during the actual conversation/presentation of your project or program.

- The preseason camp is a good opportunity (location and timing) to engage stakeholders. You have more facilities and a good atmosphere to build relationships through collaborative conversations.

THE RECOMMENDATIONS - HOW TO STRUCTURE EFFECTIVE COMMUNICATION

In order to ensure you communicate effectively about injury prevention, it is important to ensure that the following 'conditions for success' are in place:

Process	Guidelines
Why	Provide a compelling context and explanation for why injury prevention is so important and what it allows for. Suggestions: • Helps improve performance with less down time. • Better performance - more players available for training and matches. • Fitness, avoid severe injuries. • More victories, less money spent on treatment.
What	In preparing for your communication: • Be clear about what you want to share. • Be clear about what outcome you want from each conversation. • Be clear about what type of conversation to have for best outcome. * The communication structure in 'Shared Decision Making'-type conversations is illustrated below (Figure 1). • Be clear about what documentation you need to support the conversation – slide packs, videos, reference material, handout guidelines, etc . • Have data available to support your suggestions and recommendations.
Who	• Identify who will be leading and supporting these conversations (e.g. physician leading – medical staff supporting). • Identify the key audience (club administrative managers, coaches, technical staff, players) and ensure all are included and involved in the conversation about injury prevention to ensure shared understanding and alignment about the approach. • Identify who it is crucial to have onboard before you open the conversations to the group for shared understanding and alignment. For example: 1. The success of the injury prevention program is closely tied to the buy-in of the Coach. Convince him – then everything is possible. 2. You must also have the team's administrative manager's support to ensure implementation with the players.

Where	• Have the conversations at a location where everyone is able to easily join in, such as a training camp. Choose a place and time where everyone who should be part of the communication is on site. • Ensure you have the facilities you need to share information (e.g. meeting room with screen to share visuals, gym with equipment to demonstrate exercises, etc.) and a setup that is suitable for collaborative dialogue.
How	• Leave people with a clear view how to implement injury prevention – provide some clear actions or co-create actions with them that they are aligned to implement. • Offer your support, i.e. "The medical staff are here to help and work with you as one team on injury prevention. We will bring ideas, suggestions, recommendations and work with you to find the best solutions for your team." • Ensure that you set up an agreed way to follow up and stay connected for ongoing support as the injury prevention program is implemented.

Note:

- The structure for the conversation should always follow a similar process (as above); however, the actual conversation will need to be adjusted each time by the communicator to suit the audience in terms of where emphasis is placed, examples used, level of understanding, etc.
- This will be expanded on in the accompanying **'Communication Tool Kit'**.

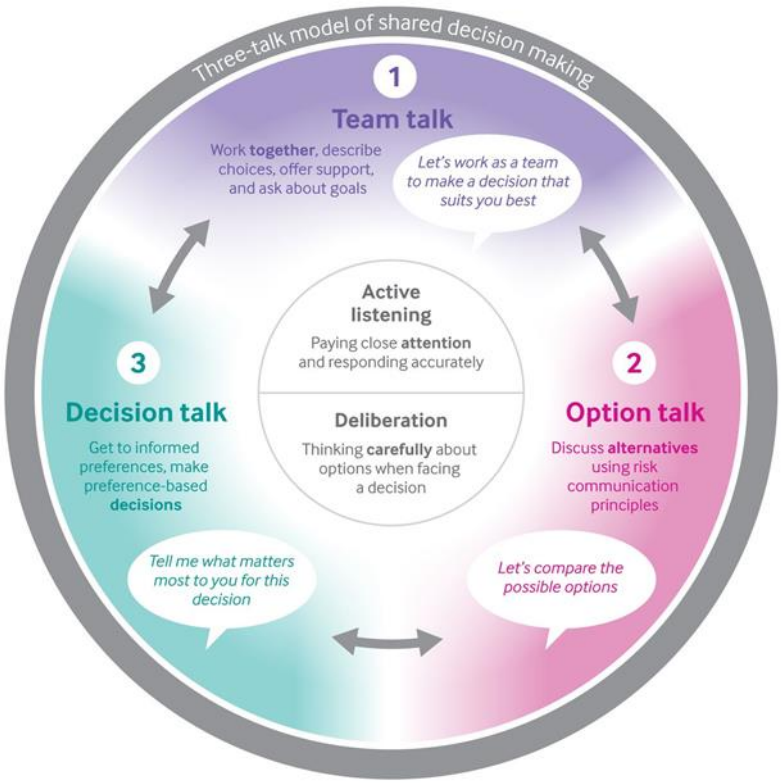

Figure 1 Effective communication skills - the structure of conversation in 'Shared Decision Making' [Elwyn et al., 2017]

Utilising a structure like this will greatly help the communicator to have a well organised and professional conversation. However, the impact or effectiveness of the conversation is largely dependent on the skills of the communicator and their ability to generate a collaborative dialogue.

Communication skills can be developed and, with practice, will allow the communicator to better interact and communicate with a broader and broader audience. The most important skill being the ability to generate the best way of listening for the needed interaction, generating collaboration and delivering the intended outcome.

The 'How to'-Communication Tool Kit suggest the necessary interpersonal self-awareness elements that an effective communicator needs to have, as well as their ability to build their listening skills.

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SLEEP

THE BACKGROUND

Appropriate sleep durations recommended for adolescents and adults are approximately 8–10 hours, but without specific recommendations for athletic populations. In the Middle East, average sleep duration is insufficient relative to typical recommendations for adults (6 hours) and adolescents (7 hours), including adolescent academy soccer players (6–7 hours) (Khalladi et al., 2019).

THE FACTS

Sleep is an essential component of health and well-being, with significant impacts on:

- Physical development
- Emotional regulation
- Cognitive performance
- Quality of life

In athletes, increased sleep duration and improved sleep quality are associated with improved performance and competitive success, as well as better health outcomes through reducing the risk of injuries and illnesses (Watson, 2017).

9 RECOMMENDED PRACTICES TO ENHANCE SLEEP (Marshall & Turner, 2016)

1. Find a quiet environment to sleep in
2. Ensure a dark room with no light source present
3. At least 7 hours of sleep per night
4. Napping no later than 3 pm (mid-afternoon)
5. Avoid the use of computer/tablet/phone (blue screens) before sleeping at night or recommend blue light filtering through specific glasses or software.
6. Maintain a cool room temperature (≈18°C), which is known to facilitate sleep
7. Ensure that bedding/clothing does not cause an environment that is too hot
8. Create a sleep routine – consistent time of going to bed and waking up
9. Avoid caffeine and food/fluid intake before sleeping (does not apply to napping)

STRATEGIES TO IMPROVE SLEEP IN ATHLETES

1. Improving sleep routines

Create a good sleep hygiene by going to bed and waking up at the same time every day. This routine should include a wind-down period before bed, a cool, dark, quiet sleep environment, turning off screens before bedtime, and having a consistent sleep schedule (Bonnar, Bartel, Kakoschke & Lang, 2018).

2. Post exercise wind down and sleep promotion strategies

Exposure to a cold bath or shower has a positive, sleep inducing effect. This might be of importance after late night training or matches (Douzi et al., 2019).

3. Increasing sleep time and napping

Longer nocturnal sleep duration and napping are likely to contribute to improve athletic performance, reaction time, daytime sleepiness, and mood (O'Donnell, Beaven & Driller, 2018).

4. Pro-active screening

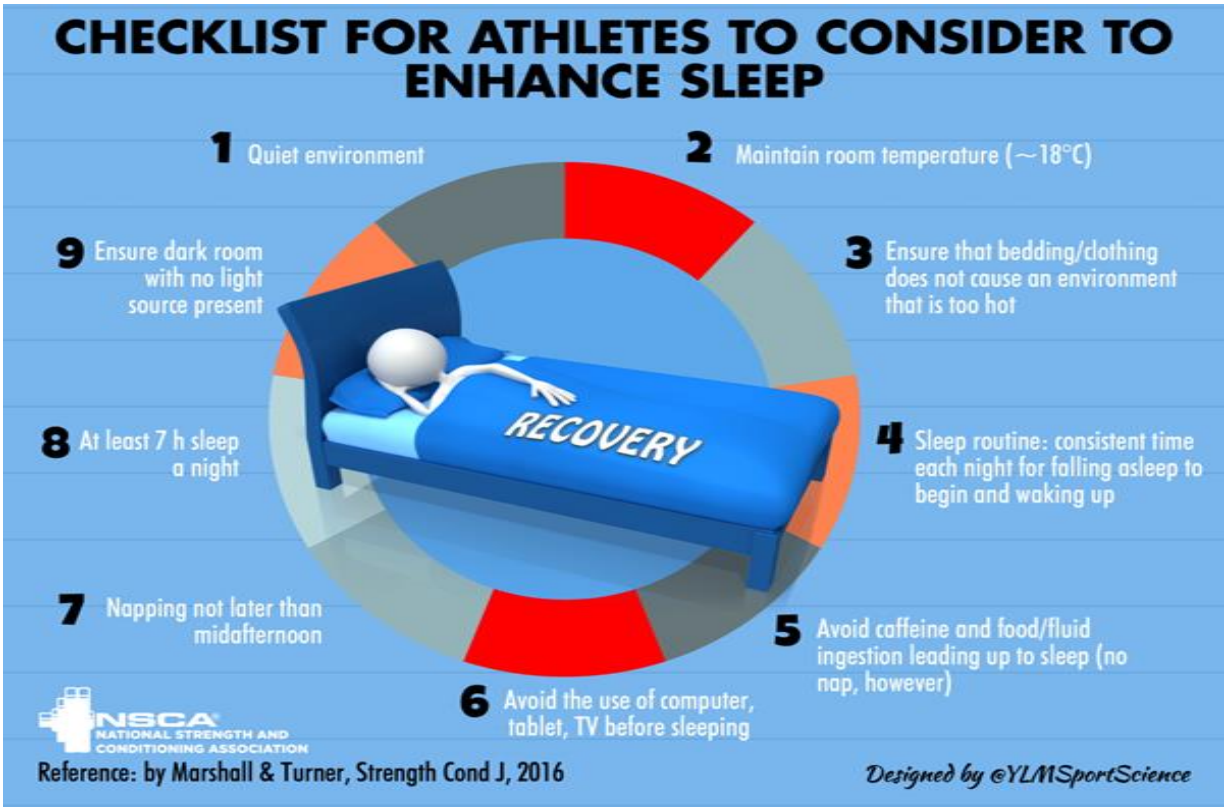
Develop individualized sleeping plans for each athlete depending on their pre-existing habits and sleep duration/quality (Venter, 2012).

5. Provide evidence-based sleep education

Include athletes, coaches and management staff who may help to identify barriers and improve sleep knowledge (Miles, Clark, Fowler, Miller & Pumpa, 2019).

6. Monitor the athlete's sleep

The use of sleep logs, questionnaires (The athlete sleep screening questionnaire, Samuels, James, Lawson & Meeuwisse, 2016), sport-specific outcome measures, and, where possible, objective measures of sleep such as actigraph recordings are encouraged.



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NUTRITION FOR FOOTBALL

High level football means competition and often the margin between victory and defeat, success or failure is very small. Thus, details can play an important role in such balanced situations (F-MARC 2010).

Football is a high-intensity intermittent sport, characterized by periods of intense anaerobic movements (e.g. sprints) alternated with periods of aerobic exercise (e.g. jogging) (Maughan 2006).

Diet can affect performance and the foods we choose during training and competition periods will be related with training quality, physical gains from the sessions, recovery and muscle adaptations (F-MARC 2010). Being able to manipulate food intervention according the above-mentioned specifications of football, makes part of the team strategy to win. From the different factors that contribute to success, food and nutrition is one the few we can control and manipulate.

Playing a key role promoting health and well-being, nutrition plays also a major role in performance, development and recovery (Oliveira et al., 2017). Each player is different, so each player's personal nutritional goals will be different, and players should be aware of the best way to meet their goals (F-MARC 2010).

A proper diet can also help supporting high intense training periods while limiting the risk of illness and injury (F-MARC 2010). Finding a proper balance between needed energy to stay healthy/perform well and avoid the excesses that can lead to body fat increase is key.

Maintaining a proper hydration status is also extremely important for health and performance and players should pay great attention to this especially when playing in hot and humid weather conditions (Oliveira et al., 2017).

The benefits of good nutrition for the health and performance of players and officials at all levels of the game of soccer are widely recognized, and optimal **nutrition is now a key strategy in the preparation of top teams**.

NUTRITION CHALLENGES

Due to lifestyle and perhaps a lack of nutrition awareness and education, lack of interest in cooking, poor choices when grocery shopping or eating out and a busy lifestyle are among the many issues causing a gap in proper nutritional practice.

The fundamentals of optimal nutrition start at home. Due to cultural and traditional factors, most families do not practice mindful and healthy nutrition. The lifestyle of players within Qatar, and the GCC as whole, is another issue needed to be tackled in order to promote healthy nutrition.

Influenced by weather conditions and cultural differences, most players follow an irregular sleeping routine. Such sleeping patterns, coupled with a busy lifestyle (i.e. school, training) lead to poor nutritional practices.

Qatari football player diets are typically high in carbohydrate and low-moderate in protein, fruits and vegetables. Given this, it is the joint responsibility of the relevant sports nutritionists, coaches and sports science staff to educate, encourage and motivate players to practice proper nutrition for the sake of their health and especially their football performance.

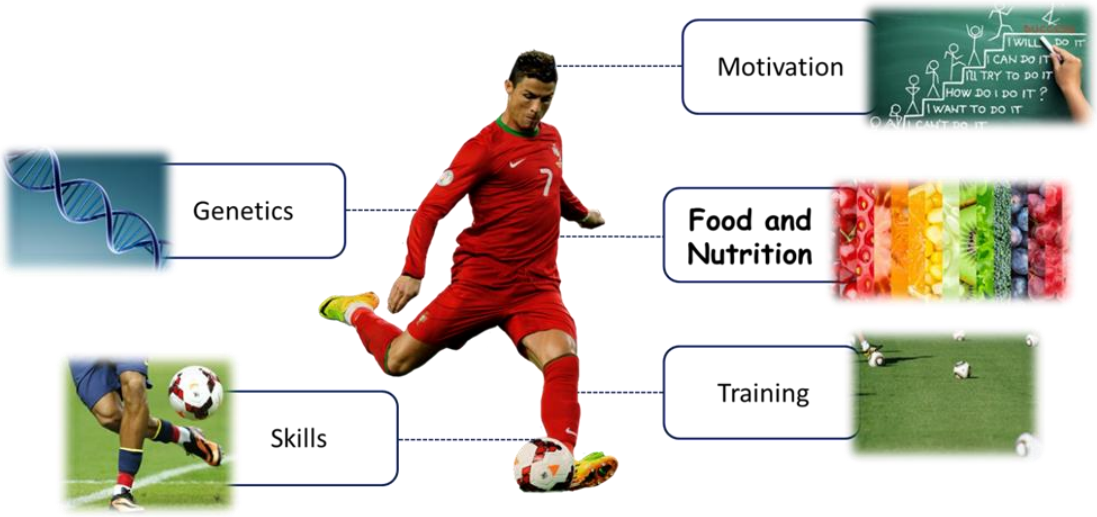


Figure 1: Different factors can influence sports success.

ENERGY REQUIREMENTS

Foods and fluids can both supply immediate body energy needs as well as affect body energy stores. This last one can play some important exercise performance related, since they might contribute for:

- Body composition (e.g. body fat and muscle mass)
- Function (e.g. muscle mass)
- Fuel for exercise (e.g. muscle and liver carbohydrate stores)

Training sessions and matches increase the energy requirements since body must spend higher amounts of energy, which is simple to understand. Extra sports related energy demands must be added on top of the energy required for normal daily activities (F-MARC 2010).

The daily energy requirement should reflect the intensity, duration & frequency of players' training schedule (Oliveira et al., 2017). Simply, more energy is needed on hard training days and less on easy training/recovery days. It is then important to adapt food intake accordingly.

This energy will come from food intake, in the form of nutrients: macronutrients (carbohydrates, protein, fat) and micronutrients (vitamins and minerals). While macronutrients will provide energy, micronutrients will play a crucial role on body's regulation, promoting wellbeing and preventing illness (F-MARC 2010).

Table 1 lists the amount of energy per gram of the three macronutrients in the diet – carbohydrates, protein and fat.

Note the fact that fat provides more than twice the amount of energy of both carbs and protein. Not all fats are the same but eating too much is a sure way to say goodbye to your six pack!

Table 1 – Energy density of the different macronutrients

MACRONUTRIENT	ENERGY DENSITY (kcal/g)
Carbohydrates	4
Protein	4
Fat	9

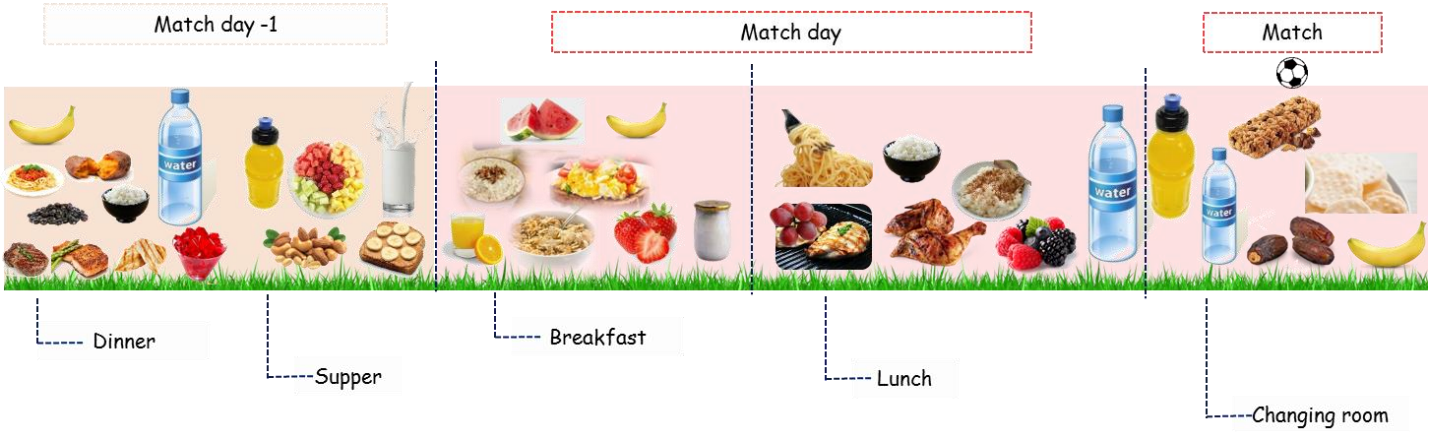
Carbohydrates are the main fuel for energy production and fatigue towards the end of a game may be related to depletion of glycogen in some of the individual muscle fibers. They are stored mostly in the muscles and in the liver as glycogen (F-MARC 2010).

The physical demands during a game vary greatly between players and are related to physical capacity and tactical role in the team. These differences should be taken into consideration in the training and nutritional strategies of all players (Oliveira et al., 2017). Although energy needs also vary greatly between individuals, the total energy cost of a game for a typical player weighing about 75 kg would be around 1800 kcal (F-MARC 2010).

These infographics show basic match preparation and match recovery nutritional strategies as an easy suggestion to help players to perform and recover as best as they can.

TIMELINE FOR MATCH PREPARATION*

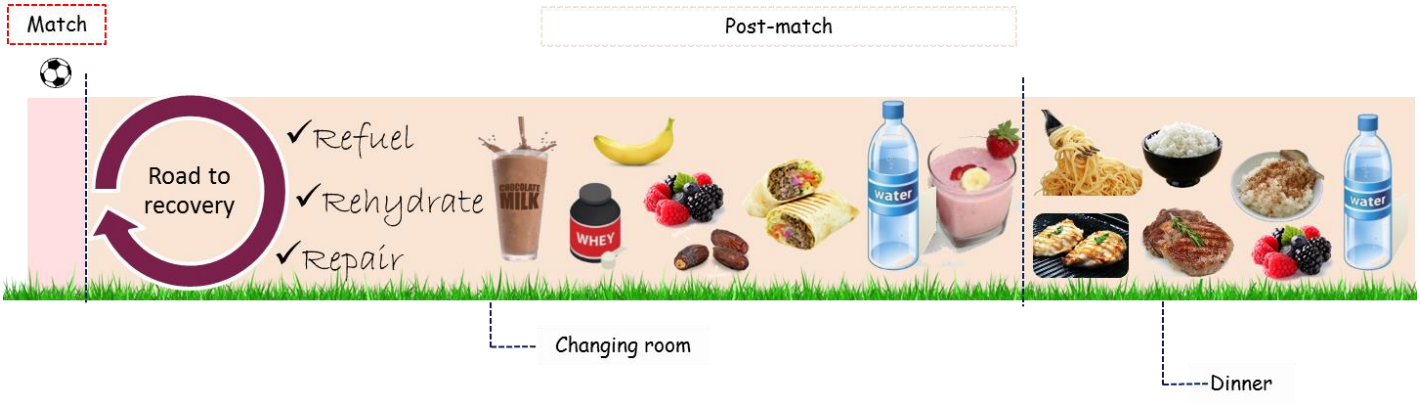
Main goal: Carb-loading & hydration



*Note: this infographic is intended to be a complement to the nutritional intervention within the team

TIMELINE FOR MATCH RECOVERY*

Main goal: Recovery



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HYDRATION

THE BACKGROUND

Water is the most abundant component of the human body as it constitutes between 50 to 70% of the total body mass (Belval et al., 2019). Fluid losses during football activities range between 0.3 to 2.5 l/h and players may lose up to 3.5% of their body mass in demanding conditions (Nuccio et al., 2017). Football players are considered at higher risk for dehydration (>2% weight loss) compared to other team sports, especially when playing in hot and/or humid environments (increases sweat loss) and when fluid intake is limited due to low availability or few opportunities to drink (Nuccio et al., 2017). Dehydration may have several adverse effects, such as reduced running performance, impaired cognitive and technical skill performance, along with increased ratings of fatigue and perception of exertion (Keen et al., 2018; Nuccio et al., 2017). The current literature does, however, suggest that fluid losses up to 2-3% of body mass have minimal impact on football performance; maintaining core temperature and blood glucose levels is more crucial (Nuccio et al., 2017). Performance detriments are more likely when dehydration is the result of heat stress (Nuccio et al., 2017). Maintaining fluid balance prior to, during and after exercise is one important preventative measure to minimize the risk of hyperthermia and exertional heat illness (Bergeron et al., 2012; Belval et al., 2019).

THE FACTS

- The main mechanism contributing to heat loss during sporting activities is the activation of sweat glands and **evaporation of this sweat from the skin**. This removes heat from the body in dry conditions but **becomes less effective in humid conditions** (Bergeron et al., 2012). Note that significant amounts of fluid can also be lost through sweating when a match is played in cold weather environment (Oliveira et al., 2017).

- A player's **hydration deficit at the beginning of a match** can compromise the performance but is often neglected (Oliveira et al., 2017). It is recommended that athletes drink **6 ml of fluid per kg of body mass every 2-3 h before training or competing in the heat** to start the training in a euhydrated state (Racinais et al., 2015).

- The average sweat quantity observed in football range from **0.3 to 2.5 l/h**. The range in fluid balance reported in the same studies was from **+0.4 to -3.5% change in body mass** (Nuccio et al., 2017).

- **Fluid restrictions up to 2.5% of body mass loss have minimal effects on cognitive performance** in football. **Maintaining blood glucose and core temperature** is considered more important (Nuccio et al., 2017).

- There is a substantial **variation in fluid loss between individuals** and it is difficult to provide universal recommendations (Bergeron et al., 2012). Metabolic rate and heat acclimatization status have been considered influencing factors (Racinais et al., 2015). In a football game, sweat rates varies between players according to their position and playing style, as well as the total time spent on the pitch (Oliveira et al., 2017).

- **Sodium is the main electrolyte lost in sweat** and to maintain plasma sodium balance, supplementation during exercise may be required, for example through solutions containing 0.5-0.7 g/l. **Fluids can also be a good source of carbohydrates** during longer exercise sessions (>1 h) (Racinais et al., 2015).

- It is recommended to **replace 100-120% of body mass losses after exercise**, preferably through a combination of fluids and foods (including salty foods). Drinks containing protein may be better for fluid balance restoration than carbohydrate-electrolyte sports drinks (Racinais et al., 2015).

RECOMMENDATIONS

1. Arrive to the session hydrated

Players should arrive for training sessions and matches in a euhydrated state, especially when training and competing in the heat (often the case in Qatar). This can be achieved by drinking regularly and general recommendations suggest 6 ml of fluid per kg of body mass every 2-3 h.

2. Avoid weight loss over 2-3% to maintain performance during exercise

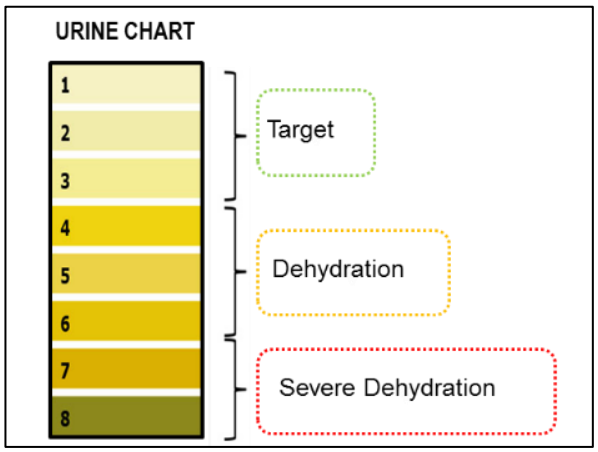
During exercise in the heat, players should aim to limit weight loss in order to reduce the physiological impact of the heat and to perform at the highest level. As long as body mass losses do not exceed 2-3%, there is little evidence that football performance is affected and there is no need to overdrink. Regular consummation of sports drinks during prolonged exercise can also be beneficial by providing carbohydrates and electrolytes (sodium), although sweat rates are very individual. Sodium supplementation before and during exercise may be especially important for "salty" sweaters, and solutions containing 0.5-0.7 g/l of sodium have been suggested.

3. Replace losses after exercise

It is recommended that at least 100-120% of body mass losses are replaced following exercise. This is especially important if the time between sessions is short, when the recommendation is to replace 150% of body mass losses during the first hour after exercise. Drinks with carbohydrates, sodium and protein (e.g. milk, chocolate milk or protein shakes) can optimize the recovery process.

4. Monitor hydration in your team

Since individual variations in sweat rates and sodium losses can be large, it can be useful to monitor hydration for each individual to provide personal rehydration strategies. Different methods, like urine specific gravity and urine osmolality are available to assess the hydration level prior to exercise but a practical way to do it is by checking urine color, comparing it with a urine chart (see figure). The chart is less useful on its own but can be used to identify dehydration after exercise in the heat in combination with body mass changes and thirst measures.



Estimating fluid losses during training sessions or matches in specific conditions can be done by weighing players before and right after (<10 min) a session. Make sure that the player wears minimal clothing and dry off sweat with a towel. Keep a record of the fluid intake during the session and measure body mass before and after any toilet visits. The estimation of sweat loss can then be calculated as:

Total sweat loss (L) = Body mass before (kg) – Body mass after (kg) + Fluid intake (L) – Urination (L)

To convert this to sweat rate per hour, divide by exercise time (min) and multiply by 60:

Total sweat loss per hour = Total swat loss (L) / Session duration x 60

Weather conditions should be recorded for each test (temperature, humidity and heat index), either by using a portable weather station or through reliable sources (e.g. https://www.accuweather.com).

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NUTRITIONAL SUPPLEMENTS

THE BACKGROUND

While athletes and their support teams are advised to adopt an individualized, planned, food-first approach (Stellingwerf et al., 2019), sports supplementation remains a key part in an athlete's physical preparation and/or competition strategy. It is difficult to discuss sports supplements without making significant reference to anti-doping. The purpose of this document is to provide a simple guide to contemporary supplement use, facts and key issues to be aware of, globally, in the GCC and Qatar.

What is a supplement?

A universal definition remains elusive. Supplements are commonly referred to as products which are consumed for the purpose of supplementing the diet and are classified based on their intended use. For athletes, these include sports foods (e.g. gels, sports drinks and bars), medical supplements (e.g. iron, calcium, Vitamin D), and ergogenic supplements (e.g. caffeine, creatine). All are referenced however, in position statements to help educate and guide athletes and support staff on supplement use (Maughan et al., 2018, Kerksick et al., 2018, SENr, 2016).

Prevalence of sports supplement use

Patterns of supplement use differ across athletic sub-populations, along with considerable variation between countries (Knapik et al., 2016). General reasons for supplement use include; correction of nutrient deficiencies, energy provision, better recovery from training, optimization of specific goals from training e.g. muscle mass, fat loss or, in some cases, a "just in case" philosophy.

Prevalence of supplement use in athletes has been reported between 15% and 93% globally, with an increasing trend linked to level of training and performance, age and sex (more among males than females). Limited studies in the GCC suggest that the prevalence is closer to 40% in elite and recreational athlete groups (Aljaloud & Ibrahim, 2016, Ghobain et al., 2016). In Qatar, new data suggests a prevalence of 30%, making it lower than other GCC countries (Kings & Wilson, 2020).

What sports supplements work?

The supplement industry is unregulated and littered with anecdotal reports from athletes or coaches with little or no evidence (Maughan et al., 2018). With the exception of clinical supplementation used to treat diagnosed clinical deficiencies, and sports foods there remains only five supplements that directly improve sports performance i.e. truly "ergogenic" in nature. **Specifically, creatine, caffeine, nitrate, beta-alanine and sodium bicarbonate.** Most recently, collagen peptides have also shown increasing levels of evidence in the injury domain when treating specific tendon related pathologies.

In the case of immunity, vitamin D, probiotics and vitamin C are highlighted as the supplements with moderate evidence for use with athletes at specific times of the season to minimize illness risk.

Many adolescent athletes also consume supplements. This is often as a result of misinformation from suppliers (Herriman, 2017) and erroneous beliefs by coaches or parents (Manore, 2017). The evidence for sports supplement use in adolescents is lacking in both football and non-football sport (AIS, 2019). For some cultures it is anticipated that well planned and executed nutrition required to support growth during higher training periods may be unrealistic in the short term due to poor habits. Here, solutions using sports foods may be required to support athlete health, particularly in certain stages of maturation, until education can have an impact on habits or coach/parent beliefs. Where high sugar containing nutritional drinks and bars are used, all athletes need to be reminded to pay attention to good oral hygiene to reduce tooth decay (Needleman 2018).

Table 1. Sports supplements and related applications in athletic preparation and performance (Over 18 yrs only)

	Protein	Caffeine	Creatine	Sodium Bicarbonate	Beta alanine	Nitrates	Collagen Peptides
↑ Training capacity (Endurance)		●		●	●	●	
↑ Training capacity (Strength)	●	●	●				
Body composition change (Muscle mass)	●	●	●				
Body composition change (Fat loss)	●	●					
Recovery, muscle adaptation and injury	●						●

Risk for inadvertent doping violations

It is well established that consumption of a contaminated sports supplement is a real and present threat for athletes, who could be banned from inadvertently failing a doping test (van Thuyne et al., 2006, Mathews, 2018). One in ten supplements sold on the market are contaminated with some form of steroid or prohibited substance. With this in mind, it is not surprising that unintentional doping from a contaminated supplement represents 7-9% of all anti-doping rule violations. In some countries, there is one case every month.

Nutritional supplements do not fall under the same strict regulations as pharmaceutical medicines. Contamination can occur when supplements are manufactured by companies who also use the same equipment to produce supplements for different clients and markets that contain prohormones and other substances prohibited by WADA.

Risk for inadvertent doping violations

The single most important factor is to **improve the decision-making process on whether a supplement should be used (efficacy) and where the supplement is sourced from (safety)**. Several resources now exist to support the decision-making tree.

In the context of **sports supplement efficacy**;

1. The latest IOC consensus statement offers flow charts for practitioners to improve decision making related to supplements for nutrient insufficiency and also the use of sports supplements for performance (Maughan et al., 2018).
2. The Australian Institute of Sport has its own established evidence-based supplement classification system resource it uses to guide its athletes and coaches (AIS, 2019).

In the context of **supplement safety** to reduce risks associated with contamination, independent third-party laboratory testing and labelling to highlight additional standards is now recognized by many national anti-doping authorities e.g. UK, Spain, Australia, USA (none in GCC currently). Examples include **Informed Sport, Informed choice, and NSF Certified for Sport**. While choosing a supplement that carries such third-party testing marque is a step forward, it does not ensure the product is 100% free of prohibited substances. It merely helps athletes choose a lower risk product. Caution is also needed as there are differences in testing standards between these marques (Maughan, 2019). For this reason, products that carry the **Informed Sport** marque remains the preferred standard where possible.

Summary

Certain sports supplements have been shown to impact on specific areas of training and competition. However, athletes must be aware that consumption of these carries a risk of inadvertent doping which can only be managed, but not completely eliminated.

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TRAINING LOAD

THE BACKGROUND

Over the last few decades, football has become a competitive, professionalized industry, where players face congested match schedules and increasing pressure to stay competitive. Consequently, athletes and coaching staff are aiming to improve performance, usually through alterations in their training methods. Training and competition loads cause a series of adaptations in the human body which, eventually, improve fitness and performance (Soligard et al., 2016). A principal goal is to improve the capacity to tolerate training loads, while avoiding injuries, illness and overtraining. Poorly managed training loads can influence different aspects of player health (Schwellnus et al., 2016; Soligard et al., 2016) and the balance between load and specific tissue capacity plays a substantial role in injury (Nielsen et al., 2018). The relationship between training load and health outcomes can be seen as a continuous balancing act between load and recovery. In this process, monitoring player load is essential.

THE FACTS

Monitoring training (and competition) load can be used to:

- Help understand changes in physical performance and increase understanding of training responses (Fox et al., 2018).
- Identify fatigue and accompanying needs for recovery (Halson, 2014).
- Inform the planning and modification of training programs and competition schedules to minimize the risk of non-functional over-reaching (fatigue lasting weeks to months), injury and illness (Schwellnus et al., 2016; Soligard et al., 2016).

MONITORING EXTERNAL AND INTERNAL LOADS

Different measures of load are available, but evidence for their validity as markers of adaptation and maladaptation is limited. The term ‘external load’ is often used interchangeably with ‘load’, referring to training or any external stimulus applied to the player, resulting in physiological and psychological responses. This individual response is referred to as ‘internal load’. There is no single marker of an athlete's response to load that consistently predicts maladaptation or injury. Monitoring external load is key to understand the work completed as well as the athlete's capacity. Internal load monitoring is vital in establishing the appropriate stimulus necessary for ideal biological adaptation. It is evident that individuals will respond differently to any given stimulus and that the load required will differ for each individual. There is no one size fits all-solution.

Examples of measurement tools to monitor external loads:

- Type, duration, intensity and frequency of training and competition
- Time-motion analysis
- Power output, speed or acceleration
- Movement repetition counts (e.g. number of jumps, throws, pitches, serves or bowls)
- Distance (e.g. kilometers run in total or above certain speed thresholds)

Examples of measurement tools to monitor internal loads:

- Perception of effort (e.g. rate of perceived exertion (RPE) or session rating of perceived effort (sRPE: session duration (min) x RPE))
- Psychological inventories (e.g. Profile of Mood States (POMS) or Recovery Stress Questionnaire for Athletes (REST-Q-Sport))
- Sleep (e.g. sleep quality and sleep duration)
- Biochemical/hormonal/immunological assessments
- Heart rate (HR), HR to RPE ratio, HR recovery (HRR) and HR variability (HRV)
- Blood lactate concentrations and blood lactate to RPE ratio

PRACTICAL GUIDELINES FOR LOAD MANAGEMENT

The overall aim of structured load management is to ideally combine training, competition and other loads to enhance adaptation and maximize performance while also reducing the risk of injury. Load management therefore entails the monitoring and correct prescription of external training loads relative to each athlete’s current capacity and response. Soligard

et al. (2016) emphasized that high loads may have either positive or negative effects on injury risks in athletes and that key factors are the rate of load application and the intrinsic risk profile of the athlete. The authors also provided some practical guidelines for prescription of training load:

- Smaller increases and decreases in load are associated with less injury risk compared to big variations in loading. Different sports have different load-injury profiles. Although current evidence is limited, it is reasonable to limit weekly increases of training load to less than 10% in order to maintain positive adaptation and therefore reduce the injury risk.
- In football, playing two matches (i.e., less than 4 days recovery between matches), compared to one match per week, increases the risk of injury (Soligard et al., 2016). Squad rotations is a strategy to protect individual players from large increases in match load, which may put them at greater risk of injury.
- Training load should be recommended on an individual basis, as there is a large variation in the time frame of response and magnitude of adaptation to similar load (Soligard et al., 2016). Load should be monitored closely, as these players are at higher risk for injury when introduced to increases in load and/or congested competition calendars.

Adequate recovery sessions should be incorporated after intensive training periods, competitions and travel. Care should be given to nutrition, hydration, sleep, rest, active relaxation strategies and emotional support.

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WARM-UP

THE BACKGROUND

The optimal warm-up strategy varies between sports and depends on the environmental conditions (Bishop et al., 2003, Racinais et al., 2017). The warm-up is considered a primary prevention strategy in participants performing physical activity, as it stimulates the transition from a state of rest to a state of exercise, while minimizing residual fatigue (Hammami et al., 2016). Injury rate in male professional football is high and the burden can impair team success in the league (Drew et al., 2017, Hagglund et al., 2013, Ekstrand et al., 2013, Hägglund et al., 2009). Therefore, warm-up routines are commonly used to prevent injuries and optimize performance. However, routines and protocols used for injury prevention are subject to controversies due to the gap between evidence-based methods and on-field practices (Abade et al., 2017).

THE FACTS

Warming up is crucial for football players, carrying out relevant specific tasks to the best of their ability, so they can maximize performance during play (Zois et al., 2011). Warm-up increases body temperature, cellular metabolism, joint range of motion, post-activation potentiation, oxygen uptake and decreases muscle stiffness (**Barnard et al., 1973,** Bishop, 2003b, Silva et al., 2018). In addition to promoting an appropriate **cardiovascular response, other benefits include** enhanced neuromuscular and mental performance, as well as motivation, preparing players for match stress (Sander et al., 2013).

- **Cardiovascular response**
  A sudden, rapid increase of high-intensity exercise without any warm-up results in ischemic change, a rapid rise in heart rate and insufficient perfusion. A warm-up is therefore recommended immediately before or 10 to 15 min prior a sudden burst of high-intensity exercise to eliminate or reduce an ischemic response (Barnard et al., 1973). The abnormal cardiac response from sudden strenuous exercise without warm-up is attributed to the inability of coronary blood flow to rapidly augment to meet the demands of high-intensity work (Barnard et al., 1973b).

- **Increased muscle temperature**
  Warming up increases muscle temperature, which induces several internal changes, such as increased blood flow and enhanced metabolic response (Bishop et al., 2003, Fradkin et al., 2010). Within the first 3 to 5 min of exercise, there is an increase in temperature that plateaus after 10-20 min of continuous exercise in normal weather conditions (Silva et al., 2018).

- **Neural activation**
  Neural activation is a factor that enhances muscle contractile response to subsequently enhance power output and induce positive psychological effects while minimizing fatigue (Silva et al., 2018). Neural activation also has injury-preventive neuromuscular effects (Hammami et al., 2016).

- **Environmental**
  Active warm-up does not impair prolonged, intermittent sprint performance in the heat compared with neutral conditions (Yaicharoen et al., 2012). However, whilst an increase in whole body temperature is beneficial to performance in cold environments, the warm-up should be adapted before exercising in the heat to promote muscle adaptations, yet minimize the increase of core and skin temperature (Racinais et al., 2017). In the Gulf region, the warm-up routine should therefore take in account the environmental conditions.

- **Types and concept of warm up**
  Warm-up techniques can be broadly classified into two major categories: passive or active warm-up. Passive warm-up involves raising muscle or core temperature by some external means, while active warm-up utilizes exercise (Bishop, 2003a).
  The general concept of a warm-up is summarized by the RAMP model, divided in 3 stages, it provides the essential parts to balance the warm-up (Racinais et al., 2017):
  1) Raise: First part of the warm-up, targets the thermoregulatory homeostatic systems of the body by increasing muscle and core temperature.
  2) Activate & Mobilise: Second part, activation is highly specific to function and movement patterns the working muscles carry out during competition, while mobilization involves dynamic movements, aiming to activate key muscle groups involved in successful performance outcome.
  3) Potentiate: Third part, involves high rates of force production and muscle-length changes at high velocity.

- **Effect on injury risk**
  The effect of a general warm-up programme (i.e. raising core and muscle temperature, heart rate and so on) on injury risk has not been studied. However, there is overwhelming evidence from large studies that structured exercise programs like the FIFA 11+ (see 11+ fact sheet) reduce injury risk substantially (Al Attar et al., 2016, Sadigursky et al., 2017, Thorborg et al., 2017). These have typically been prescribed as warm-up programmes, so it should be noted that—strictly speaking—we do not know whether it is the specific training effect of the exercises used or simply a "general" warm-up effect that confers the positive effects on injury risk.

THE RECOMMENDATIONS & PRACTICAL APPLICATION

Before applying the advice below, it is essential to structure the warm-up routine.

Active warm-up:
This is the most widely used strategy throughout the years. Short and intensive active warm-ups have gained the support of sports scientists.

- Duration: Between 20 to 30 min, also depend to the weather conditions and the characteristics of players.
- Approach: Should be progressive in intensity to rise body temperature adequately.
- Sport specific: Should prepare for sports-specific tasks.
- Intensity: Should end with exercises of maximum intensity such as sprints to induce a post-activation potentiation effect (Silva et al., 2018).

Passive warm-up:
Passive warm-up strategies have been increasingly considered as a complement to preserve or maintain the effects of an active warm-up during the transition time between the end of the warm-up and the start of the game or the half-time break. Equipment such as heated garments can preserve the benefits of the warm-up during transition phases before a game or competition (Silva et al., 2018).

Coupling active and passive warm-up:
Active warm-ups promoting neural activation should be implemented concomitantly with passive strategies during re-warm-up using heating or cooling garments (or strategies) that maintain muscle temperature and enhance performance in the appropriate environments (Silva et al., 2018, Racinais et al., 2017).

The re-warm-up:
At half-time, active re-warm-up protocols that entail post-activation potentiation exercises and multidirectional speed drills minimize the decline in body temperature and performance, facilitating the recovery of performance levels achieved during the initial warm-up. Re-warm-up exercises such as plyometrics and repeated changes of direction are simple, quick and efficient activities to attenuate losses in power output during vertical jump and sprint activities after warm-up (Abade et al., 2017).

Warm up techniques in football:
Warm-up practices in football typically include (Hammami et al., 2016):

1. Static stretching.
2. Dynamic stretching.
3. High-intensity short-duration drills.
4. Post activation potentiation exercises.
5. Sports specific technical or skill-based activities completed prior to competition.

Event Duration	INTERMEDIATE & INTERMITTENT		
		Environment	
STAGE	GOAL	COOL	HOT
RAISE	Elevate T_m & T_{core} – raise baseline VO_2	10-15 min	↓
ACTIVATE & MOBILIZE	Prehabilitation injury prevention & simulate sport-specific movement patterns	10-15 min	↓
POTENTIATE	Activate/improve neural drive	4-6 min	↓
POST WARM-UP HEATING	YES	5-15 min	N/A

Figure 1. In a hot environment, decrease the duration of three stages. The raise stage is crucial to avoid an excessive increase in core temperature (From Racinais et al., 2017).

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THE NORDIC HAMSTRING EXERCISE

THE BACKGROUND

Hamstring injuries represent a substantial injury burden in football and is the most common non-contact muscle injury overall. Hamstring injuries represent 12 to 14% of all injuries in elite soccer, accounting for 37 to 60% of all muscle injuries sustained (Ekstrand et al., 2011; Hägglund et al., 2005). This means that an elite team can expect about six hamstring injuries every season. Each club in the QSL had 3.9 time-loss hamstring injuries on average with an overall injury burden of 75.6 player days lost each season. Player availability impacts negatively on team success (Hägglund et al., 2013), and also carries a substantial financial burden; therefore, the prevention of hamstring injuries is crucial. The Nordic hamstring exercise (NHE) is an effective prevention exercise, supported by high-level scientific research (systematic reviews and randomized control trials) (van Dyk et al., 2019).

THE FACTS

- **67.5% reduction in hamstring injuries (2 randomized controlled trials)** (van der Horst et al. 2014; Petersen et al. 2011).
  Combining the results of two large randomized control trials in football, we see a massive reduction in injuries. Even if you include ALL the randomized control trials currently available, we still see at least a 50% reduction in injuries. This is strong evidence of effectiveness.

- **85% reduction in re-injuries** (Petersen et al. 2011).
  Among players with a history of a hamstring strains within the past 12 months, for every 3 players that perform the NHE, 1 hamstring injury is prevented. This is an incredibly effective exercise to prevent re-injuries. If the entire squad performs the NHE, a significant reduction in re-injuries is expected.

- **After an initial strength building phase (usually 6-10 weeks), 2 sets of 4 repetitions once a week is all that is needed to maintain a protective effect** (Presland et al. 2018).
  An initial period with overload is needed to produce adaptation in the hamstrings. But thereafter, as little as eight repetitions per week will maintain the adaption to muscle architecture, that may retain the preventive effect.

- **Improves strength and muscle architecture** (Bourne et al. 2017; Ishøi et al. 2018).
  The Nordic Hamstring Exercise training is effective in inducing positive adaptations in hamstring muscle that are related to injury risk in two ways: 1) promoting improvements in hamstring strength, and 2) lengthening biceps femoris long head fascicles.

- **The Nordic Hamstring Exercise makes you faster** (Ishøi et al. 2018).
  Apart from being successful in the prevention of hamstring injuries, the exercise has also been reported to improve sprint performance (small improvements in sprinting are seen when players perform the Nordic Hamstring Exercise).

- **Easy to do** (Petersen et al. 2011).
  The Nordic Hamstring Exercise is performed from a kneeling start position. With the ankles fixed (either with partner or braces), progressively lean forward at the slowest possible speed resisting the movement with both legs while keeping the trunk and hips in a neutral position and the hands held across/at the level of the chest (Figure 1). The exercise can be done on the pitch, with no extra equipment (except perhaps a towel under the knees on a hard pitch).

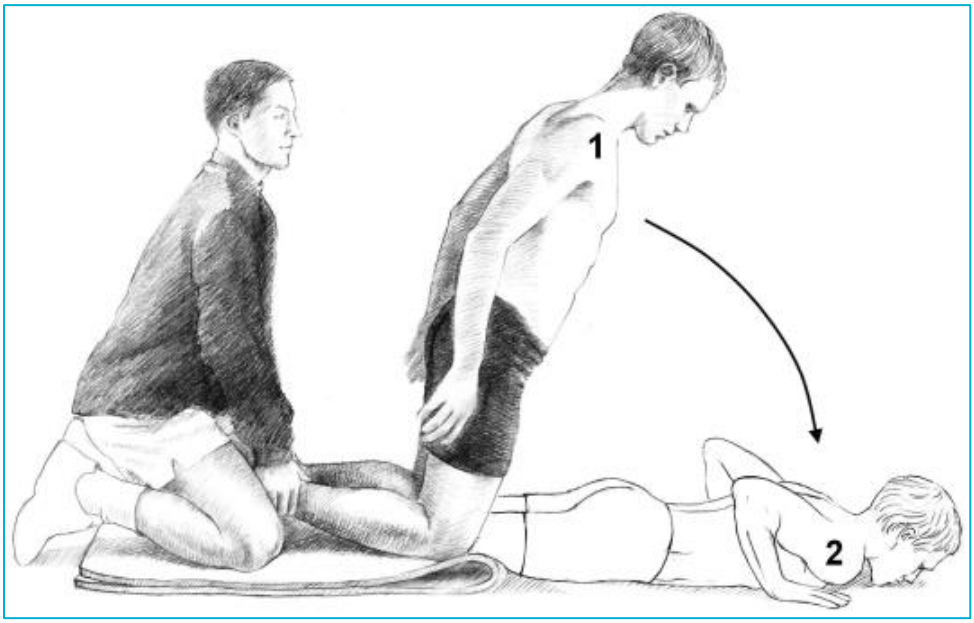

Figure 1: The Nordic hamstring exercise (NHE). Reproduced from Mjølsnes et al.

THE PROGRAMME

Recommended protocol

Introduce a period of high stimulus for 2-4 weeks (Table 1). After this, one session a week of 2 sets of 4 repetitions is enough to maintain the protective effect, although option 1 (Table 1) has also been shown to produce the needed effect without any detrimental effects experienced by the players.

Load is increased as the subject can withstand the forward fall longer. When managing to withstand the whole range of motion for 12 reps, increase load by adding speed to the starting phase of the motion. The partner can also increase loading further by pushing at the back of shoulders. Another option to increase the difficulty of the exercise, is to have the player use weighted Nordic Hamstring Exercise (for example holding a weight plate to their chest or dumbbells in their hands) (Mjølsnes et al. 2004). The increase in load, whether with speed or load, should be introduced progressively.

In-season, it is recommended to perform the maintenance session 1-2 days after matches. During congested match weeks (more than 2 games), it is important to consider the match demands for the players. For the rest of the squad (not involved in the games), we recommend that the NHE is continued (Bengtsson et al. 2018).

OPTION 1*	Week	Sessions per week	Sets and repetitions
	1	1	2 x 5
	2	2	2 x 6
	3	3	3 x 6-8
	4	3	3 x 8-10
	5 - 10	3	3 sets, 12-10-8
OPTION 2**	**Week**	**Sessions per week**	**Sets and repetitions**
	1	2	4 x 6
	2	2	4 x 6
	3 - 6	1	2 x 4

Delayed Onset Muscle Soreness

Several misconceptions have led to beliefs about the Nordic Hamstring Exercise that are not true. Although the exercise may result in mild delayed onset of muscle soreness (DOMS) initially, it disappears within the first two weeks (Bahr et al. 2015). This is a natural training effect. Still, if the Nordic Hamstring Exercise is discontinued for a period, muscle soreness may reappear after resumption. Consistent use of the Nordic Hamstring Exercise throughout the season will ensure that there is no further soreness. The Nordic Hamstring Exercise does not damage the muscle or diminish sprint performance. In fact, it will improve sprint performance.

When to do it

Different reports have demonstrated that the Nordic Hamstring Exercise can be performed before (postwarm-up) or after training (Lovell et al. 2018). Rescheduling the exercise to be done at the end of training may be useful in some cases (Whalan

et al. 2019), although many clubs have reported players prefer to do it at the end of the warm-up. Others have added some NHE post-match, as the players will be sore anyway and rest the day after. There is no definitive rule – find the best time for the team to allow the players to do it without any interruption of the football training.

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THE COPENHAGEN ADDUCTION EXERCISE

THE BACKGROUND

Groin injuries account for 12%-16% of all time-loss injuries in elite European football (Werner et al., 2009), and for 18% of all time-loss injuries in the Qatar Stars League (QSL) (Mosler et al., 2018). Each club in the QSL had 6.6 time-loss groin injuries on average with an overall injury burden of 24.3 players days lost each season (Mosler et al., 2018). Groin injuries more often occur in men than women and comprise both acute muscle injuries and gradual onset groin pain (Walden, Hägglund, & Ekstrand, 2015). Most groin injuries sustained by elite footballers result in less than a four weeks absence (Werner et al., 2009). However, there is a very high risk of recurrence (Mosler et al., 2018, Harøy et al., 2017). Furthermore, symptoms may persist following return to play (Thorborg et al., 2015). It is estimated that around 20-30% of football players will have some form of groin problems during any given week (Harøy et al., 2017, Harøy et al., 2018).

The most common type of groin injuries is adductor-related, accounting for about two thirds of all groin injuries (Serner et al., 2017, Hölmich et al., 2014). Reduced hip adduction strength is the only modifiable factor that has consistently been associated with increased groin injury risk (Whittaker et al., 2015, Mosler et al., 2018). The Copenhagen Adduction Exercise is a dynamic high-intensity exercise which has been shown to increase adduction strength considerably (Serner et al., 2014, Harøy et al., 2017), as well as reduce the prevalence of groin problems (Harøy et al., 2018).

THE FACTS

- **41% reduction in the weekly prevalence of any groin problems** (Harøy et al., 2018)
  An adductor strengthening protocol based on the Copenhagen Adduction Exercise reduced the prevalence and risk of groin problems in male football players by 41%.

- **Easy to do! Very high adductor muscle activation using only body weight** (Serner et al., 2014)
  The Copenhagen Adduction Exercise triggers a high adductor muscle activation, similar to high-load exercises using a machine or cable pulley and can be considered a dynamic high-intensity exercise with the benefit of not requiring any equipment, so it can easily be performed on the pitch.

- **Large adductor strength increases - the more you do it, the stronger you get** (Harøy et al., 2017, Ishøi et al., 2016)
  Eccentric hip adduction strength increased by around 9% following an 8-week intervention with the Copenhagen Adduction Exercise incorporated into the FIFA 11+ warm-up programme, and only performed one set three times per week. A more intensive protocol with a progressive increase from 2 to 3 sets and 3 to 15 reps during an 8-week intervention with the Copenhagen Adduction Exercise elicited a 36% increase in eccentric adduction strength.

- **Other variations of the exercise have not been tested**
  Modifications of the exercise have been described, such as the partner holding around the knee, using a box or chair instead of a partner, or performing the exercise without movement (isometric). The effects of using these modifications have however not been examined yet.

THE EXERCISE

The Copenhagen Adduction Exercise is a partner exercise where the player is positioned on the side with one forearm as support on the floor and the other arm placed along the body. The upper leg is held in approximately the height of the hip of the partner, who is holding the leg with one hand supporting the ankle and the other supporting the knee. The player then raises the body from the floor, so the upper leg works dynamically. The lower leg is also adducted so that the feet touch each other, and the body is in a straight line. The body is then lowered halfway to the ground while the foot of the lower leg is lowered so that it just touches the floor without using it for support (Serner et al., 2014).

Figure 1: The Copenhagen Adduction exercise (CA) & a modified CA with a short lever, as the partner is holding around the knee instead of the ankle. From Harøy et al., 2018.

THE PROGRAMME

Recommended protocol

As the Copenhagen Adduction Exercise might be difficult to perform initially for some football players, or if a player has a history of medial knee pain, it is possible to perform the exercise with a shorter lever arm in the beginning. It is recommended to use a progressive increase in reps and start more frequent in the pre-season. Below are three options for exercise progressions, which can be adjusted to the individual team setting for optimized implementation.

Table 1 Three options for exercise progression of the Copenhagen Adduction exercise.

Option 1 (Ekstrand, 2013)*	Week	Sessions per week	Sets per side	Repetitions per side
	1	2	2	6
	2	2	2	8
	3	2	2	10
	4	2	3	10
	5-6	2	3	12
	7-8	2	3	15

Option 2 (Thorborg et al., 2017)	Player level	Sessions per week	Sets per side	Repetitions per side
	Beginner	3	1	3-5
	Intermediate	3	1	7-10
	Advanced	3	1	12-15

Option 3 (Walden et al., 2015)	Week	Sessions per week	Sets per side	Repetitions per side
	1	2	1	3-5
	2	3	1	3-5
	3-4	3	1	7-10
	5-6	3	1	12-15
	7-8	2	1	12-15
	9+	1	1	12-15

When to do it

The Copenhagen Adduction Exercise can be performed either before or after the football training. We recommend scheduling the exercise at the end of training, as this may be more effective in reducing injuries and increase compliance. (Whalan et al., 2019).

Delayed Onset Muscle Soreness (DOMS)

Using a progressive increase in the number of repetitions has been shown to result in minimal DOMS. It is recommended to have a relatively easy progression initially, if the player is not used to adductor strengthening exercises (Harøy et al., 2017, Ishøi et al., 2016).

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CORE & DYNAMIC STABILITY

THE BACKGROUND

Football at the highest level is physiologically demanding, requiring players to perform multiple high-intensity actions over 90 minutes, such as shorter and longer sprints, rapid and unplanned changes of direction and players contesting the ball on the turf, on their feet or in the air. During these actions, forces generated from different muscle groups and body parts have to be combined in an efficient way to maximize performance in the specific task (for example protecting the ball from an opponent). Similarly, it is important to be able to correct body position when unexpected events happen (for example being pushed out of balance in aerial heading duel) to avoid positions that may lead to an injury.

Core/dynamic stability broadly refers to the ability to control posture and to transfer forces efficiently through the body (Silfies et al., 2015; Wirth et al., 2017). The core muscles are typically described as those controlling the pelvis and trunk region (Silfies et al., 2015) or all the muscles between the shoulders and pelvis (Wirth et al., 2017). The dynamic component refers to the ability to control this region and to return to the original position during expected or unexpected perturbations (Silfies et al., 2015; Wirth et al., 2017). Core/dynamic stability is therefore developed using a combination of exercises challenging both muscle capacity and neuromuscular control, preferably during functional movements similar to those faced in the competitive context.

Quantifying core/dynamic stability performance using reliable methods is difficult (Steffen et al., 2017), and the available research into the relationship with injury risk is limited. Multi-exercise programs, such as the FIFA 11+ have, however, been shown to reduce injury risk in football players and positively impact performance (Al Attar & Alshehri, 2019; Gomes Neto et al., 2017; Whyte et al., 2018). Despite the lack of scientific evidence, practitioners in elite football teams frequently list movement efficiency among the most important injury risk factors and use exercises challenging core stability and balance/proprioception in their prevention programs (McCall et al., 2014; McCall et al., 2016).

THE FACTS

- **Movement efficiency** was reported as one of the **top 5 injury risk factors** by Premier League football teams across the world (McCall et al., 2014).
- **Balance/proprioception and core stability** was one of the **5 most common exercises** used by Premier League clubs **to prevent injuries** (McCall et al., 2014). These were also among the **3 most common injury prevention exercises** among clubs in the UEFA Elite Clubs study (McCall et al., 2016).
- The injury risk in football players who perform a warm-up program (with components of core and dynamic stability) is reduced by **34% for overall injuries and 29% for lower limb injuries** (Al Attar & Alshehri, 2019).
- Warm-up programmes with components of core and dynamic stability **improve balance and agility** (Gomes Neto et al., 2017). Specific core training programmes also reduce biomechanical risk factors associated with anterior cruciate ligament injury (Whyte et al., 2018).
- **Multi-component physical training programmes addressing a variety of movement patterns are more efficient** than single-component programmes (Alentorn-Geli et al., 2009).
- Successful components to reduce non-contact ACL injury risk include **dynamic balance and strength, body awareness and targeted core and trunk control exercises** (Alentorn-Geli et al., 2009).
- **A motivated coach is crucial for adoption of prevention programmes.** Coaches identify available resources, support from other coaches, clubs and federations and player buy-in as barriers for adoption (Lindblom et al., 2018).
- **Player compliance is essential when implementing an injury prevention programme** (Alentorn-Geli et al., 2009; McCall et al., 2016; Soligard et al., 2010). **Modifying existing programmes** to better suit your specific group of players **may increase long-term player buy-in** (Lindblom et al., 2018).

THE PROGRAMME

Recommended protocol

Due to the limited research into the effect of specific core/dynamic stability exercises on future injury risk, the suggested protocol is formulated as principles that can be applied, rather than a specific programme. To maximize the available training time and effect on both football performance and injury prevention, we suggest the following principles:

1. **The exercises have to be simple** and should be possible to perform on the pitch, preferably in a separate section (pre-training) or as part of the football warm-up.
2. The exercise program – collectively – has to **challenge the player in a variety of movement patterns and provide progressive exercise variations.**
3. The program should include exercises where core and dynamic stability is **challenged in a football context.**
4. **Using tools (tubes, BOSU balls, Therabands, etc.) may improve motivation** to perform injury prevention training and give the practitioner more options for progression and variation.

Following the recommendations from the FIFA 11+ programme, exercises should be implemented in training sessions at least **twice per week**. It is up to the coach if they are implemented in dedicated sessions or sections or into the team warm-up. Two different ways to implement could be to dedicate 20 minutes prior to training sessions twice a week or to select 2-3 exercises that are used during natural breaks in other football drills, for example during the warm-up. Specific gym sessions can also be used to implement exercises and variations that challenge core/dynamic stability. Either way, it is important to establish routines so that the both the players and the coach are clear on the expectations. It is also recommended that is clear to everyone who leads the exercises (e.g. captain, fitness coach, physiotherapist). Examples of exercises and variations are provided in the supplementary Table.

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EXERCISE PROGRAMS AND VARIATIONS

Dynamic core stability program with progressions, from Whyte et al. (2018)

Exercise	Progression 1	Progression 2	Progression 3
Transversus abdominis (TA) activation	TA activation	TA activation with arm movements	TA activation with arm and leg movements
Trunk curl	Trunk curls	Trunk curl with rotation	
Dynamic bridge	Dynamic bridge	Dynamic bridge with knee extension	
Dynamic prone plank	Shortened dynamic prone plank	Full dynamic prone plank	Plank walk out
Dynamic side plank	Shortened dynamic side plank	Full dynamic side plank	Full dynamic side plank with trunk rotations
Lunges	Forward lunges with handheld weights	Backwards lunges with handheld weights	Sideway lunges with handheld weights

Strength/plyometrics/balance exercises from FIFA 11+ with progressions, from Soligard et al. (2008)

Exercise	Progression 1	Progression 2	Progression 3
The plank	Both legs (3x20-30s)	Alternate legs (3x20-30s)	One leg lift (3x20-30s)
Side plank	Static (3x20-30s per side)	Dynamic (3x20-30s per side)	With leg lift (3x20-30s per side)
Nordic hamstring	3-5 reps	7-10 reps	12-15 reps
Single leg balance	Holding ball (2x30s each leg)	Throwing ball with partner (2x30s each leg)	Testing partner (2x30s each leg)
Squats	With heels raised (2x30s)	Walking lunges (2x30s)	One leg squats (2x10 each leg)
Jumping	Vertical jumps (2x30s)	Lateral jumps (2x30s)	Box jumps (2x30s)

Suggestions for challenging core/dynamic stability using traditional gym exercises

Exercise	Variation 1	Variation 2	Variation 3
Squats	Squat with barbell	Use elastic band around the torso to challenge core stability in different direction	Squat on BOSU ball or other moderately challenging stability devices with low loads.
Lunges	Lunges in different directions with barbell	Use elastic band around the torso to challenge core stability in different directions	Lunges onto BOSU ball from different angles (forwards, sideways etc.).
Medicine ball throw	Standing medicine ball-throw across the body to partner or against a wall	Seated medicine ball-throw across the body to partner or against the wall	"Throw-in" with medicine ball to partner or against the wall
Balance on BOSU ball	Squat on BOSU ball	1 leg squat on BOSU ball	1 leg squat on BOSU ball, reach in different directions with the opposite foot

Suggestions for challenging core/dynamic stability in football-specific exercises

Exercise	Description
Protecting the ball	1vs. 1 inside a 5x5m square. One player protecting the ball, the other trying to win it. If the ball goes out of the box, roles change. Focus on transferring the force from the legs through the core to the opponent.
Aerial duels	Two players contest a ball thrown from a third player. Focus on keeping the body position throughout the contact with the opponent and landing softly on two legs with knees and toes aligned.

BALANCE

THE BACKGROUND

There is a high incidence of lower limb injuries, specifically occurring at the knee and ankle in male football players. Neuromuscular imbalances have been identified as a potential risk factors for future ligamentous injuries (Read et al., 2016). Effective performance of both static and dynamic stability tasks (postural control) requires the integration of visual, vestibular and proprioceptive inputs; these provide an efferent response to control the body's centre of mass within its base of support (Guskiewicz et al., 1996). For the purpose of the current review, our focus will be on dynamic stability and balance, with an exploration of 1) its role as a prospective risk factor; 2) testing methods; and 3) whether they can be improved following targeted interventions. Finally, recommendations will be provided to outline the most appropriate methods for integrating balance training into the football environment.

THE FACTS

- Deficits in postural control and reflex stabilization have been reported in subjects with functional ankle instability (Ross and Guskiwicz, 2008).
- Higher postural sway during unilateral balancing has been associated with increased risk of ankle sprain (McGuine et al., 2000).
- An anterior right-left reach difference >4 cm on the star excursion balance test displayed a 2.5 times greater risk of lower-extremity injury (Plisky et al., 2006).
- A composite reach distance <94% of their limb length on the star excursion balance test indicated that athletes were 6.5 times more likely to sustain a lower-extremity injury (Plisky et al 200, Calvo Gonell et al., 2015, Smith et al., 2015).
- Improving dynamic balance has been shown to significantly reduce the risk of ankle sprains in high school football and basketball players who performed a series of single leg balance and squat exercises in both stable and unstable conditions (McGuine and Keen, 2006).
- Youth male football players undertaking a proprioception training intervention enhanced postural stability indices in both anterior-posterior and medial-lateral directions on the star excursion balance test (Malliou et al., 2004). A significant reduction in the number of knee and ankle sprains was also reported across the course of a football season in these players, in comparison to those who completed their normal football training (Malliou et al., 2004).
- Incorporation of multidirectional plyometric drills improves dynamic postural control on several axes (Jlid et al., 2019).

RECOMMENDATIONS

Testing

Static balance postures do not reflect the dynamic nature of football activities during which injuries occur (Pau et al., 2015). Two common methods of assessment are time to stabilization (TTS) and the star excursion (SEBT) or y-balance test.

1. **Time to stabilization:** Measurement of TTS involves the use of a force plate to quantify the speed in which individuals stabilize after a landing task; specifically, the quantification of the time taken for an athlete on landing to reach and stabilize within a ground reaction force range representative of 5% of the athlete's body mass for a period of 1 s (Read et al., 2018). This assessment mode can be used in any land and hold task, with unilateral stance preferred.
2. **Star excursion or y-balance test:** Athletes are positioned in in a unilateral stance and asked to reach in either 8 (star excursion) or 3 (y-balance) specified directions with their opposite limb. The test is graded by marking the reach distance achieved in each direction with scores normalized to leg length.

What is the best method to implement balance training?

Traditionally, balance training has been used as part of the rehabilitation programme for ankle injuries. Multi-faceted intervention studies that included balance training along with other training modalities, such as resistance training and plyometrics, have been shown to reduce the risk of knee and ankle injuries (Hrysomallis, 2007). As a single intervention, balance training has been shown to significantly reduce the recurrence of ankle ligament injuries in football; however, it has not been clearly shown to reduce ankle injuries in athletes without a history of prior ankle injury. Cumulatively, the available evidence indicates that the effect of balance training is heightened when it is integrated as part of a multifaceted intervention.

What are the best exercises – it depends?

Balance tasks are specific in their measurement properties and balance per se is not a general ability (Ringhoff and Stein 2018). Performance and neuromuscular adaptations gained through training are specific to the task. Sports tasks analysis is important and exercise selection should closely imitate the environment in which performance takes place. In football, this means that exercises should be performed primarily on a stable surface, but instability is created by reducing the athlete's base of support and players should be exposed to a range of conditions, such as landing from a variety of directions, both with and without perturbation. In addition, enhanced trunk stabilization may also improve dynamic stability due to improved trunk motion control (Hewett and Myer, 2011). This has been confirmed in male youth football players, whereby an intervention consisting of trunk stabilization exercises including quadruped contralateral raises, front planks, back and side bridges enhanced performance during specified reach directions of the SEBT and single leg static balance tasks (Imai et al., 2014). Recently, it has also been observed that the incorporation of multidirectional plyometric drills improved dynamic postural control on several axes (Jlid et al., 2019).

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PLYOMETRICS

THE BACKGROUND

Plyometric exercises such as jumping, hopping, skipping and bouncing is a safe and effective training modality, aiming to enhance dynamic neuromuscular performance (Impellizzeri et al., 2008, Wilson et al., 1993; Wilson et al., 1996, Slimani et al., 2016). During this type of exercise, the muscles undergo a rapid elongation followed by an immediate shortening contraction, exploiting the elastic energy stored during the stretching phase (Cavagna, 1977). This rapid deceleration-acceleration generates an explosive reaction that intensifies both speed and power of the limb during sports (Kraemer et al., 2000). Plyometric tasks (with or without external load) enable the production of maximal force in the shortest amount of time by stimulating specific neural adaptations without generating muscle hypertrophy (Bobbert et al., 1996, Sharrock et al., 2011). While there is a moderate evidence of its effect to enhance performance and reduce the risk of injuries on female and adolescent players, there is a stronger evidence for elite male players (Markovic, 2007, Stojanovic and Ostojic, 2012, Asadi et al, 2015).

The multifaceted nature of the physical demands in football make plyometric exercises a highly relevant additional training modality, as it can improve several performance characteristics (Wang and Zhang, 2016), such maximal strength, sprinting speed, shooting power, endurance, ability of jumping and changing direction in all individuals of all ages (Yanci et al., 2016, Wang and Zhang, 2016). Plyometric exercises are not inherently risky but may cause tendon injuries (and injuries to the growth plates in younger athletes) if not judiciously implemented and well monitored (Visnes and Bahr, 2012, Wang and Zhang, 2016, Ramirez et al., 2018).

THE FACTS

General

- Plyometric training promotes neuromuscular coordination through the enhancement of neural efficiency and adaptation (Elben et al., 2010, Sharrock et al., 2011, Chelly et al., 2010).
- Plyometric training improves muscle and tendon strength, resulting in resilience against injuries (Wang and Zhang, 2016).
- A minimum of 8 weeks of plyometric training is required to improve performance in elite players (Slimani et al., 2016).
- Plyometric training enhances the extensibility of tendon structures and active muscle stiffness (Wu et al., 2011, Foure et al., 2011, Houghton et al., 2013, Kubo et al., 2017, Hirayama et al., 2017).
- Plyometric exercise stimulates bone remodeling (Martyn-St James and Carroll, 2009, Kish et al., 2015).
- Plyometric training in an aquatic setting or on sand induces less muscle damage and soreness than on a firm surface (Arazi et al., 2016).

Effect on performance

- Training on non-rigid surfaces (e.g. aquatic- or sand- versus grass-based plyometric training) increased jumping and change of direction ability, and as well sprinting performance as much as traditional plyometric (Slimani et al., 2016).
- Plyometric training enhances strength, power, jump sprint performance and ability to change direction components, essential in football performance (Váczi et al., 2013, Slimani et al., 2016).
- Plyometric training enhances the ability to decelerate effectively, which may help to prevent subsequent injuries (Davies et al., 2015).
- Plyometrics can help transfer specific neuromuscular gains to acceleration and speed abilities in football players (Lockie et al., 2014, Leturco et al., 2015).

Effect on prevention:

- Plyometrics reduce the risk of first-time noncontact ACL injuries (Carvalho et al., 2014; Ebben et al., 2008; Hewett et al., 1999).
- By increasing neuromuscular control in all planes, plyometrics decrease ACL stress (Carvalho et al., 2014; Struminger et al., 2013).
- Plyometrics enhance joint awareness and postural control and consequently has a potential positive effect on lower-extremity injury prevention (Asadi et al., 2015).
- There is no evidence that plyometric can reduce the risk of hamstring injuries (van de Hoef et al., 2019).
- There is potentially an effect of plyometric training in improving functional performance to reduce risk of ankle sprain (Ismail et al., 2010).

- Horizontal plyometric training was effective in promoting improvement of risk factors (Yanci et al., 2016).
- Plyometric may improve lower extremity alignment, which is assumed to decrease the risk of injuries (Myer et al., 2006).

RECOMMENDATIONS

Prior to implementing any plyometric exercise program, inform the club fitness coach, physiotherapist and physician.

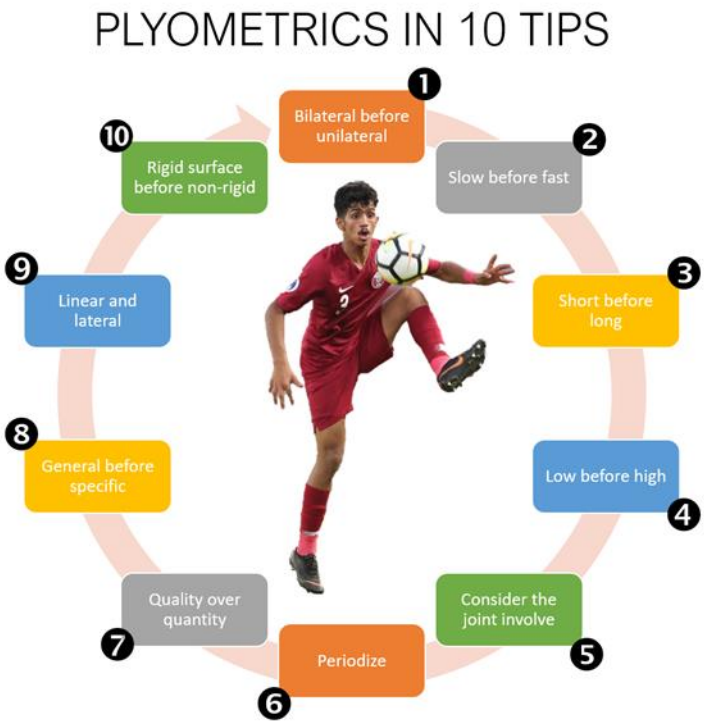
There is a variety of exercises and elements to control, such as coordination, technique, landing technique, absorption, volume, intensity. Therefore, it is essential **to follow** a **progression of different categories of exercise** and **tips** to apply a plyometric program safely:

Category 1: Coordination of the movement – Low impact, ideal to learn fundamental movement coordination and mechanics of plyometric (e.g. skipping, rope jumping).

***Category 2*:** Landing and force absorption– Progress to train landing technique to absorb ground force appropriately (e.g. drop jump).

Category 3: Plyometric strength– Improve force generation (e.g. squat jump).

***Category 4*:** Plyometric power –Improve stiffness and quick ground contact (e.g. rebound jumps).



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THE 11+ PROGRAMME

THE BACKGROUND

Injury rates in elite football are substantial, approximately 1000 times higher than in other high-risk occupations (Hagglund, Walden, & Ekstrand, 2009). In the Qatar Stars League (QSL), a team with 25 players can expect approximately 41 injuries leading to time loss from play in one season. The single most common injury type is muscle, representing 52% of all injuries. Importantly, re-injuries also constitute 13% of all injuries and cause longer absences than non-re-injuries.

The significant injury burden in football impairs the chance of successful performance and negatively affect team success (Drew, Raysmith, & Charlton, 2017; Hägglund et al., 2013); consequently, injury prevention in football is crucial (Thorborg et al., 2017). The 11+ is one effective programme to decrease the risk of injuries among football players (Al Attar et al., 2016; Sadigursky et al., 2017).

THE FACTS

- **39% reduction in football injuries**
  The 11+ prevention programme reduces the rate of the top four football injuries: Hamstring injuries by 60%, hip/groin injuries by 41%, knee injuries by 48% and ankle injuries by 32% (Thorborg et al., 2017).

- **Appropriate warm up**
  The 11+ represents an appropriate warm-up programme for football players, inducing improvements comparable with those obtained with other, general warm up routines (see fact sheet on Warmup) (Bizzini et al., 2013).

- **Improves thigh muscle strength**
  Better hamstring/quadriceps ratio (Bizzini & Dvorak, 2015).

- **Improves neuromuscular control**
  Performing the 11+ for 9 weeks improves neuromuscular control in football players (Impellizzeri et al., 2013).

- **Increases performance**
  The 11+ may improve dynamic performance, specifically vertical jumping and sprinting (Barengo et al., 2014; Nawed et al., 2018). Several of these outcomes are relevant for performance within the game.

- **Easily integrated**
  The 11+ provides a complete, football-specific warm-up and can easily be integrated into the daily training routine. The 11+ takes approx. 20 minutes to complete, replaces the usual warm-up before training. The 11+ is divided into three parts: running exercises (part I), strength exercises including balance, muscle control and core stability (part II), and concludes with further running exercises (part III) (Fifa.com, 2020).

- **15 exercises**
  The 11+ programme includes 15 exercises, used before training. The focus of these exercises is to strengthen the core and leg muscles, and to improve coordination, balance, agility, and static, dynamic, and reactive neuromuscular control (Bizzini & Dvorak, 2015). Compliance with the programme (at least twice a week) is a key to successful injury prevention (Barengo et al., 2014; Silvers-Granelli et al., 2018).

- **Rescheduling Part 2:**
  Rescheduling Part 2 of the 11+ programme to the end of training improves player compliance without compromising the effect on injury risk; it reduces the number of severe injuries and total injury burden, thereby enhancing effectiveness of the programme (Harøy et al., 2017).

- **Including the Copenhagen adduction exercise :**
  Including the Copenhagen adduction exercise in the 11 programme increases hip adduction strength, which can further help in preventing groin pain in football players (Harøy et al., 2017).

THE PROGRAMME

Recommended protocol

For all details see instructions freely available on the official website: (Fifa.com, 2020)

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FLEXIBILITY TRAINING & STRETCHING

THE BACKGROUND

In football, many believe that stretching enhances performance, increases range of motion and decreases the risk of injuries (Hammami et al., 2018, Fakhro et al., 2020, Zakaria et al 2015). Stretching exercises are therefore regularly included as part of the training programme and to prepare for matches (Witvrouw et al., 2004, Stojanovic and Ostojic, 2011). There is controversy about stretching in football; while players recognize stretching as a modality for injury prevention, applied exercises protocols in professional clubs remain inconstant and appear to depend on staff expertise (Dadebo et al., 2004, Zech and Wellmann, 2017). It should be noted that the evidence for the role and effect of stretching exercises on injury risk in football remains conflicting (Rogan et al., 2013, Apostolopoulos et al., 2015, van Dyk et al., 2018, Behm et al., 2020). Although flexibility is sports-specific, it remains unclear what is the optimal level of flexibility required to prevent injuries and to improve football performance (Witvrouw et al., 2004, Avrillon et al., 2019. Stiff tendons may improve economy of movement in sports, while a high level of flexibility is necessary to perform in sports that rely on extremes motion for movement (McHugh and Cosgrave, 2010).

THE FACTS

Definitions:

- **Stretching:** Exercise intervention designed to elongate the contractile and noncontractile components of muscle-tendon units and periarticular structures (Kisner and Colby, 2007).
- **Flexibility:** The range of motion (ROM) at a single joint or series of joints; it reflects the ability of the muscle-tendon units to elongate within the physical restrictions of the joint (Hubley and Kozey, 1991).
- ***Static flexibility*** *is defined as the maximal ROM available*.
- ***Dynamic flexibility*** *refers to the ease of movement within the maximal ROM.*

Modalities:

There are four principal modalities of stretching:

- **Static stretching:** Executed by extending the targeted muscle group to its maximal point (until a gentle feeling of "pull or stretch") and holding (10 to 45 seconds) before relaxing the muscle. Usually It has two sub-modalities:
    - Active static: Added force is applied by the individual for greater intensity.
    - Passive static: Added force is applied by an external source (partner or assistive device) to increase intensity.
- **Dynamic stretching**: Stretching the muscles whilst moving, either by limb swings or by performing sports specific movement drills (movement patterns that mimic the sport).
- **Proprioceptive Neuromuscular Facilitation (PNF) Stretching:** This can take on several forms, including hold-relax, contract-relax, and rhythmic initiation.
- **Ballistic stretching:** Muscle stretch as far as it is comfortable to do, then, at the end of range of the movement, apply "bounce" or force the joint little bit further.

Effect on ROM:

- Performing static stretching (5 days/week) for 6 weeks increased the length of the hamstrings and joint ROM (Bandy et al., 1997, Harvey et al., 2002).
- Static stretching during warm-up did not change the flexibility of the hip flexors and quadriceps in football players (Young et al., 2004).
- Active dynamic stretching and static dynamic stretching in regular warm-up training program (8 weeks) improved passive ROM (Turki-Belkhiria et al., 2012).
- Greater increase in ROM after PNF compared with ballistic stretching (O'Hora et al., 2011).
- Neurodynamic sliding technique improved hamstring flexibility in male players (Castellote-Caballero et al., 2013).

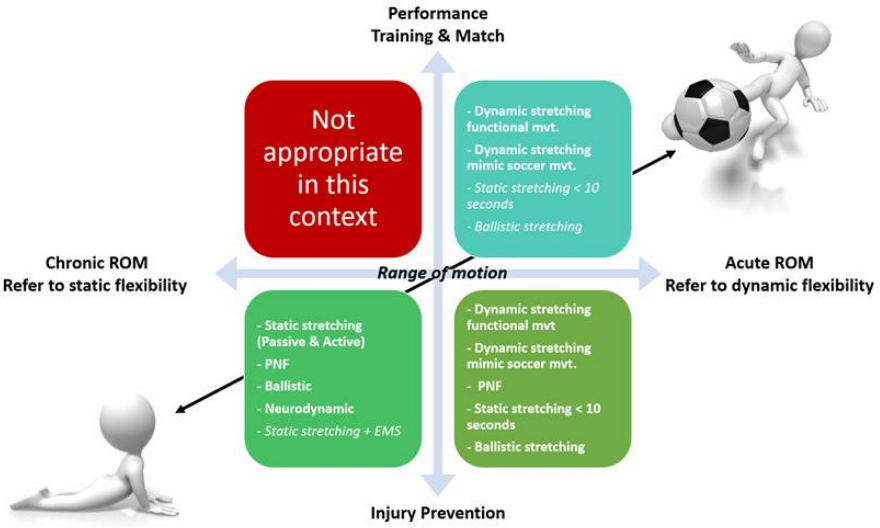
Performance:

- Dynamic stretching during warm-ups is probably more effective than static stretching to prepare for jumping and high-speed performance (Little et al., 2006, Turki-Belkhiria et al., 2012Amiri-Khorasani and Kellis, 2013, Haddad et al., 2014, Amiri-Khorasani et al., 2016).
- Ballistic and static stretching (>20 s) exerts a negative effect on jump and sprint performance. Limiting such stretching to short durations (10 s) does not cause any negative effect (Little et al., 2006, Sayers et al., 2008, Mariscal et al., 2018).

- Instep kick performance is more effective following hip joint dynamic stretching (Herda et al., 2008, Amiri-Khorasani and Kellis, 2011, Amiri-Khorasani and Kellis, 2013).

Injury prevention:

- Flexibility training alone does not appear to have any preventive effect on injury risk (Arnason et al., 2008).
- Static stretching improves musculotendinous stiffness and increases anterior tibial translation, potentially influencing knee laxity (Bandy et al., 1997, Baumgart et al., 2015)
- Dynamic stretching (with or without static stretching) with soccer-specific movements may be adequate in injury prevention (Zakaria et al 2015).
- Dynamic stretching in warm-up has a protective effect on the sprinting-induced muscle damage and may facilitate muscle recovery (Chen et al 2018).



RECOMMENDATIONS

While stretching modalities have been shown to have a positive effect on performance and range of motion, there are no studies showing any effect on injury risk. Verify with your club fitness coach, physiotherapist and physician prior to implementing any stretching exercise plan. Stretching exercises can influence your flexibility patterns in two different ways:

1. Increasing your ROM short-term, preparing to perform and adapting to specific stress (acute ROM modification).
2. Improve your long-term ROM for specific performance needs (chronic ROM modification).

Stretching efficiency outcome depends of which modality you do, when, how frequent and for how long. Depending on the objectives, the stretching modalities will be different:

Prepare your body to perform and adapt to specific stress (may protect against injury):

- Dynamic stretching (functional & specific) is more appropriate
- Short ballistic stretching (if used to do it) and static stretching <10 s seems not to be detrimental, but is not recommended unless there is a special need.

Improve ROM and/or address specific limitations:

- ***Dynamic flexibility***
  - Dynamic stretching (functional & specific), short ballistic stretching (if used to doing it), PNF and static stretching <10 s are appropriate.
- ***Static flexibility***
  - Static stretching (passive & active), PNF, Ballistic, Neurodynamic are appropriate.

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RECOVERY STRATEGIES

Massage, self-myofascial release, stretching & compression garments

THE BACKGROUND

As in many team sports, football is physically demanding, including a combination of high- and low-intensity activities causing fatigue, muscle damage and reduced neuromuscular performance after a match (Pooley et al., 2017). Neuromuscular performance alterations and fatigue have been reported following a football match. Furthermore, homeostatic balance (e.g. muscle damage, physical well-being status) is not completely restored 72 hours later (Silva et al., 2018). Given this, football players resume training generally less than 48 hours following a match to train before the next match. Using recovery tools has been suggested to improve player readiness for the following training and decrease fatigue. This could lead indirectly to a better performance and less risk of injury (Nédélec et al., 2013).

THE FACTS

Among the widely used recovery strategies, massage, stretching, self-myofascial release and compression garments are the most popular. Nevertheless, there is no solid scientific evidence supporting the use of any of these strategies alone or in combination nor their uselessness (Nédélec et al., 2013).

MASSAGE

- Several reviews of the effects of massage have concluded that the evidence does not support massage as a modality to restore optimal performance, but that massage is beneficial in improving psychological aspects of recovery (Weerapong et al., 2005, Barnett et al., 2006). It remains a challenging area of investigation as the training level of the therapist impacts the effectiveness of massage as a postrace recovery tool; greater reductions in muscle soreness were achieved by therapists with greater training and experience (Moraska et al., 2007).

- **Delayed Onset Muscle Soreness (DOMS)** A study suggested that massage seems to be an effective method for reducing DOMS and perceived fatigue (Dupuy O et al, 2018).

SELF-MYOFASCIAL RELEASE (SMR)

- Self-myofascial release does not impact the recovery of biomechanical variables after high-intensity interval training, but decreases delayed onset muscle soreness and increased active and passive range of motion of the hip (Laffaye G et al. 2019). Therefore, SMR could be an efficient alternative to allow athletes to resume training shortly after an intensive workout with severe muscle damage.

STRETCHING

- Although widely used and believed among team sport coaches and athletes to reduce muscle pain and injury risk and to improve performances after exercise, there is no strong evidence confirming its effectiveness (Dawson et al., 2005).

- **Does stretching enhance recovery?** Current evidence does not show any effect of passive stretching after eccentric exercise on delayed onset muscle soreness. It does not prevent secondary pathological alterations (Lund et al., 1998). Some studies of low or moderate level of evidence suggest low or no effect of stretching on muscle soreness felt in the week following exercise (Herbert et al., 2011).

- **Does stretching reduce muscle injuries?** There is also low evidence suggesting that muscle strains incidence is decreased by pre match stretching (McHugh et al., 2010) and that increased tightness in these muscles increases the risk of muscle injury (Witvrouw et al., 2003, Stojanovic et al., 2011).

- **Does stretching enhance flexibility** Some evidence suggests that stretching after training improves flexibility in the hamstrings (Rodriguez Fernandez et al., 2016). Low evidence suggests that 30 seconds of stretching could be enough to increase muscle flexibility and range of motion with no additional effect if is increased in duration or frequency (Bandy et al., 1997).

- **Static or dynamic stretching?** Static stretching seems to not add any value to dynamic stretching in preventing injuries according to a randomized trial (Zakaria et al., 2015). It is accepted that in football, high intensity of stretch-

shortening cycles caused by bouncing and jumping require an effective muscle-tendon unit. As some evidence suggests that stretching could influence the viscosity of the tendon and muscle flexibility, it could thus Increase the muscle-tendon unit compliance and thereby decrease injury risk (Witvrouw et al., 2004).

COMPRESSION GARMENTS

- Wearing below-knee compression socks has been shown to have positive effects on recovery. Perceived fatigue can be effectively managed using compression garments (Dupuy et al., 2018). In long distance runners, wearing such socks for 48 h after marathon running improves functional recovery as measured by a graduated treadmill test to exhaustion 2 weeks after the event (Armstrong et al., 2015). Broatch et al. (2018) suggested that compression socks are beneficial in combating the stressors imposed by long-haul travel in elite athletes, and may have merit for individuals frequently travelling long distances or competing soon after flying. It is proposed that compression garments may have a positive effect on attenuating exercise-induced muscle damage biomarkers response, inflammatory and perceptual responses suggest that compression may improve physiological and psychological recovery, but this has not been proven yet (Marqués-Jiménez et al., 2018).

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COLD WATER IMMERSION

THE BACKGROUND

In the recent decade, cold water immersion (CWI) has become very popular as a recovery modality in team sports (Tavares et al., 2017, Nedelec et al., 2013, Versey et al., 2013). Whole- or lower body CWI modalities are most common, with 10-15 min of immersion at temperatures of 10-15°C optimal for recovery (Leeder et al., 2012, Machado et al., 2016). Nevertheless, an important consideration when prescribing CWI is to first identify and understand the physiological and musculoskeletal stress induced by the preceding training activity/ sport (Leeder et al., 2012, Ihsan et al., 2016).

THE FACTS

The scientific evidence surrounding the efficacy of CWI is largely mixed, with the majority of the studies demonstrating either improved or unchanged recovery (Leeder et al., 2012 Nédélec et al., 2013, Machado et al., 2016, Micheletti et al., 2019). However, a small number of studies show impaired recovery following CWI, likely owing to extremely low immersion temperatures or extended immersion durations (Machado et al., 2016). Indeed, extreme cooling has been shown to decrease nerve conduction velocity, muscle contractility as well as may impair muscle regeneration (Racinais et al. 2010). While CWI is an effective recovery modality in the context of a tournament or when time between games is short, the benefits of routinely using CWI during the regular weekly schedule of training and recovery (7-day micro-cycle) are less clear (Cross et al., 2019, Rowsell et al., 2011).

The current evidence shows:

Immersion temperature & duration:

- Whole- or lower-body CWI are typically undertaken at temperatures between 10-15˚C for 10-15 minutes (See Fig. 1) (Ihsan et al., 2016, Machado et al., 2016).
- Although slight variations from this range is acceptable, practitioners must be cautioned against administering prolonged cold exposure, as this will be likely detrimental and delay skeletal muscle recovery. On the other hand, brief (<5 min) immersions that do not substantially lower muscle or core temperatures will confer minimal physiological benefit (Machado et al., 2016).
- The decrease of body temperature through CWI does not occur to the same extent in all tissues (See Fig. 2). The reduction of the temperature occurs first in the skin and superficial intra-muscular tissue, while deep intra-muscular cool-down takes longer (White et al., 2013).

Immersion depth and position:

- Experimental evidence for the role for hydrostatic pressure on recovery is unclear. It is nevertheless accepted that greater hydrostatic pressures are associated with improved potential for recovery (Wilcock et al., 2006).
- Hydrostatic pressure is suggested to assist with the movement of fluids from the periphery (legs) towards the thoracic region. As such, whole-body CWI is generally recommended over lower-body immersion. Moreover, if part of the recovery objective is to decrease body temperatures, then whole-body CWI may be preferred as well (Versey et al., 2013, Wilcock et al., 2006).

Immersion timing:

- CWI is generally recommended to be undertaken as soon as possible following exercise. CWI undertaken within 2 h post-exercise has been shown to enhance the recovery of exercise performance following a 24 h period.
- CWI has also been shown to be effective in facilitating recovery in scenarios where multiple competitions (e.g. qualifying rounds) are performed on the same day, or during periods of intensified training or competition (Rowsell et al., 2011, Halson et al., 2014, Tavares et al., 2019).

Immersion effect:

- There is substantial evidence indicating that post-exercise CWI may enhance both short- (<4 h) and longer-term (>4 h) recovery; the underpinning factors for such improvements are generally unclear (Ihsan et al., 2016).
- In comparison with passive (rest or placebo intervention) interventions, a significant effect on muscle soreness in favour of cold-water immersion has been shown from 24 h up to 96 h of follow-up (Bleakley et al., 2012).
- There is general consensus that CWI may reduce the extent of muscle damage following eccentric exercise. This is largely based on evidence showing enhanced recovery in muscle force and reduced magnitude of delayed-onset muscle soreness following CWI, rather than direct evidence of muscle fiber repair (Leeder et al., 2011).

- There is general belief that CWI might enhance muscle recovery through removal of accumulated metabolic products. This notion in general lacks experimental support, and is more based on circumstantial evidence.
- CWI generally benefits recovery from continuous and intermittent endurance-based exercise (Ihsan et al., 2016), and seems to enhance oxidative adaptations in muscle to endurance training, although longer-term performance gains in elite athletes need more experimental support (Halson et al., 2014, Ihsan et al., 2015, Ihsan et al., 2014).

Immersion precautions:

- Scheduling a CWI session too close to a training sessions might increase the risk of sustaining an injury, as it is well established that muscle function and proprioception are impaired at lower tissue temperatures (Racinais et al., 2010, Racinais et al., 2017).
- CWI should be avoided following resistance training, as there is emerging evidence demonstrating impaired muscle hypertrophy and strength gains following the use of this modality (Roberts et al., 2015, Frohlich et al., 2014).
- Practitioners should ensure appropriate warm-up and rewarming if the use of CWI is closely scheduled with sprint, repeated sprint or power-based performances (Tabben et al., 2018).

RECOMMENDATIONS

The implementation of a CWI protocol as a "one size fits all"-solution should be avoided. CWI should be tried out during training periods and tailored based on player comfort, perceived recovery and performance. When planning CWI sessions, keep the following in mind:

- Engage the entire support team, the fitness coach, physiotherapist and physician prior to taking the initiative to implement CWI.
- Immersion temperature & duration:
  - Between 10˚C to 15˚C for 10 to 15 min.
  - Avoid temperatures below 10˚, short bouts (<5 min) or prolonged time (>15 min).
- Immersion depth and position:
  - The deeper the immersion, the greater is the potential of recovery.
  - Remain, as possible, upright during immersion.
- Timing:
  - As soon as possible following match/training or within 2 h post-competition.
  - The more the CWI is delayed (>24h), the less effective will be the effect on recovery.
- Caution:
  - Avoid CWI following resistance exercise; this limits the training effect.
  - Ensure appropriate warm-up or rewarming if CWI is used to close to a scheduled session with sprints, repeated sprints or power-based exercises.

Figure 1: Summary of appropriate protocol for football players

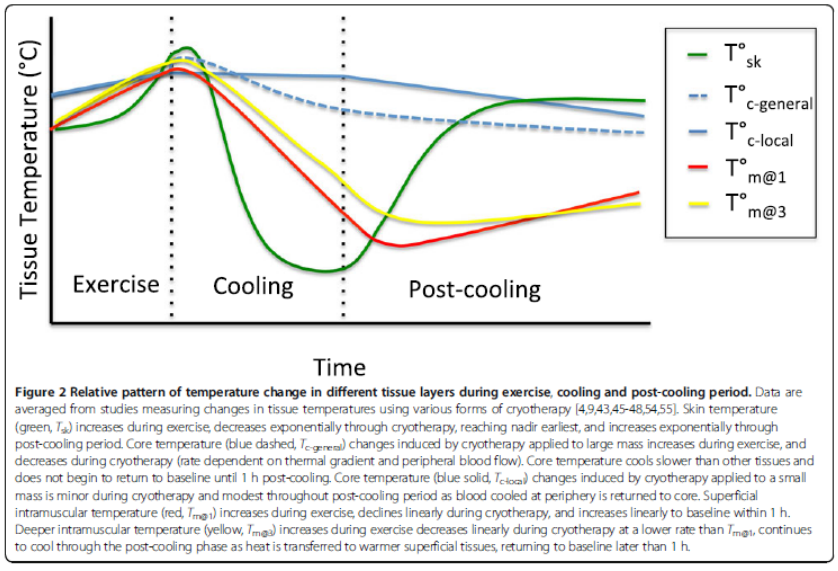

Figure 2 Relative pattern of temperature change in different tissue layers during exercise, cooling and post-cooling period. Data are averaged from studies measuring changes in tissue temperatures using various forms of cryotherapy [4,9,43,45-48,54,55]. Skin temperature (green, T_{sk}) increases during exercise, decreases exponentially through cryotherapy, reaching nadir earliest, and increases exponentially through post-cooling period. Core temperature (blue dashed, $T_{c\text{-}general}$) changes induced by cryotherapy applied to large mass increases during exercise, and decreases during cryotherapy (rate dependent on thermal gradient and peripheral blood flow). Core temperature cools slower than other tissues and does not begin to return to baseline until 1 h post-cooling. Core temperature (blue solid, $T_{c\text{-}local}$) changes induced by cryotherapy applied to a small mass is minor during cryotherapy and modest throughout post-cooling period as blood cooled at periphery is returned to core. Superficial intramuscular temperature (red, $T_{m@1}$) increases during exercise, declines linearly during cryotherapy, and increases linearly to baseline within 1 h. Deeper intramuscular temperature (yellow, $T_{m@3}$) increases during exercise decreases linearly during cryotherapy at a lower rate than $T_{m@1}$, continues to cool through the post-cooling phase as heat is transferred to warmer superficial tissues, returning to baseline later than 1 h.

Figure 2: The decrease of temperature in the body is different in each different tissues (Green-Skin; Red= Superficial intra-muscular temperature; Yellow= Deep intra-muscular temperature; Solid Blue= Core temperature in large mass; dash blue=Core temperature in minor mass. From White et al., 2013.

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TAPING & BRACING

THE BACKGROUND

The use of tape and brace to prevent musculoskeletal injuries or re-injuries is common in sports. In the Roman Empire, the gladiators were already using the application of bandage to prevent injuries, even if it was not always successful. In football, taping is used by 40.2% of previously injured players and 13.6% of players without a history of injuries (Zech and Wellmann, 2017). The prophylactic use of tape and braces for the knee and ankle has been the most extensively studied compared with other anatomical regions. Taping is believed to have three main effects: Mechanical stability, neuromuscular control, as well as psychological readiness, particularly after injury (Kaminski et al., 2019). However, it remains a paucity of well-designed prospective randomized controlled trials relevant to the primary prevention, especially across a range of sport settings (Fousekis et al., 2016, Kaminski et al., 2019).

THE FACTS

BRACING:

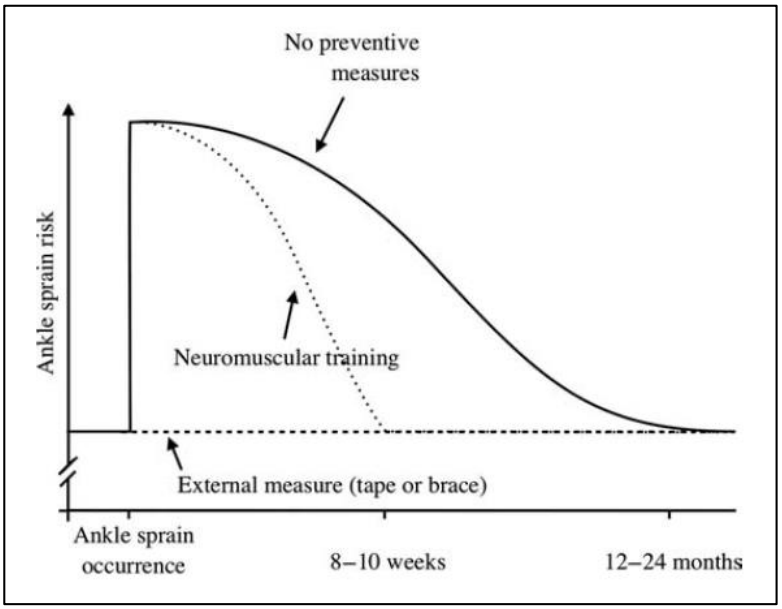
- Reduces excessive range of motion in all directions without affecting lower extremity alignment, dynamic balance or functional athletic performance (Gunay et al., 2014, Hueber et al., 2017, Moon et al., 2018, Willeford et al., 2018, Gregory et al., 2019).
- Beneficial effects on proprioception and postural stability (Ghai et al., 2017).
- Reduces the risk of an acute ankle injury in players with a history of recent ankle injury (within the past 6-12 months) by at least 50%, and in one study also on players with no previous ankle injury (McGuine et al., 2011). However, the effect on healthy ankles is not consistent across studies.
- Long-term use of ankle braces to reduce the risk of ankle sprains should be weighed against the potential to overload other anatomical areas (Mason-Mackay et al., 2016).

TAPING:

- **For healthy players**:
  - Limits end range of motion, improves joint position sense, reduces impact forces, balance, kinesthesia, neuromuscular control and kinetic change (Someeh et al., 2014, Fousekis et al., 2016, Sato et al., 2017, Brogden et al., 2018, Willeford et al., 2018, Jahjah et al., 2018, Gregory et al., 2019).
  - Enhances proprioception in athletes with poor ankle control, but impairs the proprioception in athletes with good ankle control (Long et al., 2016).
- **For players with an history of previous injury:**
  - Effective for improving balance and preventing re-injuries in football players with a history of recent ankle sprain (Olmsted et al., 2004, Jun Shin and Kwon Kim, 2017).
- **For players with a chronic instability:**
  - Greatest effect of taping as injury prevention is for players with chronic ankle instability as it helps place the ankle in a in a less vulnerable position at touch down (Someeh et al., 2014, De Ridder et al., 2018).
  - Enhances perceived stability by increasing self-efficacy and confidence in dynamic tasks, suggesting that taping may reduce apprehension without affecting functional performance (De Ridder et al., 2015, Halim-Kertanegara et al., 2016).
  - Non-elastic tape stabilises the midfoot best (Kuni et al., 2016).
- **Effect on performance:**
  - *N*o adverse effect on performance (Halim-Kertanegara et al., 2016, Stryker et al., 2016).
  - No influence on lower extremity biomechanics during a control cutting task, functional and stability testing (Moore et al., 2018, Stryker et al., 2016).
  - No negative effect on instep kicks in soccer (Sasadai et al. (2015).
  - Nonelastic tape may enhance dynamic muscle support of the ankle and improve joint position sense when fatigued (Briem et al., 2011, Jahjah et al., 2018).
- **Overall:**
  - Ankle taping appears to have an upstream effect on the knee, which may increase injury risk (Williams et al., 2018).
  - Taping is only mechanically effective during the first 15 min of a match (Lohkamp et al., 2009, Forbes et al., 2013).
  - Elastic tape is perceived as more comfortable, less restrictive and produces the same restriction of range of motion as inelastic (Abian-Vicen, 2009).

- Comparing cost and time between taping and bracing, ankle bracing may be less costly to provide the support necessary to prevent ankle sprains. The sport also matters, as a brace may limit football skills (Olmsted et al., 2004).

Taping or bracing reduces the risk of an ankle sprain recurrence **by 50%**, and is recommended during rehabilitation period until a balance training program has been completed for at least 10 weeks (Verhagen and Bay, 2010).



SPECIFIC RECOMMENDATIONS AND TIPS

Will taping or bracing limit football performance?
Most available evidence shows that taping and bracing does not affect performance. Careful selection of a brace that accommodates individual anatomy and feels comfortable is important. For taping, it is important that the player and physiotherapist find the best type of tape suiting the player's requirements and comfort.

Is it just for people who have already been injured?
Athletes with a recent injury and athletes who exhibit signs and symptoms of instability will benefit the most from bracing. There is possibly a small preventive effect of ankle bracing for healthy players, but this is uncertain.

Will it weaken the ankle?
Taping and bracing are designed to limit excessive movements of a joint, which might cause an injury. If applied correctly, both taping and bracing will allow unrestricted, normal movements, which will in turn allow normal muscle activity to occur around the joint and maintain normal strength. Therefore, taping or bracing is extra help to the ankle's normal protective mechanisms and will not cause any weakness.

Can players brace or tape themselves?
Taping requires skills and should only be applied by trained professionals. Different patients will require different methods of taping dependent on their foot shape or type of injury.

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FOOTBALL SHOES

THE BACKGROUND

Footwear should be considered an integral piece of protective equipment rather than simply an extension of the uniform apparel (Jastifer et al., 2017). Players select footwear based on comfort, traction, and stability while protection from injury is given low priority (Hennig et al., 2014). Shoe type, outsole groups (studs), and grass species significantly affect rotational traction, which again is linked to increased lower extremity injury risk (Lambson et al., 1996; Orchard et al., 2013; Thomson et al., 2019). At kick-off for a match the surface properties are somewhat 'set', and it is therefore crucial for players to match the type of shoe outsoles they use to the current surface and climate conditions. The goal is to keep rotational traction within an optimal window for performance, yet at the same time minimize injury risk.

THE FACTS

- **Players can modulate rotational traction**
  Climate, surface hardness, surface traction, grass type, pitch preparation and climate are out of the athlete's control, but shoe outsole selection is one of the few immediately modifiable factors that can allow a player to modulate the traction experienced at the shoe-surface interface (Sterzing et al., 2009; Thomson et al., 2019). Therefore, **choosing a shoe with lower rotational traction (e.g. small round moulded studs instead of metal screw-in studs) is recommended to minimize risk of lower extremity injury.**

- **Grass type affects rotational traction**
  Warm-season grass shows higher rotational traction, particularly when coupled with soft ground outsoles. In contrast, **cool-season grass shows lower rotational traction (Thomson et al., 2019).**

- **Considerations for return to field specific rehabilitation following injury**
  In Qatar, **rotational traction for artificial ground outsoles is consistently lower** regardless of grass type, climate and mechanical properties (e.g. hardness) of the pitch. We **suggest this should be the outsole of choice for players returning to on-field sports-specific rehabilitation** following ACL, syndesmosis or other lower extremity injuries where it is vital to minimize rotational traction forces.

  Soft-ground metal screw-in studs consistently show high rotational traction and should ideally be avoided during early-stage on-field sport-specific rehabilitation.

  Overall, **choosing a shoe with lower rotational traction that results in no consequent detriment to performance** (high translational traction) is recommended.

PREVENTION PROGRAMME

- Rotational traction can be modified by the athlete's footwear selection for a given surface and weather conditions. Accordingly, athlete's injury prevention strategies should include a tailored footwear program.

- A tailored footwear program should consist of player education, prescription of footwear, monitoring of footwear and footwear modification.

- Shoes should fit well and be wide enough to accommodate the foot. Kangaroo leather uppers will "shape' around the foot while synthetic materials will not.

- Players should have multiple shoes with varied outsole configurations available to be able to pick the shoes that provide optimal traction at the shoe-ground interface.

- Club staff can play a role in shoe selection by collecting information on the pitch conditions for a given training session or match. This includes awareness of areas on the pitch with different levels of traction, such as the "run-off" areas.

- We suggest that artificial grass (AG) or firm ground (FG) outsole shoes (small moulded round studs) be used for training and matches in Doha. Following ACL surgery or ankle syndesmosis injury only AG outsoles should be used.

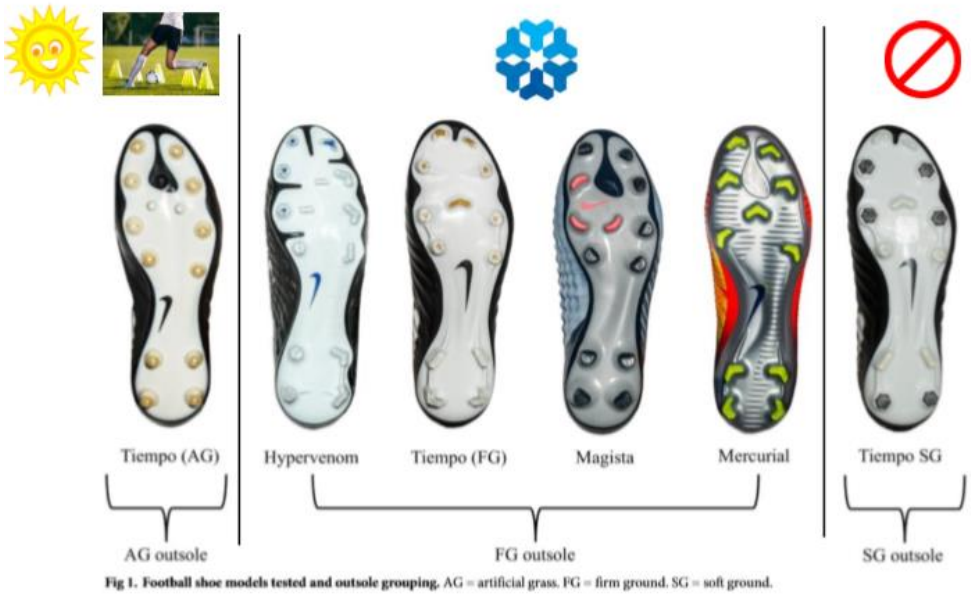

Fig 1. Football shoe models tested and outsole grouping. AG = artificial grass. FG = firm ground. SG = soft ground.

Figure 1: Example of different outsole types from Thomson et al. (2019), PLOS ONE, 14(4). Rotational traction is significantly lower for the AG outsole (left) with small round moulded studs compared to the SG outsole, which has long metal screw-in studs. The AG outsole type is therefore recommended for rehabilitation purposes, while both AG and FG outsoles are recommended for training and matches in Doha.

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SHIN GUARDS

THE BACKGROUND

In Qatar professional football (QSL), fractures represent 2.7% of all injuries with an injury burden of 624 days lost per season. QSL teams experience a mean of 8 fractures per season, of which 21% involve the lower leg, resulting in a mean absence of 55 days per fracture. Internationally, fractures represent 3.5% of all football injuries and lower leg fractures account for 16% of all football fractures (Larsson et al., 2016). Unexpected actions such as kicks or slide tackles are the main cause of these injuries (Boden et al., 1999) and shin guards represent a basic compulsory piece of protective equipment that can decrease the risk of leg impact abrasions, contusions and fractures (Vriend et al., 2015).

THE FACTS

- **It is mandatory to wear shin guards** during football matches (FIFA, 2015).
- FIFA's Medical Assessment and Research Centre (FMARC) suggest shin guards as an effective method to prevent injuries.
- **Shin guards reduce minor and serious injuries in football** (Arnason et al., 2004; Ekstrand et al., 1982; Vriend et al., 2015).
- The main function of shin guards is to **protect the soft tissues and bones in the lower extremities from external impact,** provide shock absorption and facilitate energy dissipation (Tatar et al., 2014). **Custom-made shin guards outperform standard models** in terms of load transfer. When selecting shin guards, players should consider comfort, maximizing the protective area and minimizing weight.
- **The use of shin guards indirectly increases your chances of winning and saves the team money** by decreasing the number of injuries. Fewer injuries have been associated with greater team performance and success (Hägglund et al., 2013; Ekstrand et al., 2013) and a lower economic burden (Ekstrand et al., 2016).

THE PROGRAMME

- It is important to select the appropriate material and apply the right geometry (size and fit) when selecting shin guards (Lees et al., 1996; SAK Project, 2019). Increasing the protective surface area is the critical factor, while comfort and weight should also be taken into consideration. Carbon shin guards are approximately 30 g lighter on each side, which will minimize energy expenditure compared to alternative materials.
- Custom made carbon shin guards are recommended as a preventive measure during both matches and training sessions. They outperform standard models in terms of load transfer, because of their rigid outer material, which suggests clubs should invest in these. (Vriend et al., 2015; Tatar et al., 2014).

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TIPS FOR THE OFF-SEASON

THE BACKGROUND

The physical load of a Premiership footballer is very high. For successful teams, the fixture demand will be even greater. For example, Liverpool FC was involved in 63 competitive matches during the 2005-2006 seasons. Also, most players participated in the 2006 World Cup and National selection friendly matches, extending even further the annual match exposure. This example highlights the importance of introducing a transition period where players can relax, reduce the training volume and get a break from competitive matches.

The off-season period, which runs between the end of the competitive season and the start of the pre-season training period, provides a good opportunity for players to rest and recover, while maintaining their baseline physical performance to avoid detraining. The support team (e.g. fitness coach) should carefully plan the off-season for the individual player, to ensure a good balance between recovery and activity. The aim of this document is to provide key messages for planning the off-season period, covering five different aspects: planning (duration of rest), psychological, nutritional, physical (strength and conditioning) and medical. Together, these aspects all play a role in preventing injuries.

THE FACTS

- A long football off-season period (e.g. 5 or 6 weeks) will have a detraining effect and may negatively affect bone physiology as well (Koundourakis et al., 2017).
- The magnitude of the detraining effect is greatest in the highly trained athletes (Coyle et al., 1985, Mujika & Padilla 2003).
- Detraining leads to loss of neuromuscular function and adaptations (Bosquet & Mujika 2012). The time course for performance deterioration depends on the training status of the individual and the extent to which the training load is decreased (Coyle et al., 1985).
- Detraining is associated with a decrease in maximal oxygen consumption. However, in highly trained individuals, brief periods of detraining (10 to 14 days) appear not to result in a decrease (Mujika & Padilla 2003).
- Elite football players can be allowed **2 weeks of rest** during a break of several weeks. Despite the risk of a small increase in skinfold thickness, the players returned well recovered, with preserved to improved levels of strength and cardiorespiratory fitness (Buchheit et al., 2015; Suarez-Arrones et al., 2019).
- The ability to recover from the physical and psychological stresses during a pre-competitive and competitive season is one factor that affects football performance. Therefore, maintaining adequate sport-specific fitness levels during the off-season may therefore be one key to improve performance and reduce injuries (Miller et al., 2011).
- Adding one high-intensity interval training (HIIT) session every second week to normal off-season activity is enough to maintain maximal oxygen consumption (Slettaløkken and Rønnestad, 2014).
- HIIT sessions (shorter duration and higher intensity) are more efficient for retaining overall running performance than lower intensity running and plyometric training (Nakamura et al., 20102, Clarke et al., 2013).
- In practice, the magnitude of neuromuscular load during HIIT can be modulated through the manipulation of the variables (e.g. work intensity or duration, exercise mode/pattern) and the responses are highly player profile dependent (Buchheit and Laursen, 2013).

RECOMMENDATIONS

Every player has a different set of strengths and weaknesses and obviously not all the players get the same load during the competitive season (e.g. line-up, position, substitute, injuries, National Teams, etc..). Moreover, the response of each player to identical exercise during the off-season program will differ. Therefore, the off-season plan should be tailored individually, where possible.

- Using the off-season break to affect specific fitness aspects can positively transfer to the game only if focused on the things that really matter specifically for each player.
- Individual priorities need to be tailored based on each player's abilities and weak points.
- There are 5 main components that should be addressed in the off-season program: 1) Aerobic capacity, 2) strength/neuromuscular training/activation, 3) core activation, 4) mobility and 5) prevention exercises (weak points).
- The off-season plan should be a holistic programme around the players, aiming at (i) caring about their heath and (ii) maintain their fitness or limit its decline. This programme should be developed in collaboration with the coach, fitness coach, medical staff and nutritionist.

TIPS on "WHAT TO DO DURING THE OFF-SEASON":

- Change your training environment (change sports activities stimuli)
- Adopt a holistic view (e.g. social factors and training background) when defining the individual training variables (e.g. frequency, volume and intensity) and the modality of the exercise interventions (Silva et al., 2016).
- An individualized training program during the off season may represent an adequate methodological and physiological strategy favoring a more efficient individualized periodization of the subsequent pre-season phase (Silva et al., 2016).
- The workout must touch the 5 main components:
    - Aerobic capacity (HIIT training type)
    - Strength and neuromuscular function (focus on fundamental movements, e.g. squats, lounges, etc.)
    - Core stability (basic core exercises to maintain fitness; there is no need for complex or hyper solicitation of adominal or hip flexor in football players)
    - Mobility (weekly input of stretching - hip, groin, ankle, spine)
    - Targeted prevention exercises such as Nordic Hamstring Exercise or Copenhagen Adduction Exercise (and other specific exercises based on current or recent injuries
- Monitor diet and nutritional intake

TIPS on "WHAT NOT TO DO DURING THE OFF-SEASON":

- Too many training sessions (high frequency)
- Too high intensity exercise
- Too much football-specific training; take the opportunity to clean/reset the players' head from football.
- No plan or periodization. Develop a plan, balancing rest and activity and involving the 5 key components.
- More than 14 days of rest and/or complete inactivity.

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MENTAL HEALTH & WELLBEING

THE BACKGROUND

Despite some prominent cases, mental disorders such as depression and anxiety are rarely reported in -level athletes. However, elite athletes also experience mental disorders and challenges to their mental well-being; unfortunately, these tend to be detected late among elite athletes. This is probably due to a lack of awareness from the athletes themselves and the lack of knowledge of the team staff. The stigma attached to mental health issues further makes it an under-investigated and under-reported area in football and in elite sport in general (Gouttebarge et al., 2019, Reardon et al., 2019).

Scientific evidence relating to the mental health of athletes is limited. The few existing studies on mental health problems among football players indicate that mental health problems are at least as frequent as among the general population. As expected, depression and anxiety seem to be the most common mental disorders reported in football players (Gouttebarge et al., 2015, Reardon et al., 2019).

Team physicians and staff should also pay attention to other issues related to well-being, such as stress, eating disorders, poor sleeping patterns, gambling, and signs of drug and alcohol abuse. Some players may be predisposed to developing early signs and symptoms of depression, anxiety or other clinical conditions. In addition, it is important to also consider factors as age, gender, recurrent injuries, presentation of social conflicts, retirement, inadequate expectations, other social issues, and other possible personal stressors.

Professional football can be harsh and brutal; it is a result-oriented environment. The culture surrounding football also predisposes players to mental health issues, explaining why the rate of mental health issues in football may be similar or even higher than in general population. Mental disorders have a direct health impact and can impair performance. There are also many life-, team- and sports-related event that can directly affect performance and health (Sebbens et al., 2016, Rice et al., 2016). Such situations happen daily in the team environment. Thus, working as a multidisciplinary health care team, team medical staff should be able to detect and refer any issues to a well-trained psychologist or other relevant professional as necessary.

THE FACTS

DEPRESSION

- Depression can become a serious health issue and can lead to incidents of morbidity and mortality if left untreated. This is especially true when it is long-lasting or when it is of moderate or severe intensity (World Health Organization, 2012).
- Depression is different from usual mood fluctuations and short-lived emotional responses to the troubles associated with daily life.
- Depression is a common; 1 in 5 individuals will experience a major depressive episode in their lifetime.
- Depression can cause the affected person to suffer greatly and function poorly at work, at school or in the family and will highly impact on elite sport performance.
- There are many reports from high level athletes and coaches who confess to being depressed in the recent past.
- There is effective treatment for depression, but fewer than half of those affected in the world (in many countries, fewer than 10%) receive such treatment (Rice et al., 2016).
- Barriers to effective care include a lack of resources, a lack of trained health care providers (especially in sports) and the social stigma associated with mental disorders. Another barrier to effective care is inaccurate assessment. In countries of all income levels, people who are depressed are often not correctly diagnosed.
- Depression symptoms include sadness, feelings of guilt, low self-worth, disturbed appetite or sleep, loss of interest in things one used to enjoy, poor concentration, fatigue, feeling tearful, difficulty making decisions, low motivation, thoughts of self-harm.

ANXIETY

- Anxiety is also found among football players and for most people is viewed as a normal part of sport and life.
- Players might feel anxious when preparing for a game, when considering selection or when making an important decision.
- The prevalence of anxiety symptoms varies between 3.8% and 22.2% in male athletes.

- In professional football, only 1.4% of players experienced at least a moderate anxiety disorder (Junge & Feddermann-Demont, 2016).
-
- When players have an anxiety disorder, they will report having more than temporary or situational worry or fear. For a person with an anxiety disorder, the anxiety does not go away and can get worse over time. These feelings can interfere with daily activities such as their football or work performance, academic studies and/or relationships. There is a variety of anxiety disorders and each anxiety disorder has different symptoms, but all the symptoms cluster around excessive, irrational fear and dread. The three most common types are: generalized anxiety disorder, panic disorders and social anxiety disorder (social phobia).
- Anxiety symptoms include inability to relax, sleep problems, difficulty concentrating, muscle tension, irritability, being "on edge", trembling, dry mouth, headache, stomachache shortness of breath, worry/fear.

It is important to mention that having symptoms of depression or anxiety, does not necessarily mean that a disorder has developed. Everyone experiences some of these symptoms at some stage. It is their persistent nature that is significant.

THE RECOMMENDATIONS

For players:
If you are affected by any of the issues mentioned above: stress, depression, anxiety or any other mental health issue:

- Do not manage it on your own! Don't bottle it up, talk to your physio or team physician, who may refer you for more specialized help. Many top athletes' players have reported having struggled with their well-being and it is important to talk to someone about how you are feeling.
- Take action to find help, this will make you feel more in control.
- Treatment could be medical (medication) and non-medical (therapies): Cognitive behavioral therapy is very effective for athletes with mood disorders.
- Care for yourself and improve your lifestyle: Find time to eat properly, avoid smoking and alcohol intake, and enough sleep, in addition to your regular exercise.
- To face your stressors: Focus on the positive aspects of your life and change what you can; learn to relax.
- To cope with your fears: Face your fear, sort out your worries and don't let them stop you; know yourself and find out more about your fears and anxiety.
- Faith and spirituality: If you are religious or spiritual, rely on your faith. This does not mean that you should not seek help from a professional.
- Learn strategies by working with a professional to assist with general and sport-specific stress, pre-competition anxiety and overall relaxation.

For coaches:

- Integrate mental health into your environment by making it OK to talk about these issues; encourage players to open up.
- Create a supportive culture that encourages excellence, while allowing for each player to feel they can express their feelings from time to time.
- Be approachable; make yourself available for players to talk to you. If you are concerned about someone, ask them privately if they are OK.
- Encourage players to build supportive relationships and connect with family and close friends.
- Get to know your players and teammates: try to understand their motivations, goals and habits

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Useful links:

https://www.fifamedicalnetwork.com/lessons/mental-mental-health-of-football-players

https://www.thepfa.com/wellbeing/mental-health-and-football

CONCUSSION

THE BACKGROUND

Sport-related concussion is a traumatic brain injury induced by biomechanical forces. It may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head. Concussion typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some cases, signs and symptoms evolve over several days or even weeks. A concussion may result in neuropathological changes, but the acute clinical signs and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies (Mc Crory et al., 2012; Mc Crory et al., 2016). In European soccer, the concussion incidence ranges from 0.56 to 0.67 per 1000 h of exposure, while in the Qatar Stars League (QSL) the incidence was 0.016 during the period 2008-12, but has increased to 0.026 for the period 2016-18. Since the rate of other injuries is similar between professional football in Europe and Qatar, it seems likely that concussions are underreported in Qatar. But based on the current figures, there are presently of 2 to 4 concussions per season in the QSL, corresponding to 0.18 concussions per team per season. Major League Soccer created a concussion committee in 2010 and instituted a mandatory baseline neuropsychological testing for players. Now, players must be removed from a game immediately if they show signs of a head injury (e.g., loss of consciousness, tonic posturing, balance disturbance). If a series of cognitive tests are failed, the player must see a doctor before returning to play and must be allowed to play after completing a graduate return to play protocol.

DEFINITION

Concussion results in a range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged.

Consensus statements by the Concussion in Sport Group (CISG) and the American Medical Society for Sports Medicine define concussion as follows: *Concussion is a traumatically induced transient disturbance of brain function that involves a complex pathophysiological process. Concussion is a subset of mild traumatic brain injury which is classified based on acute injury characteristics at the less severe end of the brain injury spectrum. The clinical signs and symptoms of concussion cannot be otherwise explained by drug, alcohol, medication use, or other injuries (such as cervical injuries or peripheral vestibular dysfunction) or other comorbidities (psychological or medical conditions).*

Table 1. Common symptoms that may develop (Harmon et al., 2019).

Physical	Cognitive	Emotional and psychiatric problems	Sleep-related disorders
Appears to be dazed or stunned	Confusion	Shows behaviour or personality change	Change in sleep pattern
Moves clumsily	Unsure of game, score or opponent	Sadness	Fatigue
Headache	Difficulties remembering	Nervous or Anxious	Low energy
Double or fuzzy vision	Forgets events prior to hit (retrograde amnesia)	Irritability	Trouble falling asleep
Sensitivity to light or noise	Forgets events after hit (anterograde amnesia)	Depression	Drowsiness
Neck pain	Concentration problems	“Don’t feel right”	
Loss of consciousness (even temporarily)	Slowed processing Answers questions slowly		
Balance problems	Feeling "foggy"		
Dizziness	Difficulty speaking and communicating		
Nausea			
Feeling sluggish			

POST-CONCUSSION SYNDROME

Although the majority of athletes who experience a concussion are likely to recover within 7-10 days, an unknown number may experience chronic cognitive and neurobehavioral difficulties related to recurrent injury. Symptoms may include: Chronic headaches, fatigue, sleep difficulties and sensitivity to light or noise. Personality changes, dizziness when standing quickly as well as deficits in short-term memory, problem solving, and general academic functioning are also reported (Laurie et al., 2003).

This constellation of symptoms is referred to as "Post-Concussion Syndrome" and can be quite disabling for an athlete. In some cases, such difficulties can be permanent and career ending (Laurie et al., 2003).
In addition to Post-Concussion Syndrome, suffering a second blow to the head while recovering from an initial concussion can have catastrophic consequences as in the case of "Second Impact Syndrome," which has led to approximately 30-40 deaths over the past decade in the US (Nicolas et al., 2010).

CONCUSSION MANAGEMENT

According to the Vienna, Prague, Zurich and Berlin Conference Recommendations, athletes should complete the following step-wise process prior to return to play following concussion:

- -Removal from contest following signs and symptoms of concussion
- -No return to play in current game
- -Medical evaluation following injury
- -Rule out more serious intracranial pathology

Step-wise return to play:

1. First 24–48 h should be symptom-limited cognitive and physical rest
2. After 48 hours or faster improvement of initial symptoms, encourage gradual symptom-limited increase in physical and cognitive activity until resolution of symptoms
3. Light aerobic exercise, staying below symptom-exacerbation thresholds
4. Sport-specific training, staying below symptom-exacerbation thresholds
5. Non-contact drills, staying below symptom-exacerbation thresholds
6. Full-contact drills, staying below symptom-exacerbation thresholds
7. Game play

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RAMADAN - FASTING & SPORT

THE FACTS

- During the month of Ramadan, Muslim believers restrain themselves from food consumption and liquid intake from dawn until sunset. Fasting duration varies according to the geographical location and month of the year. Therefore, advice to athletes should take into consideration the actual fasting duration and environmental conditions.
- Fasting athletes could potentially suffer from dehydration, altered sleep patterns, sleep disturbances, mood swings, immunological and hematologic alterations, impaired psychomotor performance, and overall perceived physical and mental fatigue.
- Research outcomes on the effect of Ramadan on physical performance are not all in agreement: Study results range from no effect to marked impairment of performance (Chaouachi et al., 2012).
- Training load is generally decreased during Ramadan.
- Professional players surveyed before an important tournament generally reported strong negative beliefs and attitudes about the effects of Ramadan fasting on their mental, cognitive and physical match performance during Ramadan (Farooq, 2016).
- The following recommendations are aimed to guide both athletes and support staff on how to promote appropriate behavioural, social and psychological strategies to cope with the changes and constraints induced by Ramadan fasting.
- **The following advice should not be considered as a "one size fits all" approach, but should rather take into account the variability among athletes and their specific needs.**

ADVICE TO FASTING ATHLETES AND SUPPORT STAFF

1. Training

When possible, training sessions should be performed at night, starting about 3 hours after iftar. This time of day seems to be the best option for athletes to maintain an acceptable hydration and nutritional status throughout the training session, since intake of food and fluid is allowed before and during training. It is recommended to perform high intensity and/or long duration training sessions at this time.

In case of a daytime session, it should be scheduled 1-2 h just before iftar, thus enabling the athlete to replenish their nutrients and fluids immediately post-training. For this time of day, it is recommended to perform light technical-tactical sessions with low cardiovascular load or resistance training sessions of relatively short duration. Nevertheless, coaches are advised to be cautious in excessively scheduling repeated low load sessions to avoid detraining effects.

In terms of training intensity, to facilitate adaptation to training in the fasted state, a progressive approach should be adopted, gradually increasing the exercise resistance or stimuli and loading variation throughout the Ramadan month.

Regarding the type of exercise performed during the training session, the training protocol should incorporate strength or resistance sessions to mitigate the potential for protein loss and help preserve muscle integrity and function.

These recommendations seem to favour a gradual adaptation to the fasting month. However, the player's training objectives, the need to preserve psychomotor performance and minimize the risk of hypoglycemia and injuries must be balanced against the risk of detraining (due to reduced training volume and load). In order to minimize this risk, coaches and sports managers should closely monitor their athletes (for example utilizing reliable and validated psychometric tools, such as the Borg rating of perceived exertion scale) and, eventually, dynamically adapt and adjust the training protocol accordingly.

Depending on the geographical location, unfavourable environmental conditions such as high humidity and heat can represent an additional challenge for the Ramadan-fasted athlete, imposing relevant additional stress and resulting in increased body temperature and significant sweat loss. If possible, this should be avoided, because it leads to acute poorer physical and psychomotor performance.

Coaches and managers are encouraged to consider preparing Ramadan with training rehearsals before the commencement of Ramadan for athletes who are planning to train and compete in the fasted state. This can help dampen the potential negative perceptions and improve the pacing strategies of fasting Muslim athletes during exercise (Aziz et al., 2017; Fleming & James, 2014).

2. Nutrition & Hydration

It is important that food containing nutrients with a high glycemic index foods are ingested for the sahur meal in addition to food with low glycemic index (start of the day's fast) in order to guarantee or even increase the bioavailability of carbohydrates during the eventual training session performed later during the day (Png et al., 2014).

Either low or high glycemic index nutrients are suggested when breaking the day's fast (iftar), so that they provide athletes with adequate nutrients to rebuild muscle glycogen stores (Chua et al., 2019). It is fundamental to regularly monitor nutritional-related parameters during the fast (including body mass and, if possible, body composition – lean/fat mass).

Athletes are recommended to hydrate themselves well between the iftar and sahur time points, with frequent, small volumes of drinks (≈200 ml every 30 minutes) and eventually adding osmotically active agents such as sodium salts, in order to promote fluid retention and attenuate excessive urine loss. Fluids such as coffee and tea should be avoided, as they might promote fluid excretion.

Hydration status can be easily monitored, the primary target would be to keep dehydration to <2% body mass.

To maintain thermoregulatory homeostasis, cooling strategies such ice baths, cold towels, plunge pools, ice vests and appropriate clothing could be used before and during exercise. Mouth-rinsing (fluids with or without carbohydrates) could lead to some relief, although the evidence for this strategy has been conflicting. Indeed, even if mouth-rinsing has led to improved performance for prolonged exercise tasks, it has not shown similar positive effects during all-out repeated sprints performed after 3 days of Islamic religious fasting in trained adults. From a religious prospective, it is important to note that Ramadan-fasted individuals who are engaging in mouth-rinsing during exercise should take into consideration the risk of inadvertently swallowing small quantities of liquid. Keep in mind that mouth-rinsing with carbohydrate fluids requires proper attention to dental care.

3. Sleep during Ramadan

As sleep is an important pre-requisite for optimal sport performance and injury prevention, athletes should avoid the sleep deprivation that typically accompanies the lifestyle changes occurring during Ramadan. Daytime naps of about 30-40 minutes could be a useful strategy to help to make up for the loss of nocturnal sleep.

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