

# NUTRITION FOR TOURNAMENT FOOTBALL

## A PRACTICAL FOCUS ON THE FIFA WORLD CUP QATAR 2022™

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### INTRODUCTION – THE FIFA WORLD CUP

Every four years, soccer teams from across the globe compete in a Fédération Internationale de Football Association (FIFA) tournament to decide the world champions. The current format involves 32 teams (due to increase in 2026 to 48 teams) who must first qualify to participate in advance of the competition. From a physiological and nutritional perspective, this tournament is particularly taxing on teams as 7 matches are played over 28 days in challenging environmental conditions leaving minimal time for recovery and nutritional preparation for the next game. Players will have 4 days recovery between group-stage matches, 4 and 4-5 days between semi-finals and the final which presents many challenges for the sport science support team.

In 2022, The FIFA World Cup is due to be held in Qatar in the Middle East across 5 host cities (see Figure 1). This will be the first Arab country, the second Asian country and the 18th overall country to host the World Cup. Qatar is an Islamic country meaning that appreciation of cultural rules and laws

is important. The desert climate means long summers characterised by intense dry heat, with summer temperature highs of ~40-45°C. Due to concerns surrounding summer temperatures surrounding the traditional June-July time frame for the competition, the tournament has been moved to November-December, where although heat is reduced, temperatures are still likely to be between ~15-30°C with ~50% humidity. Another factor to be considered is the time zone of Qatar (GMT+3) as qualified countries can be based GMT-8 to GMT+13.

Due to the competition schedule along with the high physical demands of the competition (Table 1), fuelling, recovery and (re)hydration are some of the most important considerations during this period. Whilst it is important players are optimally prepared in the weeks leading into the competition (summarised in Table 2), this article will focus upon the unique nutritional considerations during the condensed fixture periods that occur during tournament soccer, with a specific focus on Qatar 2022.

### MATCH FUELLING (WITH A FOCUS ON CARBOHYDRATES)

#### *Loading on match day-1:*

Carbohydrate is the predominant fuel source during soccer training and match-play. Research has shown that ~50% of muscle fibres become partially or fully glycogen-depleted following match-play (Krustrup et al., 2006). From a physical performance perspective, players who begin match-play with suboptimal muscle glycogen concentrations will cover less total distance and less high-speed and sprinting distance, particularly in the latter stages of a match, compared to players who begin match-play with optimal muscle glycogen concentrations (Saltin 1973; Mohr et al., 2003). Therefore, a key nutritional objective the day before match day (MD-1) is to ensure that players consume enough carbohydrate to increase both muscle and liver glycogen stores sufficiently. To achieve this, current recommendations suggest that outfield players should consume at least 6–8 grams per kilogram of body mass (g.kg<sup>-1</sup>) of carbohydrate (e.g. 480-640 grams of carbohydrate for an 80 kg player) on a

**TABLE 1**

	Average Team Distance Per Match (Range)	Average Individual Player Distance Per Match (Highest)	Average Competition Winners Distance Per Match
<b>UEFA Euro 2020</b>	99.3 – 114.0 km (Wales – Czech Republic)	12.7 km (Pedri, Spain)	111.3 km (Italy)
<b>FIFA World Cup 2018</b>	97.1 – 113.0 km (Panama – Serbia)	10.3 km (Perisic, Croatia)	101.0 km (France)

**Table 1:** An overview of the distance demands of elite soccer match play.

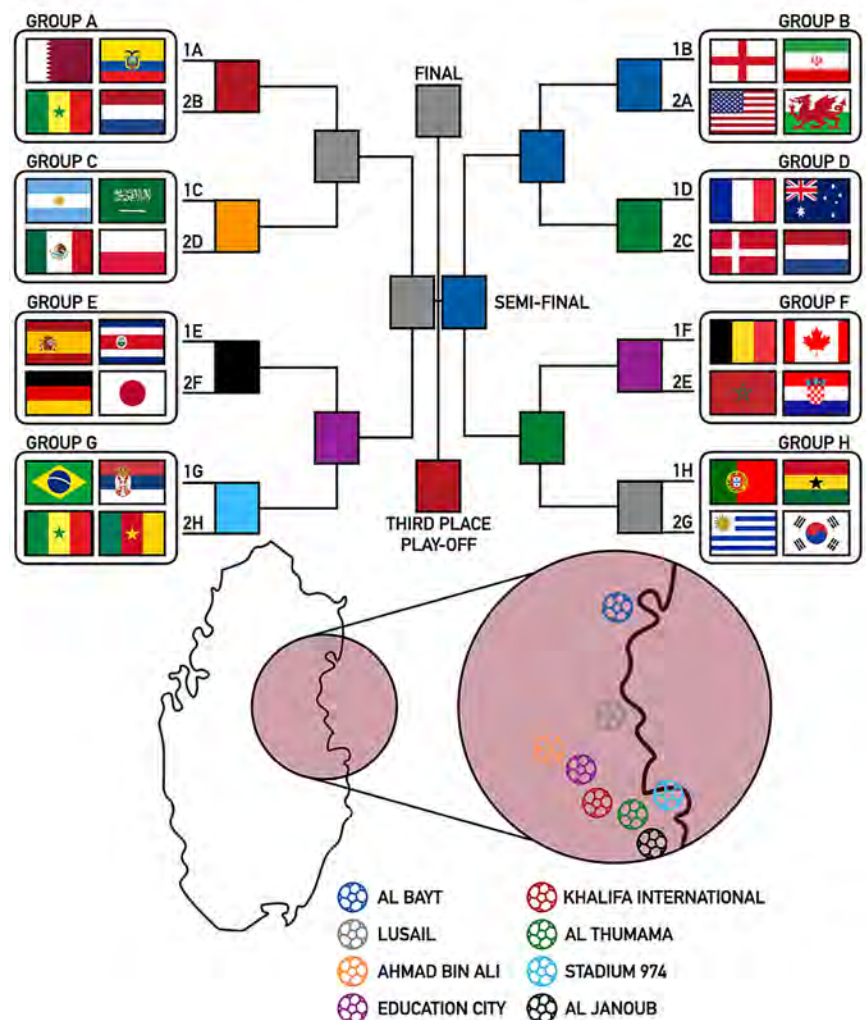
MD-1 (Collins et al., 2021). Whilst this is a well-accepted strategy, both research and our own personal observations working in elite soccer suggests that many players fail to achieve these pre game carbohydrate targets.

**TOP TIPS FOR LOADING ON MATCH DAY-1:**

- Players are encouraged to consume carbohydrate from both food and fluid sources.
- A range of glycaemic index (GI) carbohydrates should be consumed to promote muscle and liver glycogen storage.
- On MD-1, players should increase portion sizes of carbohydrate rich foods and drinks at mealtimes in addition to consuming carbohydrate rich snacks throughout the day.
- Players should aim to reduce their fat and fibre intake on a MD-1 and limit intake of slower digesting foods e.g. red meat.

**Topping-up at pre-match:**

Following an (~11 hour) overnight fast there are significant reductions in liver glycogen stores (~32%), whilst muscle glycogen stores remain relatively unaltered (Iwayama et al., 2020). Consequently, a key nutritional objective on match day (MD) is to ensure that players top-up liver glycogen stores so that they begin match-play with optimal (muscle and liver) glycogen stores. Research suggests that a higher (~1.1 g.kg<sup>-1</sup>) carbohydrate containing pre-match meal versus one that contains less carbohydrate (~0.6 g.kg<sup>-1</sup>), consumed ~90 minutes prior to kick-off, may be more beneficial to soccer



**Figure 1:** An overview of the tournament format.

performance during match-play (Briggs et al., 2017).

Current recommendations suggest that a pre-match meal should be consumed 3-4 hours prior to kick-off and should contain 1-3 g.kg<sup>-1</sup> of carbohydrate (e.g. 80-240 grams of carbohydrate for an 80kg player; Collins et al., 2021). At the Qatar World Cup, kick-off times are staggered throughout the day

(13:00, 16:00, 18:00, 19:00 and 22:00 local time), which of course, will influence what a player eats and drinks (types and amounts of foods/drinks) and when they consume these foods/drinks. For a 13:00 kick-off a player may only consume one meal before the match (i.e. breakfast/pre-match meal), however for a 22:00 kick-off a player may consume breakfast, lunch, a snack and a pre-

TABLE 2

**BODY COMPOSITION:**

Although body composition may have an impact on overall performance and may be manipulated across a season, players should not try to manipulate this drastically during tournaments such as the FIFA World Cup. Instead, the focus should be on fuelling in preparation for and recovery from matches. Players who are unused substitutes or getting low match minutes should concentrate on body composition and weight maintenance outside of the competitive fixtures. Body composition will not be discussed in detail, as this should be a focus prior to tournament commencement.

**BLOOD BIOMARKERS:**

Prior to commencement of tournament soccer, blood samples should be collected and analysed for key markers of health and performance to ensure deficiencies are corrected in advance of the tournament. It is crucial this is overseen by the medical and performance support team with input from the sports nutritionist where required. Common nutritional biomarkers that players may need checking prior to the tournament will include a full Iron profile, vitamin D, B vitamins and any specific concerns relevant to the individual player.

**SWEAT RATE AND SODIUM CONCENTRATION:**

In addition to acclimatising players to the hot weather, it may also be worthwhile to understand the variety of fluid and electrolyte requirements across the squad (Sabou et al., 2020). It is important to understand the different methodologies available to assess sweat rate and sweat sodium concentration (Baker, 2017). Fluid and electrolyte imbalances can have detrimental effects on exercise performance (Cheuvront et al., 2005; Kenefick et al., 2010).

**SUPPLEMENTATION:**

Although a food first strategy for performance nutrition should be the focus, this does not necessarily mean food only (Close et al, 2022). Certain compounds proven to aid performance are difficult to get through whole foods only (such as creatine, beta-alanine, nitrates) and thus individual supplementation strategies may be designed to help improve aspects of performance. In addition, consider the supplements that require loading prior to the tournament commencing (e.g. creatine and beta-alanine) whilst any supplement regime should be practiced well in advance of the actual tournament. Finally, it is essential to ensure that all supplements are from a reputable batch tested company.

**TRAVEL:**

Although once in Qatar the travel between stadiums is relatively short (55 km between the stadiums farthest apart), dependent upon home departure locations, jet lag must be managed to help acclimatise players as efficiently as possible to allow high quality training as soon as possible. In addition, long distance travel can also increase the risk of illness and dehydration, reduce the ability to consume quality / sufficient nutrients and reduce sleep quantity and quality during transit. A well-planned jet lag strategy including some nutritional considerations has been shown to significantly reduce the amount of time take to acclimate and should be planned prior to travel.

**OTHER CONSIDERATIONS:**

Once circadian body clock has adjusted to the time zone, kick-off times occur across the course of the day, ranging from 13:00-22:00, which may be very different to match times that players are accustomed to. It is important teams arrive as far in advance to the first match and may decide to train at different times of the day to help players adjust. In addition, players may wish to design and practice strategies for these different kick-off times in advance. Figure 2 highlights some of the main factors to consider when designing nutritional interventions for The FIFA World Cup 2022.

match meal. In addition to being optimally fuelled, it is important that following a pre-match meal a player feels comfortable and does not feel hungry in the lead-in to kick-off.

**TOP TIPS FOR TOPPING UP AT PRE-MATCH:**

- Fruits (including fruit juices and smoothies), honey, milk and yogurt contain the carbohydrates fructose and galactose which help promote liver glycogen stores. These foods are therefore advised in the pre-match meal.
- Players should consume foods/drinks that are easily digestible and avoid foods/drinks which are high in fat and fibre.
- Players should be encouraged to consume carbohydrate from both food and fluid sources to also promote hydration prior to kick-off.
- It is advised that before competitive tournament soccer begins, players develop a routine (alongside a performance dietitian/nutritionist) around their pre-match meal which incorporates their individual nutritional requirements and food/drink preferences.

**The changing room (and breaks in play):**

Carbohydrate consumption during soccer match-play can improve both physical (e.g. high-intensity running) and technical (e.g. dribbling and shooting accuracy) actions (Currell et al., 2009; Russell et al., 2012; Rodriguez-Giustini et al., 2019). Current recommendations suggest that outfield players should consume 30-60 grams of carbohydrate per hour during soccer activities (Collins et al., 2021), however, again research and our own observations suggests that this is not often achieved. Considering players usually begin exercising at the start of their warm-up, which typically starts 40-45 minutes before kick-off and lasts ~30 minutes, players should be aiming to fuel for a minimum of ~120 minutes (i.e. 60-120 grams) during match-play. Whilst there are many ways of achieving these requirements, it is advised that a player develops a

Table 2: Pre-tournament preparation considerations.





**Figure 2:** Key considerations prior to travelling to the FIFA World Cup Qatar 2022™.

routine around match fuelling alongside a performance dietitian/nutritionist, to not only optimise their fuelling strategy but also to limit the potential occurrence of any gastrointestinal issues. Whilst breaks in play during a match provide good opportunities to consume carbohydrate (and fluid), they are unpredictable and cannot always be relied upon. Players should target the two guaranteed opportunities during a match (i.e. after the warm up and at half-time), to fuel (and hydrate) appropriately with a range of carbohydrate options (drinks, gels, foods) being available. Players that struggle to consume carbohydrate foods/drinks due to GI issues may wish to consider simply rinsing the mouth with carbohydrate which has been shown to also be beneficial to exercise performance.

During the knockout stages of Qatar 2022, if two teams are drawing at the end of 90 minutes, there will be an additional two 15-minute periods of match-play (followed by a penalty shootout if teams are still level). Carbohydrate consumption prior to and during extra time has been shown to improve dribbling performance (Harper et al., 2016) and is advised in these scenarios accordingly.

#### *Recovering post-match (with a focus on carbohydrates & protein):*

With only four days between most of

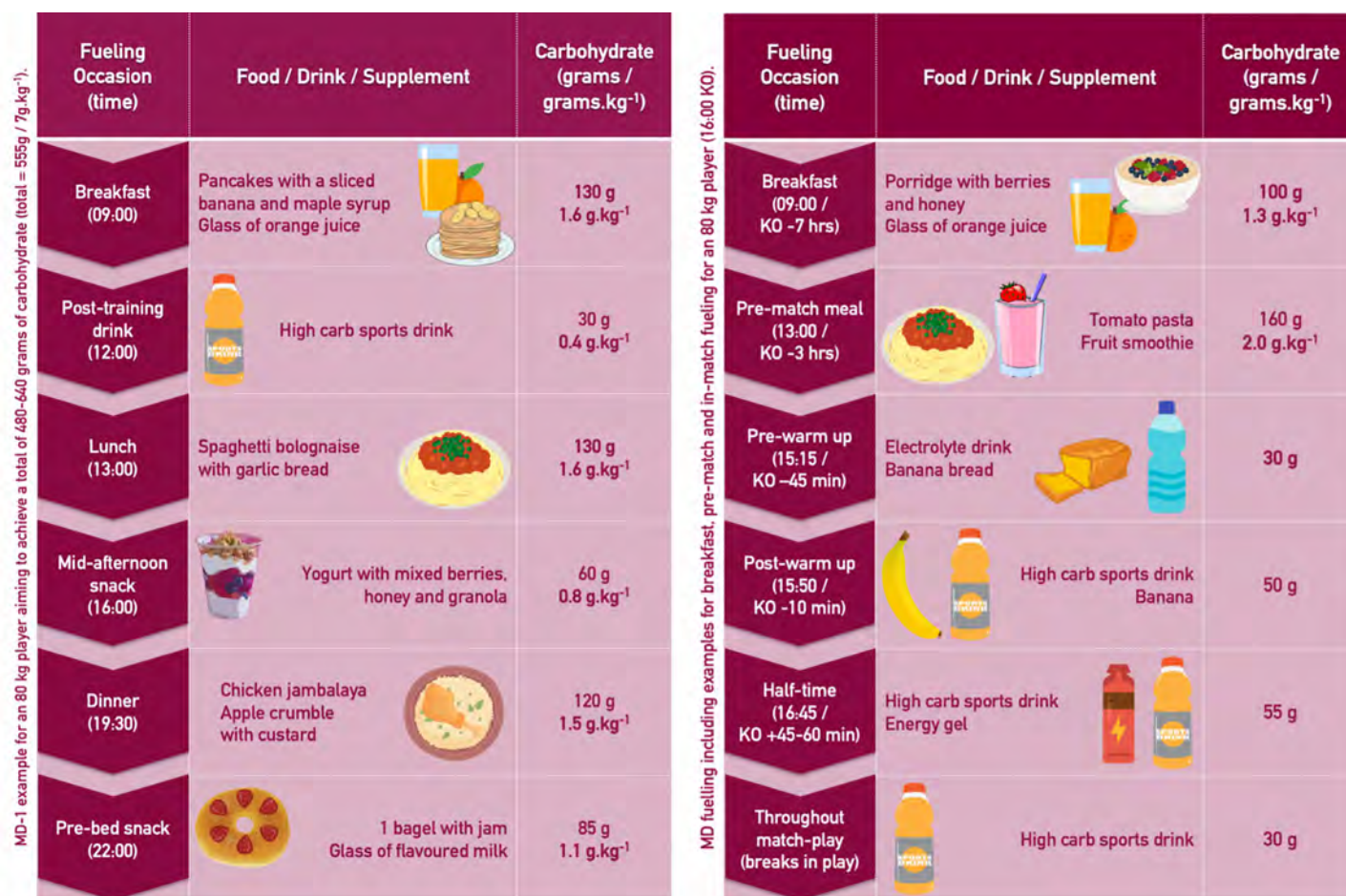
the games, one of the most important nutritional priorities during tournament soccer is to reduce the time it takes to fully recover between matches. Following match-play, replenishing muscle and liver glycogen concentrations, repairing muscle damage and rehydrating are three key nutritional priorities. This is often termed the 3 Rs of recovery (Replenish, Repair, Rehydrate). Specific recovery strategies used by players may be influenced by the staggered kick-off times (and subsequent finish times) of matches throughout the day, given that some matches will not finish until around midnight. Whilst not a direct nutritional consideration, sleep plays a vital role in both physiological and psychological recovery and restoration. Sleep deprivation, which is common in soccer players post-match (for numerous reasons), can significantly impair both glycogen resynthesis and muscle damage repair (Nedelec et al., 2015; Skein et al., 2011) and as such, strategies to promote both sleep quality and quantity post-match should also be targeted.

#### *Replenishing glycogen stores*

In the subsequent four hours after the final whistle players should aim to consume 1-1.2 g.kg<sup>-1</sup>.hr<sup>-1</sup> of carbohydrate (e.g. 80-96 grams of carbohydrate per hour for an 80 kg player; Jentjens & Jeukendrup, 2003; Collins et al., 2021). Delaying carbohydrate intake by two

#### **TOP TIPS FOR THE CHANGING ROOM (AND BREAKS IN PLAY):**

- A selection of carbohydrate rich foods (e.g. bananas, banana bread, flapjack, sweets), gels and fluids (e.g. sports drinks) should be available for players to consume during a match.
- Sports drinks will not only provide a player with carbohydrate but also fluid (and electrolytes) which will replace any water and electrolyte loss through sweating.
- Consider higher % carbohydrate solutions – could be achieved by using a powder mix or adding a gel to a smaller amount of fluid
- If a player struggles with gastrointestinal issues and cannot tolerate optimal amounts of carbohydrate during a match, carbohydrate mouth rinsing could offer an alternative solution which might provide a performance benefit.
- Practice all in game fuelling strategies prior to the tournament to minimise the risk of GI distress.



**Figure 3:** A practical fuelling timeline the day before (MD-1) and the day of (MD) for an outfield player (based on an 80kg player) with a 4pm kick off.

hours significantly attenuates glycogen resynthesis, and as such, carbohydrate should be consumed as soon as possible after the final whistle to optimise replenishment of glycogen stores (Ivy et al., 1988). In the first 24 hours post-match, predominately higher glycaemic index (GI) carbohydrates should be consumed instead of lower GI carbohydrates as they elicit higher rates of glycogen resynthesis (Burke et al., 1993).

Research has demonstrated that 48 hours after competitive match-play in professional soccer players, glycogen stores are often still not fully replenished, particularly in type II muscle fibres, despite adherence to high carbohydrate diet (6–8 g.kg<sup>-1</sup> carbohydrate) during this period (Gunnarsson et al., 2013). It is likely that muscle damage sustained during match-play impairs the rate of glycogen resynthesis in the days following a match. Current recommendations advise that outfield players consume a high carbohydrate intake, between 6–8 g.kg<sup>-1</sup> (e.g. 480–640 grams of carbohydrate for an 80kg player), for up to 72 hours post-

match (Collins et al., 2021). Co-ingesting creatine alongside carbohydrate may also help augment glycogen resynthesis and supplementation is recommended during tournament scenarios (4 x 5 grams doses per day; Robinson et al., 1999).

#### Repairing muscle damage

During match-play sprinting, decelerating and rapid changes in direction result in a high number of eccentric muscle contractions, causing exercise-induced muscle damage in players. Consequently, this leads to reduced muscle function and increased muscle soreness for up to 72 hours post-match (Nedelec et al., 2014). It is therefore important that players consume protein as soon as possible after match-play to begin the muscle remodelling process and to help minimise any performance decrements for the next match. Current recommendations advise that players consume 0.3–0.4 g.kg<sup>-1</sup> of protein (e.g. 24–32 grams of protein for an 80kg player) from high quality

sources, at 3–4 hour intervals post-match (Collins et al., 2021). Pre-bed protein is of particular importance to stimulate muscle repair during sleep. Research has shown that consumption of 40 grams of protein (~0.5 g.kg<sup>-1</sup>) taken pre-bed (and following match-play) accelerates recovery of muscle function in professional soccer players (Abbott et al., 2019).

#### Limiting inflammation

Intense exercise (such as competitive soccer) can lead to an increased level of inflammation within the muscle. High levels of muscle damage can lead to inflammation, soreness and reduced muscle function. However, certain nutritional interventions have been linked with reducing inflammation and the potential associated negative effects, allowing athletes to repair / recover and potentially train more effectively in days following damaging exercise (Rawson et al., 2018). These strategies include functional foods such as turmeric (McFarlin et al.,



2016) and polyphenol rich foods including tart cherry juice (Sciberras et al., 2015). Whilst there has been suggestions that high dose antioxidant / anti-inflammatory supplementation may blunt some of the adaptive processes associated with exercise training (Bell et al., 2014), during periods of competition such as The Qatar World Cup, adaptations may not be as important as recovery and as such strategies to limit inflammation should take precedence.




#### TOP TIPS FOR RECOVERING FOLLOWING THE MATCH:

- Recovery should start in the changing rooms as soon as the players return from the pitch. Recovery options should be readily available in the dressing room post-match and ideally where appropriate recovery foods/drinks should be left at each players changing place.
- A post-match smoothie is a good option for providing optimal amounts of carbohydrate, protein and fluid. Where possible these should be individualised to meet both player requirements and player preference to help increase adherence post-match.
- Some players struggle with appetite in the hours following a match. Different drink options (which provide carbohydrate, protein and fluids) and highly palatable 'finger food' options (e.g. sushi, potato wedges, pizza slices, chicken strips, banana bread) provide an alternative for players that may find it difficult to consume a large meal at this time.
- See Figure 5 for 3 recipes to support fuelling for and recovery from matches.

#### HYDRATION (FOCUS ON FLUIDS AND ELECTROLYTES)

Qatar has a dry, subtropical desert climate and is coolest between December and February, however during November and December, average temperatures range between 15-30°C. Due to the heat and humidity, it is important that hydration

An example of an acute recovery strategy for the 4-hours post-match play for an 80 kg player.

Fuelling Occasion (time)	Food / Drink / Supplement	Nutrition (grams / grams.kg <sup>-1</sup> )
Post-match (18:00-19:00 / +0-60 mins)	Recovery smoothie (milk, ice-cream, banana, frozen berries with added carbohydrate and protein powder and creatine) 	100 g carbs 1.3 g.kg <sup>-1</sup> carbs  50 g protein 0.6 g.kg <sup>-1</sup> protein  500 ml fluid
Post-match (19:00-21:00 +60-180 mins)	Selection of sushi, homemade flatbread pizza, a fruit salad and an electrolyte drink. 	150 g carbs 1.9 g.kg <sup>-1</sup> carbs  40 g protein 0.5 g.kg <sup>-1</sup> protein  500 ml fluid
Post-match (21:00-22:00 / +180-240 mins)	Fruit yogurt with granola and a bottle of water 	70 g carbs 0.6 g.kg <sup>-1</sup> carbs  20 g protein 0.3 g.kg <sup>-1</sup> protein  500 ml fluid

**Figure 4:** A practical recovery timeline (based on an 80 kg outfield player) with a 4pm kick off time.

strategies are designed accordingly to combat this. As sweating is the primary mechanism in which the body dissipates heat during exercise, players should aim to start the match in a euhydrated state. Players would ideally aim to have good urine colour, urine osmolality (<700 mOsmol/kg) and/or urine specific gravity (<1.020) prior to kick off (Kenefick et al., 2012). In the acute period prior to kick off (2-4 hours), players should target 5-7 ml/kg body mass of fluid (e.g. 400-560 ml of fluid for an 80kg player; Sawka et al, 2007). Where large amounts of fluids are consumed, it may be necessary to take

on additional electrolytes to aid with electrolyte balance. During the match itself, players should consume enough fluids to avoid a >2% loss in body weight which contain sufficient electrolyte content to avoid excessive sodium loss. Although when recovering from matches, players may have sufficient opportunity to restore fluid and electrolytes within the body through normal eating and drinking practices, they should target a fluid intake of 1.5 litres for every kg lost over the acute period following a match as this has been shown to be optimal for post-exercise fluid replacement (Maughan et al, 1996).

			
	BIRCHER OATS	BANANA BREAD	MUESLI BARS
Ingredients	<ul style="list-style-type: none"> <li>- 200g x Porridge oats.</li> <li>- 900g x Greek yoghurt.</li> <li>- 40g x Raisins.</li> <li>- 40g x Crushed to a powder Hazelnuts.</li> <li>- 2 x green apple skinned and grated.</li> <li>- 40g x Honey.</li> <li>- Semi-Skimmed milk to loosen.</li> </ul>	<ul style="list-style-type: none"> <li>- 3 x Medium mashed bananas.</li> <li>- 75g x Butter.</li> <li>- ½ teaspoon x Baking soda.</li> <li>- 1 pinch x Salt.</li> <li>- 150g x Sugar.</li> <li>- 1 x Large beaten egg.</li> <li>- 1 teaspoon x Vanilla extract.</li> <li>- 200g x All-purpose flour.</li> </ul>	<ul style="list-style-type: none"> <li>- 100g x Rolled Oats</li> <li>- 70g x Desiccated Coconut</li> <li>- 40g x Wheatgerm</li> <li>- 35g x Sesame Seeds</li> <li>- 70g x Sunflower Seeds</li> <li>- 70g x Raw Pumpkin Seeds</li> <li>- 100g x Dries Cranberries</li> <li>- 35g x Flax Seeds</li> <li>- 100g x Butter</li> <li>- 175g x Honey</li> <li>- 25g x Brown Sugar</li> </ul>
Method	<ul style="list-style-type: none"> <li>- Mix all the ingredients the day before.</li> <li>- It is required to be thick and creamy, so loosen with milk, so it is wet but not sticky prior to serving.</li> </ul>	<ul style="list-style-type: none"> <li>- Pre-heat oven to 175 degrees Celsius and grease 4 8x4-inch loaf pan.</li> <li>- Mash the banana and stir in melted butter.</li> <li>- Mix in baking soda and salt as well as the sugar, beaten egg and vanilla extract.</li> <li>- Mix in the flour.</li> <li>- Bake for 55-65 minutes.</li> </ul>	<ul style="list-style-type: none"> <li>- Grease and line a square baking tin with baking paper.</li> <li>- Being careful not to burn, cook the oats, coconut, wheatgerm, sesame-, sunflower-, and pumpkin-seeds in a pan.</li> <li>- Stir in the cranberries and flax-seeds.</li> <li>- Stirring constantly, cook the butter, honey and sugar in a pan until sugar has dissolved., then set to low heat for 5 min before adding to other mixture.</li> <li>- Spoon the mixture in to the tinned press firmly and evenly.</li> <li>- Allow to cool and portion.</li> </ul>

Figure 5: Practical recipe ideas to support fuelling for and recovery from matches.

#### TOP TIPS FOR HYDRATION:

- Ensure player drinks are designed to be palatable and are not too acidic, not cause gastrointestinal stress/discomfort. Carbohydrate content of drinks should be relevant for the session and environment, and on an individual basis.
- In general, drinks should be designed with electrolytes (40-80 mM), mainly sodium, however, remember higher levels of electrolytes may affect palatability.
- Drinks should also be isotonic (280-300 mOsm/kg) in nature to ensure effective rehydration.
- Chilling drinks can help with palatability from players and although 10-12 degrees Celsius may be sufficient to help with body cooling, practitioners may wish to use iced drinks / slushes post-sessions.

#### SUMMARY

Teams competing in this year's FIFA World Cup in Qatar will have undertaken four years of preparation, including detailed planning, and practicing of their nutritional strategies. When the time arrives, teams will have to ensure that their players are optimally prepared for the unique nutritional considerations that come with tournament football. The successful design and implementation of a players match day fuelling, recovery and hydration can have a major influence of the performance of the player and ultimately the success of the team. Whilst in many ways the science of nutrition for tournament football is quite simple, the art is in the application, ensuring that practical strategies to deliver the key nutritional requirements are developed and implemented in a manner that is accessible to each player and their personal requirements. Teams that get this right could be the ones we see lifting the 2022 FIFA World Cup.

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