



F-MARC Nutrition for Football

A practical guide to eating and drinking
for health and performance



100 YEARS FIFA 1904-2004

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F-MARC

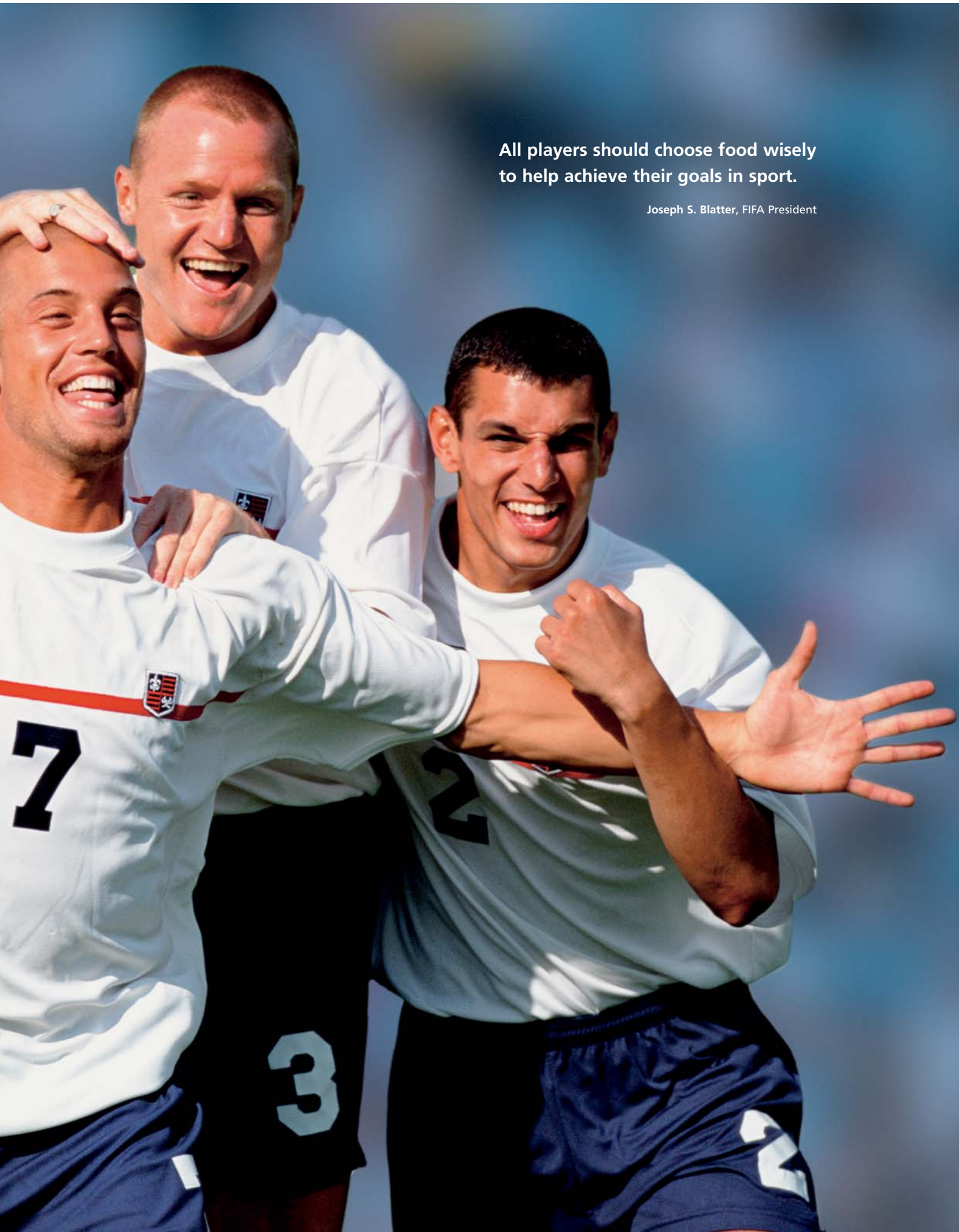
Nutrition for Football

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President Joseph S. Blatter

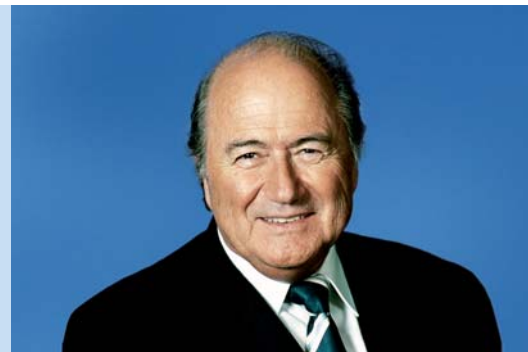
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All players should choose food wisely to help achieve their goals in sport.

Joseph S. Blatter, FIFA President



The food and drink that players choose to consume can affect how they perform in sport and help them to stay fit and healthy. All players should choose food wisely to help achieve their goals in sport.

We must also remember the important social and cultural aspects of eating and the pleasure that we gain from food. A healthy diet that is good for performance can also be a source of enjoyment.

FIFA is committed to helping all players to achieve their goals. This booklet is part of that commitment.

Joseph S. Blatter
FIFA President

The Coca-Cola Company, via the POWERADE brand, has formed a very successful partnership with FIFA and the FIFA Medical Assessment and Research Centre (F-MARC). This partnership has created this nutrition brochure which we hope will provide you with practical information in advance of the 2006 FIFA World Cup™.

We are delighted to support athletes as they pursue their personal goals. One way we do this is through the POWERADE sports drink brand. It was developed to help athletes perform at their best, thanks to its formulation, which can help delay the onset of fatigue during exercise and prevent dehydration.

This brochure recognizes the importance of diet as a crucial part of sporting performance and we hope you find the information useful.

Neville Isdell
Chairman of the Board & CEO
The Coca-Cola Company



Key messages

Whenever highly talented, motivated and well trained players meet in competition, the margin between victory and defeat is small. Attention to detail can make that vital difference.

Diet affects performance, and the food that we choose in training and competition will affect how well we train and play. All players need to be aware of their personal nutritional goals and of how they can select an eating strategy to meet those goals.

Every player is different, and there is no single diet that meets the needs of all players at all times. Individual needs also change across the season and players must be flexible to accommodate this.

Diet may have its biggest impact on training, and **a good diet will help support consistent intensive training** while limiting the risks of illness or injury. Good food choices can also promote adaptations to the training stimulus.

Getting the right amount of energy to stay healthy and to perform well is key. Too much and body fat increases: too little – and performance falls, injuries occur and illness – results.

Carbohydrate supplies the muscles and brain with the fuels they need to meet the stress of training and competition. **Players must be aware of what foods they should choose** to meet their carbohydrate needs, how much should be eaten, and when these foods should be eaten.

Foods rich in protein are important for building and repairing muscles, but **a varied diet containing everyday foods will generally supply more than enough protein.**

Wellchosen vegetarian diets can easily meet protein needs.

A varied diet that meets energy needs and is based largely on nutrient-rich choices such as vegetables, fruits, beans, legumes, cereals, lean meats, fish and dairy foods should ensure an adequate intake of vitamins and minerals. Excluding any of these food groups means that more careful food choices must be made.

Maintaining hydration is important for performance. Fluid intake before, during (where appropriate) and after exercise is important, especially in hot climates. When sweat losses are high, food and drink consumed must contain sufficient salt to replace these losses.

Players are cautioned against the indiscriminate use of dietary supplements.

This booklet contains information that will help players at all levels of competition to make informed choices to meet their nutritional needs in different situations. This booklet tries to give practical information that will be of use to the serious player, but is not a substitute for individual advice from a qualified professional.





The benefits of eating well

A well-chosen diet offers many benefits to every sportsman and woman

- Optimal gains from the training programme
- Enhanced recovery within and between workouts and events
- Achievement and maintenance of an ideal body weight and physique
- A reduced risk of injury and illness
- Confidence in being well-prepared for match play
- Consistency in achieving high level performances in matches
- Enjoyment of food and social eating occasions

Despite these advantages, many players do not meet their nutrition goals. Common problems and challenges include

- Poor knowledge of food and drink and inadequate cooking skills
- Poor choices when shopping or dining out
- Poor or outdated knowledge of sports nutrition
- Inadequate finances
- Busy lifestyle leading to inadequate time to obtain or consume appropriate foods
- Poor availability of good food and drink choices
- Frequent travel
- Indiscriminate use of supplements and sports foods

The information in this booklet is designed to provide players and coaches with an overview of the latest guidelines in sports nutrition. While there is no such thing as a magic diet or food, there are many ways in which eating and drinking well can allow players at all levels of performance to achieve the special goals of their training and competition programmes. It makes no sense to train hard and ignore the benefits that follow from good food choices.

Nutrition for Football is based on the conclusions of the FIFA/F-MARC Consensus Conference on Nutrition for Sport, held in Zurich in September 2005. We gratefully acknowledge the contribution of the conference participants as the expert scientific sources for this booklet.

This booklet was prepared for the **FIFA Sports Medical Committee** by
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We thank all the participants in the FIFA/F-MARC International Consensus Conference for their insight and comments in the preparation of this booklet.

Energy demands of training and match play

Most serious football players play in one or more competitive games per week for a large part of the year and will train most days of the week, sometimes twice a day, throughout this time. The energy demands of training must be met to maintain performance capacity and prevent the development of chronic fatigue.

Energy for match play

Soccer is a game of intermittent work. Players generally perform low intensity activities for more than 70% of the game, but heart rate and body temperature measurements suggest that the total energy demand is high. The high energy demand may be partly explained by the repeated high intensity efforts that players are called upon to perform. A top class player performs about 150-250 brief intense actions during a game. These efforts place high demands on the anaerobic energy systems, so the rates of creatine phosphate (CP) utilisation and glycolysis are high during the course of a game.

Carbohydrate, which is stored in the muscles and in the liver as glycogen, is probably the most important substrate for energy production, and fatigue towards the end of a game may be related to depletion of glycogen in some of the individual muscle fibres. If even a few of these are unable to contract, then sprinting ability is reduced, and skill may also be impaired. Free fatty acid (FFA) levels in blood increase progressively during a game, partially compensating for the progressive lowering of muscle glycogen.

There are major individual differences in the physical demands on a player during a game related to physical capacity and tactical role in the team. Fatigue also occurs temporarily during a game, but it is still unclear what causes the reduced ability to perform maximally. These differences should be taken into account in the training and nutritional strategies for a top class player.

The total distance run by a player during a game depends on many different factors, including the level of competition, the player's position, and the playing style and fitness level of the individual. At the elite level, male outfield players typically cover about 10-13 km, making football an endurance sport. The demands are increased, however, by the fact that more than 600 m are covered at sprinting speed and about 2.4 km at high intensity. Over the whole duration of the game, heart rate is about 85% of the maximum rate and the oxygen demand is about 70% of the maximum oxygen uptake (VO₂max). These values suggest that the total energy cost of a game for a typical player weighing about 75 kg would be about 1600 kcal (about 6.5 MJ). The value for players at lower levels of the game is somewhat less than this; because the VO₂max is also lower, the total energy expended will be less. Of course, energy needs will vary greatly between individuals.

Energy demands of training

The energy demands of training will vary depending on the intensity, frequency and duration of the training sessions, but they will also change over the course of the season. Most players will follow a weekly cycle that involves a reduced training load to allow recovery from the previous game, days of harder training, and a reduction in training load in preparation for the next game.

In pre-season, the training load is usually at its greatest as players strive to reach full fitness for the opening games of the season.

Energy demands in a training session focused on fitness may reach those of a hard game. In sessions where the emphasis is on recovery and regeneration or on skill, the energy cost will be much less.

Energy needs

The foods we eat and the fluids we drink provide for the immediate energy needs of the body as well as influencing body energy stores. Energy stores play a number of important roles related to exercise performance, since they contribute to

- size and physique (e.g. body fat and muscle mass)
- function (e.g. muscle mass)
- fuel for exercise (e.g. muscle and liver carbohydrate)

The energy needed for training and match play must be added to the energy required for normal daily activities. As outlined above, the energy demands of training will depend on the intensity and duration of the training session. These will vary across the season and at different levels of competition.

How much food a player needs will depend largely on energy needs, and there is no simple formula to predict this. Energy needs depend not only on the demands of training and match play, but also on activities outside the game. For those who train infrequently, or where training sessions are short or easy, the energy demands will not be high. Similarly, energy needs are lower during periods of inactivity such as the off-season or while a player is injured, and players should adapt their food intake accordingly.



Body Fat

An individual's body fat stores represent a lifetime history of the balance between energy intake and energy expenditure. Fat is the major energy store in the body, and is an efficient way to store excess energy for use in times of need.

A player will perform best when the amount of body fat is within his or her individual optimum range. This will vary between individuals, and will also vary across a player's career, so there is no single value that is ideal. If the body fat stores fall too low, health will suffer. If body fat stores are too high, the player will be slowed down by having to carry unnecessary additional weight. It is important, therefore that players manage their food intake and energy output to achieve an optimum body size and body composition.

Strategies for managing energy intake and energy balance

Players should individually manage their energy stores of body fat, carbohydrate (muscle fuel) and protein (muscle mass) by managing intake and expenditure of these nutrients separately. These issues will be discussed in separate parts of this booklet.

Players should follow an eating plan that achieves their specific goals rather than relying on appetite to guide energy intake. Advice from a sports nutrition expert is often required to develop this plan.

Players should have a number of separate bio-markers to monitor their progress in achieving each of their energy-related goals.



Body weight is not a reliable or accurate indicator of energy balance. Monitoring body weight can be misleading, and the information can be misinterpreted.

Monitoring of skinfold fat thicknesses across the season, especially when undertaken by a trained kinanthropometrist, can provide useful information about changes in body fat stores.

Urinary ketones can provide a marker of inadequate carbohydrate intake.

Measurements of changes in muscle strength and endurance provide a useful biomarker of muscle development.

Special concerns about restricting energy intake

Although many players reduce their energy intake at times to assist with the loss of body weight and body fat, it is harmful to restrict energy intake below levels that interfere with healthy body function.

Energy availability = total dietary energy intake – energy used in daily activity/exercise

There is evidence from recent research that when energy availability drops below a daily intake of 30 kcal (135 kJ) per kg fat-free mass (FFM), there are substantial impairments of metabolic and hormonal function, which affect performance, growth and health.

In females, one outcome of low energy availability is a disturbance of reproductive function and menstrual regularity. Other problems are likely to occur in male players.

Players requiring advice for weight loss or fat loss should seek guidance from a qualified sports nutrition expert such as a sports dietitian.

If a reduction in body fat content is necessary, this should be achieved gradually. Players can avoid potential problems by taking care to avoid excess weight gain in the off-season. Careful management of both diet and activity levels in the off-season and in the pre-season can help the player to reach his or her ideal weight and body fat level with minimal impact on health or performance.

To avoid irreversible skeletal damage, any female player with disruption of normal menstrual function should be referred without delay to a medical expert for investigation.

Example of low energy availability

60 kg female with 20 % body fat = 48 kg FFM
 Daily energy intake is 1800 kcal (7560 kJ)
 Cost of daily exercise (1 h/d) = 500 kcal (2100 kJ)
 Energy availability = 1800-500 = 1300 kcal (5460 kJ)
 Energy availability = 1300/48 or 27 kcal/kg FFM (113 kJ per kg FFM)



Carbohydrates in the diet

Carbohydrate provides an important, but relatively short-lived, supply of fuel for exercise that must be refilled each day from carbohydrate foods in the diet. The players' everyday eating and drinking plan needs to provide enough carbohydrate to fuel their training programme and to optimise the recovery of muscle glycogen stores between workouts. General targets can be provided for carbohydrate needs, based on the player's size and the demands of the training programme (see table below). However, actual needs are specific to the individual and need to be fine-tuned with consideration of the total energy needs and specific training goals. It is important to get feedback from performance in training and match play to assess whether there is a problem with fuel availability.

Strategies for choosing carbohydrate foods and drinks and for optimising glycogen recovery

When the period between training sessions is less than 8 hours (as in pre-season for elite players), carbohydrate intake, in the form of solids or liquids, should start as soon as practicable after the first session to maximise the effective recovery time. There may be some advantages in meeting carbohydrate targets through a series of snacks during the early recovery phase.

During longer recovery periods (24 hours), the pattern and timing of carbohydrate-rich meals and snacks does not appear to be critical, and can be organised according to what is practical and comfortable for each player.

Targets for carbohydrate intake

Immediate recovery after exercise (0-4 hours): about 1 g per kg of the player's body weight per hour, consumed at frequent intervals

Daily recovery from a moderate duration/low intensity training session: 5-7 g per kg body weight per day

Recovery from moderate-heavy endurance training (such as pre-season) or fuelling up for a match: 7-10 g per kg body weight per day

There is no difference in glycogen synthesis when carbohydrate is consumed in liquid form or as solid foods. Given the amount of carbohydrate to be consumed, high carbohydrate foods will need to be spread out over the full 24 hours.

It is valuable to choose nutrient-rich carbohydrates and to add other foods to recovery meals and snacks to provide a good source of protein and other nutrients. These nutrients may assist in other recovery processes, and in the case of protein, may promote additional glycogen recovery when carbohydrate intake is below target or when frequent snacking is not possible.

Carbohydrate-rich foods and drinks with a moderate to high glycaemic index (GI) provide a readily available source of carbohydrate for glycogen synthesis. These foods should form the major part of recovery meals.

Adequate energy intake is also important for optimum glycogen recovery; the restrained eating practices of some players, particularly females, make it difficult to meet carbohydrate intake targets and to optimise glycogen storage from this intake.

Special comments

Guidelines for carbohydrate should not be provided in terms of percentage contributions to total dietary energy intake. Such recommendations are neither user-friendly nor strongly related to the muscle's absolute needs for fuel.

Examples of carbohydrate foods with moderate-high Glycaemic Index

- Most breakfast cereals
- Most forms of rice
- White and brown breads
- Sports drinks and soft drinks
- Sugar, jam and honey
- Potatoes
- Tropical fruits and juices

Examples of nutrient-rich carbohydrate foods and meal combinations

- Breakfast cereal with milk
- Flavoured yoghurt
- Fruit smoothie or liquid meal supplement
- Sandwich with meat and salad filling
- Stir-fry with rice or noodles



Protein needs for training and bulking up

Protein has been considered a key nutrient for sporting success by athletes of all eras and in all sports. Whereas ancient Olympians were reported to eat unusually large amounts of meat, today's players are provided with a vast array of protein and amino acid supplements to increase their protein intakes.

Protein plays an important role in the response to exercise. Amino acids from proteins form building blocks for the manufacture of new tissue including muscle, and the repair of old tissue. They are also the building blocks for hormones and enzymes that regulate metabolism and other body functions. Protein provides a small source of fuel for the exercising muscle.

Some scientists have suggested that endurance and resistance-training exercise may increase daily protein needs up to a maximum of 1.2-1.6 g per kg (body weight), compared to the recommended intake of 0.8 g/kg body weight for a sedentary person. However, the evidence for this increase in protein needs is not clear or universal. Part of the confusion is caused by problems involved in scientific techniques used to measure protein requirements.

The debate over the precise protein needs of players is largely unnecessary. Dietary surveys show that most players already consume diets providing protein intakes above 1.2-1.6 g/kg/d, even without the use of protein supplements. Therefore, most players do not need to be encouraged or educated to increase their protein intakes. Rather, anyone who consumes adequate energy intake from a variety of nutrient-rich foods should be confident of meeting his or her protein needs, including any increases that could arise from high-level training.

Players most at risk of failing to meet their protein needs are those who severely restrict their energy intake or dietary variety. An adequate energy intake is also important in promoting protein balance or increasing protein retention.

Although some resistance-trained athletes and body builders consume protein intake in excess of 2-3 g/kg body weight, there is no evidence that such dietary patterns enhance the response to training or increase the gains in muscle mass and strength. While such diets are not necessarily harmful, they are expensive and can fail to meet other nutritional goals, such as providing the fuel needed to optimise training and performance.

Recent studies have focused on the acute response to workouts of both endurance and resistance training. Enhanced protein balance is a desirable goal of the recovery phase – to overturn the increased rates of protein breakdown that occur during exercise, and to promote muscle growth, repair and adaptation following the exercise stimulus. These studies have found that the intake of protein, combined with carbohydrate, enhances protein synthesis during the recovery period. There is some evidence that the response is enhanced when these nutrients are provided soon after exercise, or in the case of a resistance workout, perhaps immediately before training.

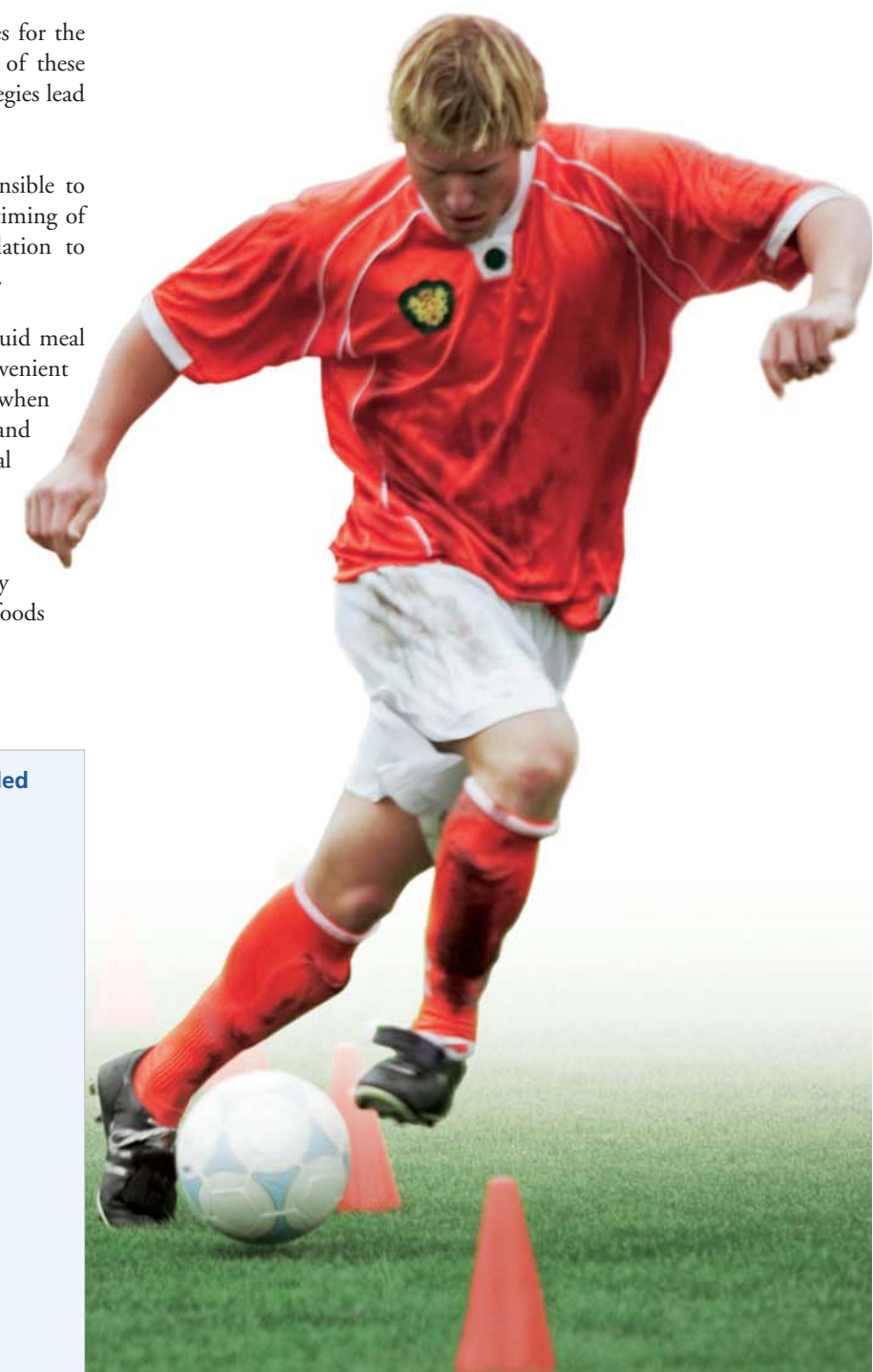
Further work is required to fine-tune guidelines for the optimum amount, type and timing of intake of these nutrients, and to confirm that these eating strategies lead to an enhancement of the goals of training.

In the light of this information, it appears sensible to focus on the total balance of the diet and the timing of protein-carbohydrate meals and snacks in relation to training, rather than high protein intakes per se.

Special sports foods such as sports bars and liquid meal supplements can provide a compact and convenient way to consume carbohydrate and protein when everyday foods are unavailable or are too bulky and impractical to consume. However, the additional cost of these products, and the fact that they contain only a limited range of nutrients, must be taken into account. There is little justification for using very expensive protein-only powders or amino acid supplements. Everyday foods are likely to be just as effective.

Protein rich foods – 10 g protein is provided by any of the following

- 2 small eggs
- 300 ml cow's milk
- 20 g skim milk powder
- 30 g cheese
- 200 g yoghurt
- 35-50 g meat, fish or chicken
- 4 slices bread
- 90 g breakfast cereal
- 2 cups cooked pasta or 3 cups rice
- 400 ml soy milk
- 60 g nuts or seeds
- 120 g tofu or soy meat
- 150 g legumes or lentils
- 200 g baked beans
- 150 ml fruit smoothie or liquid meal supplement



Vitamins, minerals and anti-oxidants for training and staying healthy

Strenuous bouts of prolonged exercise and heavy training, particularly aerobic exercise, stress the body. Adequate intakes of energy, protein, iron, copper, manganese, magnesium, selenium, sodium, zinc, and vitamins A, C, E, B6 and B12 are particularly important to health and performance. These nutrients, as well as others, are best when obtained from a varied diet based largely on nutrient-rich foods such as vegetables, fruits, beans, legumes, grains, lean meats, fish, dairy products and unsaturated oils. Dietary surveys show that most football players are able to meet the recommended intakes for vitamins and minerals by eating everyday foods. Those at risk of sub-optimum intakes of these micronutrients include:

- players who restrict their energy intake, especially over long periods, to meet weight loss goals
- players who follow eating patterns with restricted food variety and reliance on foods with a poor nutrient-density



The best way to correct this situation is to seek advice from a qualified sports nutrition expert such as a sports dietitian. When food intake cannot be adequately improved – for example, when the player is travelling in a country with a limited food supply – or if an individual is found to be suffering from a lack of a particular vitamin or mineral, then supplementation can be warranted. This should be undertaken with the advice of a qualified sports nutrition expert. In general, a broad-range multivitamin/mineral supplement is the best choice to support a restricted food intake, although targeted nutrient supplements may be necessary to correct an established nutrient deficiency (e.g. iron deficiency).

Anti-oxidant nutrients

Anti-oxidant nutrients are important in helping protect the body's tissues against the stresses of hard exercise. It is not known whether hard training increases the need for dietary antioxidants, as the body naturally develops an effective defence with a balanced diet. Supplementation with antioxidants cannot be recommended because there is little evidence of benefit while it is known that over-supplementation can diminish the body's natural defence system.

Ideas for promoting dietary variety and nutrient-rich eating

Be open to trying new foods and new recipes

Make the most of foods in season

Explore all the varieties of different foods

Mix and match foods at meals

Think carefully before banishing a food or group of foods from your eating plans

Include fruits and vegetables at every meal. The strong colours of many fruits and vegetables are a sign of a high content of various vitamins and other food anti-oxidants. Aim to fill your plate with highly coloured foods to ensure a good intake of the range of these health-promoting dietary compounds. It is good to ensure that you "eat rainbow" each day by choosing fruits and vegetables from each of the following schemes:

White – e.g. cauliflowers, bananas, onions, potatoes

Green – e.g. broccoli, lettuce, green apples and grapes

Blue/purple – e.g. blueberries, plums, purple grapes, raisins

Orange/Yellow – e.g. carrots, apricots, peaches, oranges, cantaloupe, mangoes

Red – e.g. tomatoes, watermelon, cherries, berries, red apples, red peppers

Special concerns

Iron. Iron deficiency is the most common nutrient deficiency in the world. It may occur in athletes, including football players, and can impair training and match performance. Unexplained fatigue, especially in vegetarian eaters should be explored with a sports physician and sports nutrition expert. Routine use of iron supplements is not wise: too much is just as harmful as too little. Self-medication with iron supplements may not address the real problem that is causing fatigue, or solve the cause of poor iron status.

Calcium. Calcium is important for healthy bones. The best sources are dairy foods, including low fat varieties. Fortified soy foods may provide a useful substitute where players cannot consume dairy foods. Three servings a day are required by adults, with an increased requirement during growth spurts in childhood and adolescence, and for pregnancy and lactation.



Preparation for competition

Most players appreciate the need to rest and eat well during the days prior to an important match, but questions arise regarding how much to eat, what type of food and when is the best time. This includes what to eat during the few hours immediately before competition or intense training.

Carbohydrate is the key energy-providing nutrient that must be optimised during the days leading up to and including the day of competition. Attention should also be given to optimising water and salt levels in the body. However, during the 2-4 days prior to a competition, a player's need for protein and fat, as well as most other nutrients, typically does not increase above the levels that are recommended for normal, moderate level training.

Carbo-loading

Players who compete intensely may benefit from "carbohydrate-loading" for a few days. This loading of muscle glycogen to super-compensated levels can be achieved within 2-3 days by consuming a large amount of carbohydrate (about 8-10 g per kg of body weight per

Example of one day of a carbohydrate loading diet providing 630 g of carbohydrate* (i.e. to provide 9 g/kg carbohydrate for a player weighing 70 kg)

Early morning – 150 g = 2 cups cereal with milk + 250 ml fruit juice + 1 banana + 2 thick slices toast + thick spread of jam

Late morning – 50 g = 500 ml soft drink or 750 ml sports drink

Mid-day – 150 g = 1 large bread roll + 1 medium muffin + fruit smoothie

Snack – 50 g = 200 g flavoured yoghurt + 250 ml fruit juice

Dinner – 200 g = 3 cups cooked pasta + 2 cups fruit salad + 2 scoops ice cream + 500 ml sports drink

Snack – 30 g = 50 g chocolate

(* Foods added to balance a meal, such as sauce on the pasta, can meet needs for energy and other nutrients.)

day; see below) at the same time that training intensity is reduced to no more than easy levels of short duration. It is assumed that a moderate to hard bout of fatiguing exercise is performed in normal training sometime earlier in the week prior to competition.

Carbohydrate in the 6-h period before playing

Players sometimes find a favourite pre-competition meal that not only provides extra energy during the match, but also feels "right" in terms of curbing hunger, quieting their stomach and being convenient and practical. In low key competition, or for some players who do little running in a game, the pre-match meal need not be predominantly carbohydrate. However, in intense competitions players are generally advised to:

Eat 1-4 g/ kg body weight of carbohydrate during the 6-h period before exercise.

The main "mistake" players might make is to eat too little carbohydrate (less than 1 g per kg body weight) during the 1-6 h period before exercise. This small carbohydrate meal "primes" the body to rely more heavily on blood glucose, but it does not provide enough carbohydrate to sustain the player throughout the subsequent exercise.

Fluid intake prior to competition

Players should drink sufficient fluid with meals on the day before competition to ensure they are well-hydrated on the morning of competition. Players should not refrain from drinking water or carbohydrate-containing fluids during the hours leading up to competition.

In hot weather, it is recommended that approximately 500 ml be ingested during the 60-90 minute period before the start of the game. This will allow sufficient time for urination of excess fluid before the game begins. In training or competitions that cause heavy sweating without sufficient opportunity for fluid intake, players often benefit by drinking 300-600 ml of fluid during the 15-minute period immediately before the start of the event.

These volumes should be scaled down for female and youth players with a smaller body size.

Five different examples of foods that each provide 140 g carbohydrate in a pre-competition meal* (2 g/kg for a 70 kg player) are

2.5 cups breakfast cereal + milk + large banana

Large bread roll or 3 thick slices bread + thick spread honey

2 cups boiled rice + 2 slices bread

4 stack pancakes + 0.5 cups syrup

60 g sports bar + 500 ml liquid meal supplement or fruit smoothie

(* Note that other foods may be eaten at the meal.)



Hydration strategies

No other dietary strategies enjoy the reputation of proven performance enhancers as do the consumption of water and carbohydrate during exercise. Players can turn this science into optimum performance and well-being by learning the practical aspects of: a) how much, b) what type of foods and drinks, c) when during exercise, and d) what modifications should be made in hot or cold environments. Just as general training and competition strategies should be tailored for individual athletes in accordance with their unique needs and preferences, so should their drinking and eating choices during exercise. Players, coaches and trainers should “fine-tune” these recommendations to identify their own winning formula.

How much and when to drink?

Limit dehydration during training and matches by drinking water or a sports drink. Obvious opportunities to drink during a match include warm-up and at half time. During training, the coach or manager should organise drink breaks according to the weather and intensity of exercise.

Get a feel for sweat rates during exercise so that drink practices can be adjusted accordingly (see box). It is not necessary to drink enough to prevent loss of body weight, but the amount of dehydration should normally be limited to a loss of less than 2% of body weight (i.e., 1 kg for 50 kg person, 1.5 kg for a 75 kg person, and 2 kg for a 100 kg person).

Since the negative effects of dehydration on high-intensity performance are greater in warm environments, upgrade drinking practices in these conditions to minimise the overall fluid deficit. This may include drinking at the side-line when match play is interrupted, or having extra drink breaks during training sessions.

Don't drink at rates that are greater than sweat losses so that you actually gain weight during exercise.



When do you need more than water?

Depletion of fuel stores can be an issue for soccer matches, especially for players in mobile positions or with a running game style. High carbohydrate strategies – fuelling up for the game and consuming extra carbohydrate during the match – have been shown to enhance performance in such players.

Better match intake of fluid and fuel may not only keep players running further and faster in the second half of a match, but may help to maintain skills and judgement when players would otherwise become fatigued. Games are often won and lost in the last minutes of the match, and fatigued players are at increased risk of injury.

The use of commercial sports drinks with a carbohydrate content of about 4-8% (4-8 g/100 ml) allows carbohydrate and fluid needs to be met simultaneously in most events. The intake of carbohydrate that is generally associated with performance benefits is ~ 20-60 g per hour.

Sodium should be included in fluids consumed during exercise lasting longer than 1-2 hours or by individuals during any event that stimulates heavy sodium loss (i.e., more than 3-4 grams of sodium).

Caffeine is present in many commonly available beverages and foods, and can enhance endurance during prolonged exercise. This benefit can be obtained with the relatively small doses of caffeine that are commonly consumed by people of various cultures (e.g. about 1.5 mg/kg bodyweight as found in a small cup of brewed coffee or 500-750 ml of a cola beverage).

How to estimate sweating rate

Measure body weight (kg) both before and after at least one hour of exercise under conditions similar to competition or a hard practice.

Measure body weight wearing minimal clothing and while bare footed. Dry with a towel after exercise and obtain body weight as soon as is practical after exercise (i.e. less than 10 min).

Note volume of fluid consumed during exercise (litres)

Sweat loss (litres) = body weight before exercise (kg) – body weight after exercise (kg) + fluid consumed during exercise (litre)

To convert to a sweat rate per hour, divide by the exercise time in minutes and multiply by 60

(Note: 2.2 pounds equals 1 kg and converts to a volume of 1 litre or 1,000 ml or 34 ounces of water.)

Rehydration after exercise

Recovery after exercise is part of the preparation for the next exercise session, and replacement of sweat losses is an essential part of this process. Both water and salts lost in sweat must be replaced. Aim to drink about 1.2-1.5 litres of fluid for each kg of weight lost in training or matches. Drinks should contain sodium (the main salt lost in sweat) if no food is eaten at this time. Sports drinks that contain electrolytes are helpful, but many foods can also supply the salt that is needed. A little extra salt may be added to meals when sweat losses are high, but salt tablets should be used with caution.

Just like new boots, do not try out new plans for fluid and fuel intake during important competitions. Do it in practice and find out what fits you best.



Supplements and sports foods

The use of dietary supplements is widespread in football, but players should not expect benefits from most of these supplements.

Players look to nutritional supplements for many benefits, including:

- promoting adaptations to training
- increasing energy supply
- allowing more consistent and intensive training by promoting recovery between training sessions
- maintaining good health and reducing interruptions to training due to chronic fatigue, illness or injury
- enhancing competitive performance.

Few of the products used by athletes are supported by a sound research base and some may even be harmful to the player. All players should look carefully at the risks and rewards of individual supplements before trying them.

Where there is a demonstrated deficiency of an essential vitamin or mineral, and an increased intake from food is not possible, a supplement may be helpful. The use of supplements, however, does not compensate for poor food choices and an inadequate diet. Many players ignore the need for caution in supplement use, and take supplements in doses that are not necessary, and may even be harmful.

Protein powders and supplements

Protein supplements, high protein bars and amino acid preparations are among the biggest selling sports nutrition products. Although an adequate intake of protein is essential for muscle growth and repair, this can easily be achieved from everyday foods and extra protein is seldom required.

Protein-carbohydrate supplements may have a role as part of a post-exercise recovery plan, but the whole proteins that are found in foods generally have advantages over individual amino acids.

Fat reduction and muscle building

A huge array of supplements is on sale with claims that they can reduce body fat levels and build bigger and stronger muscles – claims that appeal to athletes and non-athletes alike.

The reality is that many of the products that are effective in doing this are either on the banned list or are associated with serious health risks (or both).

Compounds in the muscle building category include chromium, boron, hydroxymethylbutyrate, colostrum and others. Based on current research, none of these has anything worthwhile to offer the player.

Increasing energy supply

Supplements in this category include carnitine, pyruvate and ribose as well as some more exotic herbal preparations. None of these is likely to improve performance and, in spite of advertising claims, none is supported by good independent evidence.

Nutrition and the immune system

There is some evidence that players who are training hard may be at increased risk of minor illnesses and infections. These are generally trivial, but they can interrupt training or cause a player to miss important competitions. Hard training may compromise the body's immune system, and high levels of stress hormones reduce its ability to fight these infections.

Many nutrition supplements, including glutamine, zinc, Echinacea, colostrum and others, are on sale with claims that they can boost the immune system, but there is no strong evidence that any of these is effective. The best evidence supports the use of a high carbohydrate diet, which lowers stress hormone levels, and appropriate rest periods.

Supplements for bone and joint health

Hard training puts extra wear and tear on the bones, joints and associated structures, and numerous supplements are claimed to look after these tissues. Healthy bones need a good supply of calcium and Vitamin D. In most cases these nutrients can be supplied by the diet. Players who suffer from problems related to sub-optimum bone density should seek professional advice and supervised treatment from a sports physician.

Glucosamine, chondroitin, methylsulphonylmethane (MSM) and other products are promoted for joint health. Long-term (2-6 months) glucosamine treatment may provide subjective relief in elderly individuals suffering from osteoarthritis, but there is little or no evidence of benefit for otherwise healthy players.

Supplements that might work

Some supplements do offer the prospect of improved performance: these include creatine, caffeine, bicarbonate, and perhaps a very few others.

Creatine. Creatine supplements can increase the amount of high energy creatine phosphate stored in the muscles, and may improve performance in single or multiple sprints. It may also lead to a gain in muscle mass, which is helpful for some players but harmful for others. As with all supplements, exceeding the maximum effective dose is not helpful. Creatine is normally found in meat and fish, but the doses used in supplementation protocols (10-20 g per day for 4-5 days to load, and 2-3 g per day for maintenance) are more than is found in normal foods. Creatine supplementation appears not to be harmful to health.

Caffeine. A small amount of caffeine (1-3 mg/kg) can help performance in prolonged exercise and may also be helpful in exercise of shorter duration. Such moderate doses can be found in everyday amounts of coffee, cola drinks and some sports products (e.g. gels). For example, 100 mg of caffeine is supplied by a small cup of brewed

coffee or 750 ml of a cola drink. Larger doses of caffeine do not seem to be more effective, and may have negative outcomes such as over-arousal and poor sleep patterns after an event.

Bicarbonate. In very hard exercise, the muscles produce lactic acid. This is both good (giving energy to allow hard efforts) and bad (causing pain and interfering with muscle function). In the same way that excess stomach acidity can be neutralised by taking bicarbonate, so sodium bicarbonate (in a dose of about 0.3 g per kg body weight) before an event can counter the negative effects of lactic acid. Bicarbonate supplements are widely used by athletes in events that cause fatigue within a few minutes, and there is now evidence of possible benefits from studies designed to simulate the activity patterns of football players. There is a real risk of gastrointestinal problems and players should experiment in training.

A number of sports foods have been developed to supply a specific formulation of energy and nutrients in a form that is easy to consume. These can be valuable in allowing players to meet their special nutrition needs when everyday foods are unavailable or impractical to eat. This is most often the case just prior to, during, or after an exercise session. Examples of useful sports foods include:

- sports drinks (providing fluid and carbohydrate during exercise)
- sports gels (additional carbohydrate intake, especially during exercise)
- liquid meals (carbohydrate, protein, vitamins and minerals for a pre-event meal, post-exercise recovery or a high-energy diet)
- sports bars (carbohydrate, protein, vitamins and minerals – often a solid form of the liquid meal)

Of course, the cost of these sports foods must be taken into account when deciding to use them.

Supplements and doping issues

Players who are liable for drug testing under national or international programmes should be especially cautious about supplement use.

Some supplements are prepared in unhygienic conditions and contain toxins that may cause gastrointestinal problems. Others do not contain ingredients – especially the expensive ones – that are listed on the label. Contamination of dietary supplements with substances that may cause a player to fail a doping test is widespread – some surveys have suggested that as many as one in four supplements may result in a positive test. These prohibited compounds have not been declared on the label, so there is no way for the player to know that they are present.

At present, there is no guarantee of the purity of any commercial supplement. The only way to be sure is to avoid supplements altogether, but many players are unwilling to accept this advice. The sensible player will want to see very good reasons for using a supplement and a very low risk of an adverse test before deciding to use it.

There is no evidence that prohormones such as androstenedione and norandrostenedione are effective in enhancing muscle mass or strength. These prohormones are promoted for use by players and are readily available in shops and via the internet, but they will result in negative health consequences as well as positive drug tests.

Many herbal supplements are claimed to increase testosterone levels and hence have an anabolic action: such supplements include Tribulus Terrestris, Chrysin, Indole-3-Carbinol, Saw Palmetto, Gamma-oryzanol, Smilax and Mummio. These claims are based on experiments carried out in test tubes, and none has been shown to work in humans. All players are cautioned against the use of these supplements.

Players must be aware of the strict liability principle that makes them responsible for everything they eat and drink.

Ignorance is not an acceptable excuse for a positive doping result.

Check all supplements with a medical officer. If there is any doubt at all, do not take it.



Alcohol

The use of alcohol is often intimately associated with sport, and the association is particularly strong in football. As well as providing a source of energy, alcohol (ethanol) has metabolic, cardiovascular, thermoregulatory and neuromuscular actions that may affect exercise performance.

Sensible drinking guidelines for the community

Alcohol intake may be measured in grams or ml of ethanol, or in units of alcohol: each unit of alcohol in the UK contains approximately 8 grams (10 ml) of ethanol. The UK Department of Health recommends that adult men should not consume more than 3-4 units of alcohol per day and women should not consume more than 2-3 units daily. In the US, however, a standard drink delivers about 12-14 grams of alcohol, and the US Department of Agriculture recommends that men should not drink more than 1-2 drinks per day and that women should not exceed 1 drink per day.

Although these recommendations provide a guide to the everyday use of alcohol, the problems associated with alcohol in football generally arise from “binge” drinking on specific occasions – especially in the post-match period. This type of drinking has implications for the players’ recovery, their well-being and their reputation.

Alcohol metabolism

Alcohol is metabolised primarily in the liver, and the rate of metabolism varies greatly between individuals. Alcohol can be oxidised at a rate of about 100 mg/kg body mass per hour – equivalent to – one serve or unit of alcohol per hour for most people. Despite old wives’ tales, the clearance of alcohol from the system cannot be enhanced by having showers, drinking coffee or other practices believed to help an intoxicated person “sober up”.

The actions of alcohol on the central nervous system result in decrements in skill and behavioural changes that may have adverse effects on performance. There is also evidence of dose-dependent decrements in aerobic capacity. Although the mechanisms are not well understood, the aftermath of alcohol use (hangover) may also adversely affect performance for many hours after intoxication.

The most important problem associated with the excessive consumption of alcohol after exercise is that it may distract the player from making good choices. Alcohol intoxication may make the player forget about following sound recovery practices such as appropriate treatment for injuries, adequate sleep or optimal eating and drinking. Alcohol may displace carbohydrate from the diet at a time when restoration of glycogen stores should be a priority. The need for other important nutrients may be neglected while the player is consuming large amounts of alcohol, or sleeping off the hangover next day. An intoxicated athlete often succumbs to high-risk activities leading to accidents, violence or other anti-social behaviour. Negative outcomes range from the tarnishing of a reputation to serious (often fatal) injury.

Alcohol is not an essential component of a diet. It is a personal choice whether an adult player consumes alcohol at all. However, there is no evidence of impairments to health and performance when alcohol is used sensibly. Alcohol is a high-energy (and nutrient-poor) food and should be restricted when the player is attempting to reduce body fat.

The player should avoid a heavy intake of alcohol on the night before a match. It appears unlikely that the intake of 1-2 standard drinks will have negative effects in most people. Before consuming any alcohol after a match, the player should consume a meal or snack to replace carbohydrate, fluid and perhaps protein. This snack or meal will start the recovery process. Food intake will also help to reduce the rate of alcohol absorption and thus reduce the rate of intoxication.

Once post-exercise recovery priorities have been addressed, the player who chooses to drink is encouraged to do so “in moderation”. Drink-driving education messages in various countries may provide a guide to sensible and well-paced drinking.

The player who drinks heavily after a match, or at other times, should avoid driving and other hazardous activities.

Examples of one unit (~10g) alcohol

- 250 ml standard beer (4% alcohol)
- 500 ml standard low alcohol beer (2% alcohol)
- 250 ml wine coolers or alcoholic soft drinks
- 100 ml wine or champagne
- 60 ml fortified wines, port
- 25 ml (one nip) spirits

Special needs of the elite player

There are no easy games for the elite player whose season includes pre-season tours, domestic league and Cup games and international competitions. Each game is played at high pace, with corresponding physical demands. The elite player's club will usually provide support and advice, but most meals will be taken away from the club, so players must take some responsibility for meeting their nutrition needs.

Training issues

A demanding endurance training programme usually involves daily or twice daily workouts. Inadequate refuelling leads to fatigue, ineffective training, and a risk of injury. Traditionally, many team players have focussed on fuelling up only on the day before a match or in the pre-event meal. However, the daily demands of training are best met by a permanent, daily approach to adequate fuel intake.



Competition issues

Competition can be played in weekly league games, or as a tournament with games every day for several days. Recovery must be adjusted according to the schedule. The elite, professional player has competitive demands beyond scheduled domestic league matches including Cup competitions, national team duty in friendly matches or qualifying matches for a variety of international competitions.

Fatigue is largely related to declining glycogen levels as the game progresses. Carbohydrate intake during a match can be effective at delaying fatigue, and although the nature of the game makes it difficult to ingest carbohydrate during a match, it is not impossible. The most difficult players to reach are the central midfielders as they are the most distant from the sides/ends of the field.

Special issues and eating strategies

Many team sports have a large contingent of young players who are "fresh from home". It is a good team strategy to organise cooking and shopping classes for young players to help them develop the domestic skills and nutrition knowledge that will allow them to reach their full potential as players. Players looking after themselves for the first time can find it hard to juggle the team commitments, as well as work/school. Many recipe books developed for athletes offer quick and nutritious meal ideas suited to the special needs of sport.

The pre-event meal is a good opportunity for a shared meal, ensuring final nutritional preparation as well as an opportunity to boost morale and share final tactics. Ideas for the pre-event meal are found in the box below, and are best provided as a buffet, to allow each team member to meet his/her individual needs and preferences.

An individual approach to fluid and fuel needs during matches is also useful. Undertaking fluid balance monitoring sessions during training or practice matches may help players to adjust their drinking practices to better meet their individual needs. The current rules of football place some limitations on the intake of fluid or sports foods during matches. Players may need to use creative ideas to meet their refuelling and rehydration goals.



Post-match or post-training recovery is another good opportunity for team nutrition. Many professional football clubs have invested in an organised dining room or cafeteria to offer meals or snacks to players after training. This not only provides players with immediate access to the nutrients to promote recovery, but provides an educational message of the importance of nutrition in recovery. The provision of post-match snacks and light meals providing nutritious forms of carbohydrate and protein, as well as fluid options, will help players to recover effectively while celebrating or commiserating the results of the match. Alcohol is often a large part of post-game activities but should be discouraged, unless in moderation and after recovery eating goals are achieved.

Ideas for high carbohydrate pre-event meals*

Breakfast menus

Breakfast cereal and milk, fresh or canned fruit
Toast and jam/honey
Pancakes and syrup
Fruit-flavoured yoghurt
Baked beans or tinned spaghetti on toast
Liquid meal supplement or fruit smoothie
Fruit juice or sports drink

Lunch and dinner menus

Rice dishes – risotto, fried rice, paella
Pasta and light sauce
Bread, including rolls and sandwiches
Fruit and fruit based desserts
Rice pudding

(* A low-fat or low-fibre menu may help to reduce the risk of gastrointestinal problems in susceptible athletes.)

Snacks for recovery after training or matches

Each choice provides ~ 50 g carbohydrate and a valuable source of protein and other nutrients
250-350 ml fruit smoothie or liquid meal
60 g (1-2 cups) breakfast cereal + milk + 1 fruit
200 g carton of yoghurt + cereal/breakfast bar
1 round of meat/cheese and salad sandwiches or roll + 250 ml fruit juice
150 g thick crust pizza – lean meat and vegetable toppings and little cheese
60 g sports bar + 250 ml sports drink

Special needs of the semi-professional player

The ambition of most young semi-professional players is to become a full-time player. Most teams at this level will include a mixture of older players who have played at a higher level with younger players wanting to move up. This combination of youthful ambition and experience gives these teams a unique set of opportunities and challenges.

Within the team, there may be very different approaches to training, depending on the demands of other employment and on individual perceptions of the need for training to maintain fitness. Experienced players with proven skills may not be able – or may not feel it necessary – to train as hard as the younger players. Any nutrition strategy developed for the team must take account of these individual differences as well as the individual food preferences of the different players.

Training issues

Semi-professional players typically must balance two competing demands, that of their work/career and that of the football team. Schedules need to be flexible so that the player can competently handle both responsibilities. Each will have their own daily demands, travel schedules, and time requirements that may, at times, conflict with each other.

The demands of training (intensity, duration, frequency) are likely to be less than that of full-time professionals. Training times are most commonly after the work day meaning the player has had a full day of some other activity prior to training. The time demands of two jobs means limited opportunity for adequate nutrition.

Competition issues

Semi-professional teams vary a great deal in the level of support available to their players. Some clubs might offer a high level of support while others offer little. Each player needs to take responsibility for his or her own food choices to ensure they are as prepared as possible for competition.

A semi-professional club usually has a fixed schedule of matches, most commonly one match per week. The number of Cup matches is likely to be fewer than for professionals. It is not unusual for these players to have a match on some midweek evenings after their regular daily activities.



The match is played at a lower absolute speed and the amount of work is less due to lower levels of fitness, reduced training demands and other reasons. Yet players are still very committed about their play and should do everything possible to ensure they can play at the levels they desire.

Strategies to help with planning meals for the week

Plan the weekly menu around matches and training sessions. Note the days that the meal plan must be altered to suit this schedule.

Use days with light or no football commitments to get on top of the nutrition plan. Do the shopping, and cook meals ahead of need. Refrigerate or freeze one-portion servings of meals for a pre-game meal at work, or a quick meal after training or matches.

If you live in a shared household, work as a team to share these tasks.

If you are struggling, consider seeking advice from an expert in nutrition or time management.

Special issues and eating strategies

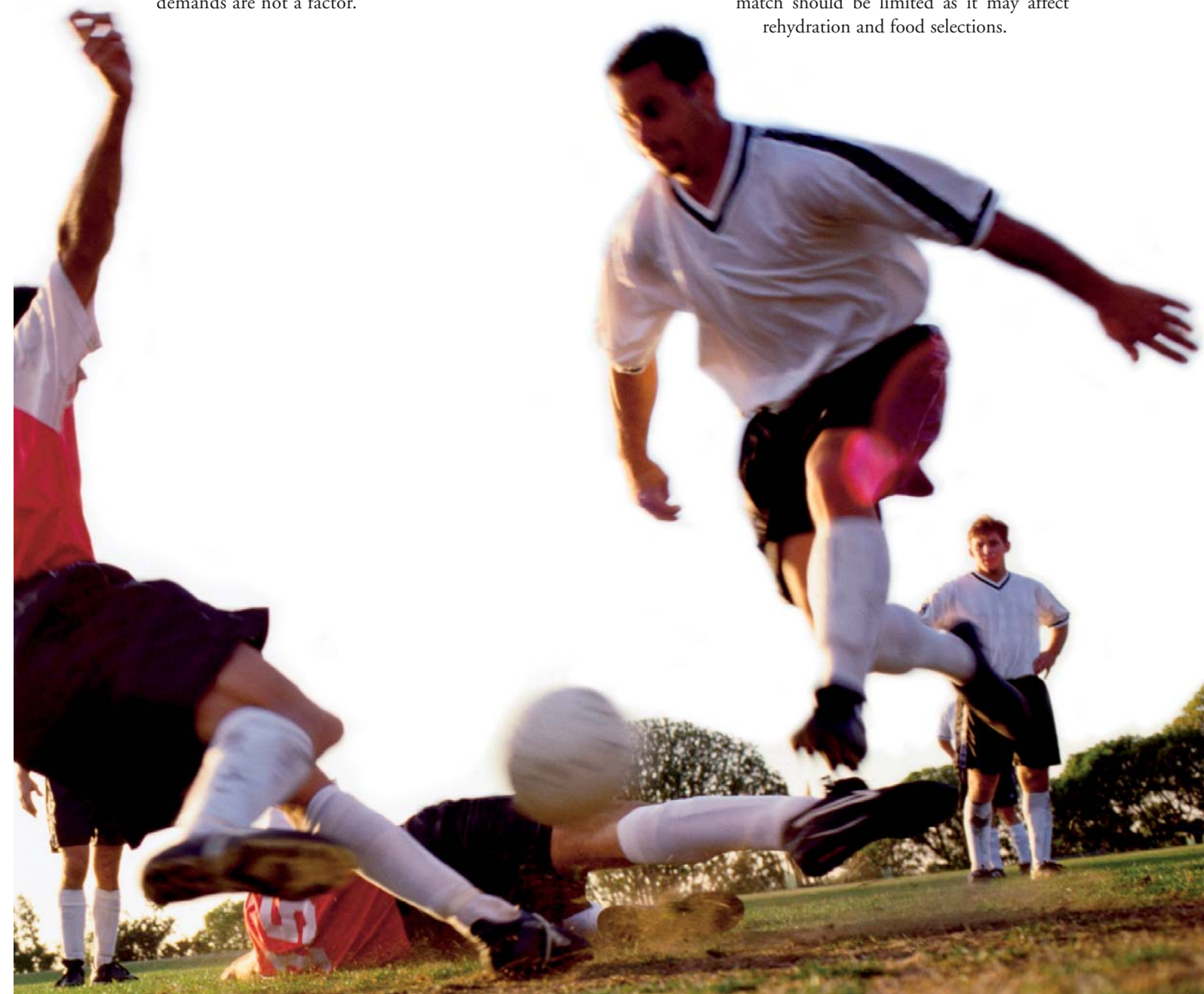
Semi-professional players are unlikely to have the dietary support that a professional will receive and will have to make all their own purchasing, preparation, selection, and timing decisions. This is further complicated by

trying to balance dietary demands with the challenges of work/training/matches. These players frequently must seek out the information necessary to educate themselves about the details of sports nutrition. The semi professional player can follow the suggested food choices for the professionals (page 27).

The pre-match meal for a midweek game would need to be eaten during their work day and the timing may not always coincide with the normal midday meal. A weekend match could follow the timing and selection guidelines for the professional, assuming that job demands are not a factor.

Players still have a fluid requirement and should follow the guidelines for the professional regarding timing, type, and volume of replenishment. All players should strive to minimise fluid losses to 2% body weight.

The scheduling of matches and training at this level is probably not as dense as the professional, meaning the player has more time to refill the muscles of depleted glycogen. Muscle is most receptive for glycogen refuelling immediately after exercise and the player should still strive to eat some carbohydrates after a match following choices outlined for professionals. Alcohol after the match should be limited as it may affect rehydration and food selections.



Special needs of the amateur player

The vast majority of football players worldwide are amateurs who play for the enjoyment of the game. Their commitment may be purely recreational or they may play in an attempt to improve their game to move up in their level of play. The age range extends from the very young up to older adults who continue as veterans to play for the love of the game.

These players often play in organised teams that have no organised support other than setting up a team and alerting team mates of the schedule. More serious teams may have sponsors and some measure of external support.

Training issues

There is a wide range of training schedules for amateur teams. Some teams may only gather for matches while others may train between one or more days each week. These sessions are commonly in the afternoon (youth) or evening (adults). While there might be some emphasis on fitness, most practices focus on tactics and technique.

The intensity and volume of training will be well below that of players at higher, more competitive levels. Attendance at training can be quite variable.

Competition issues

The number of matches per week, month, or year is likely to be variable. The amateur adult will likely compete once per week, but could play multiple, usually shorter, games in a weekend at a tournament. Youth teams usually have one match per week, but long travel might mean two or more games on any one trip to save travel time and money. Youth players may play in multiple teams and accumulate a substantial number of matches in a year. There are reports of young players playing 100 or more matches a year.

Matches will be played at a slower pace than in professional games, leading to reduced volume of running. These games, however, are still important to the players and teams, meaning that these players can still benefit from practising sound principles of sports nutrition.

Special issues and eating strategies

The vast majority of research into football focuses on professionals. The mixture of carbohydrates, fats and proteins is the same regardless of the level of play. What is different is the volume of food eaten. The amateur who tries to eat the same volume of food as a professional would probably gain weight. Amateur players can choose foods from the suggestions for professional players, but they may not need to eat the same volume of food.



Amateur leagues sometimes modify the Laws of football for their own circumstances. Primary changes usually involve unlimited substitutions and match duration. This means some players will not play the entire match and will probably not experience the level of glycogen depletion seen after highly competitive matches. Thus, there is probably no need to eat the amount of carbohydrate required by the glycogen-depleted player. This does not mean the player can ignore sound dietary principles.

At amateur matches, each player is probably responsible for his or her own hydration because amateurs lack the support a more organised programme might have. All players need to prepare for training and matches by bringing their individual fluids and bottles. Sound hygiene suggests that each player should have his or her own bottle and not share with team mates.

The amount of football training and supplemental training is well below that of professional teams. The amateur needs to carefully monitor weight and food intake to minimise changes in weight. The older amateur who has played at a very high level might remember their diet as a professional and eat far more than needed, leading to increased body fat and weight gain.

An amateur's competitive season is not as lengthy as that of a professional. During the off-season, the amateur needs to reduce food intake during this period of reduced energy expenditure because there is little or no training.

Some amateur players are motivated to play football by the social element of team sport. However, this can be expressed in the form of heavy drinking after matches or training sessions. Whatever the level of play, abuse of alcohol impairs performance and health, and can cause social problems. The information about alcohol on page 25 provides a guide to sensible use of alcohol in sport.



Special needs of the female player

Training and competition issues

The women's game is now more popular than ever, and it is estimated that more women than men will be playing the game by the year 2010. Estimates of work rate and energy demand suggest that women generally cover less distance in training and match play than men, but the relative exercise intensity over the course of a game is about the same, at 70% of maximum oxygen uptake. Typical energy expenditure during a match is about 1,100 kcal for a 60 kg football player.

There have been few studies of the eating habits of female players, but the information we do have suggests that their dietary habits and nutrition concerns are not so different from those of other female athletes.

General health issues

Players should eat sufficient food to achieve an energy intake that:

- provides sufficient energy for training and competition needs
 - the energy demands of other daily activities
 - allows the player to achieve a body size and composition that meets her health and fitness goals

Some players do not achieve this, and restrict food intake to achieve their desired weight at the expense of both health and performance.

Losing body fat

There is enormous pressure on many women to achieve an unrealistic body weight and body fat level. This can compromise both short-term playing performance and long-term health, with the real possibility to harm to reproductive health and bone health. Any player with menstrual irregularities should treat these as a possible warning sign, and seek professional advice.

If there is a need to reduce body fat, this should be done sensibly. Reducing body fat requires a negative energy balance – energy expenditure should be greater than energy intake – and a negative body fat balance. It is a mistake to reduce energy intake – especially protein and carbohydrate intake – too far. This increases fatigue in training and daily life, reducing energy levels and thus limiting weight loss.



Strategies for reducing body fat

- Set realistic targets: this is a medium-term goal rather than something to be achieved by next week.
- Limit portion sizes at meals rather than skip meals altogether.
- Use well-chosen snacks between meals to maintain fuel levels for training sessions. Save part of a meal for a later snack, rather than eat extra food.
- Maintain carbohydrate intake to maintain fuel levels for exercise.
- Use low-fat strategies in choosing foods and while cooking or preparing meals.
- Limit alcohol intake or cut it out altogether – it is not an essential part of the diet.
- Make meals and snacks more “filling” by including plenty of salads and vegetables, by taking the higher-fibre option, and by including low glycaemic forms of carbohydrate-rich foods.

Calcium

Calcium is important for healthy bones. In some countries, many everyday foods are fortified with calcium (e.g. fruit juice). However, the best sources of calcium are dairy foods, with low fat varieties providing a great way to meet calcium needs within a smaller energy budget.

Each player should aim to include at least 3 servings of dairy foods in their daily eating plans – e.g. 200 ml of low fat milk, 30 g cheese or a 200 ml carton of low fat yoghurt.

Calcium-fortified soy versions of dairy foods are also suitable – e.g. soy milk, soy yoghurt.

An additional one-two daily servings are required during growth spurts in childhood and adolescence, and for pregnancy and when breast feeding.

Fish eaten with bones (e.g. tinned salmon, sardines) and leafy green vegetables (e.g. broccoli, spinach) provide a useful source of additional dietary calcium.

Iron

Iron deficiency is a cause of fatigue and reduced performance. Females are particularly at risk because of increased iron requirements due to menstrual blood losses matched against a smaller intake of food. Iron-rich eating will help to reduce this risk.

Iron-rich eating

Consume moderate servings of red meats (well-absorbed iron) in 3-5 meals per week.

Choose iron-fortified cereal products such as breakfast cereals.

Combine plant and non-meat sources of iron (e.g. legumes, cereals, eggs, green leafy vegetables) with food factors that enhance iron absorption. These include vitamin C and a factor found in meat/fish/chicken. Examples of clever matching include fruit juice or fruit with breakfast cereal, or chilli con carne (meat and beans).



Special needs of the young player

Football enjoys one of the highest participation rates for children and adolescents around the world, offering the benefits of aerobic fitness, skill development and a team environment without the risks of a contact sport. Girls and boys can start playing at an early age, often with modifications to rules, playing time and pitch sizes. Soccer continues as a popular sport from primary school through to university levels. Those with particular talent may be chosen for scholarships to junior development programmes for football. Others continue to play football for recreation, fitness or social contact.

Training issues

Depending on the age and calibre of the young player, “training” may range from the weekly match to structured squad sessions. The goals of training may range from simply having fun through to a progressive programme aimed at developing the skills and specific fitness and physique required to play soccer at high levels. Talented young players may be invited to train with another age group or with a senior squad, often in addition to their involvement with their primary team.

Competition issues

At junior levels, players may follow modified rules, which alter the duration of their play and the activity patterns of the game. Young players typically play in a weekly competition, over a short competition season. However, players who are being developed towards a potential career in elite or professional teams may play in a number of teams or competitions. This can lead to heavy physical demands on these young players, and parents, teachers and coaches should be aware of the risks of playing too many games.

Special issues and eating strategies

Parents are often roped in to become the coaches and trainers of under-age teams. They may accept these positions without an appreciation of the nutritional needs

of football or young people, and without any resources to implement a team programme. It is important that education resources are made available to these coaches so that they can guide young players into good habits.

Players should be encouraged to develop good nutritional habits at an early age. Adolescence is a time marked by an increased independence in food choice and food preparation. The promise of sporting success may provide strong motivation to develop good dietary practices. Information and the example of good role models may help a young person to develop sound eating practices in everyday (training) diets as well as the specific preparation for matches.

The physiology of children and adolescents differs from that of adults in several ways. The mechanisms of thermoregulation are less efficient in children, and special attention must be paid to the environment, activity patterns, clothing and hydration to avoid problems of hyperthermia or hypothermia.

Strategies for high energy eating

It is usually more efficient to increase the number of times that food is eaten each day – for example, a series of 5-9 meals and snacks – than trying simply to increase the size of meals.

Drinks such as fruit smoothies, liquid meal supplements and fortified milk shakes and juices can provide a substantial source of energy and nutrients that are quick and compact to consume, and less likely to cause gastrointestinal discomfort than bulky foods.

Sugary foods and specialised sports products (drinks, bars) can provide a compact form of carbohydrate and other nutrients, which is particularly useful when energy needs are high.

A food record can identify the times in a busy day that are not being well used for fuelling up. The player should use creative ideas and good planning to arrange a supply of portable snacks and drinks that can travel with them over their day.

Adaptation to a resistance training programme may be enhanced by consuming “recovery” snacks providing protein and carbohydrate before and after each workout.

The growth spurts during childhood and adolescents require nutritional support in terms of adequate intake of energy, protein and minerals. Active young people may find it difficult to meet their needs for energy and nutrients when the costs of training and growth are added. Young people may not have developed the nutritional knowledge and time management skills to fit in all the eating occasions required to achieve high-energy, nutrient-rich eating.

The rate of obesity in children is still rising, but active youngsters do need to eat lots of food.

Many young players are eager to increase the rate of their growth and muscular development in pursuit of the physique of an adult player. While growth and maturation are genetically determined, high-energy eating plans can assist the athlete to maximise the outcomes of growth and specialised training programmes.

Young players eating a wide range of foods should not need to use dietary supplements, and players should be aware that these do not provide a short cut to success.

Food combinations supplying carbohydrate and proteingy eating

- Breakfast cereal and milk
- Sandwiches with meats, cheese or egg fillings
- Meat/fish/chicken stir-fries served with rice or noodles
- Fruit smoothies or liquid meal supplements
- Fruit and yoghurt
- Dried fruit and nut mixes



Special needs of the referees

The referee is frequently the forgotten participant in the match. Much is written about training and nutrition for the player, but the referee must also keep up with the game and needs similar guidance to minimise fatigue. The players may have someone watching out for them during training and competition while referees are often left to themselves to prepare for the demands of a match.

There have been several studies of the volume and intensity of running by the referee during a match. Recent data show that the referee runs about as far as the players, but in a different pattern of movement. For example, the referee covers more distance going backwards than do players.

Without an appropriate training programme and good nutritional preparation, the referee may become fatigued and may not be able to exert proper control over a match. In particular, the referees should tailor their intake prior to and during a match to the demands of the game. Obviously, the referee's assistant does not have the physical demands of the referee, but each assistant needs to be prepared to carry the whistle if necessary.

It is interesting to note that there is little in the referee's training and education regarding adequate fitness preparation or nutrition for performance. Another factor that is often neglected is that the referee is often older than the players in the match.



Training issues

A team generally trains as a group under the guidance of a coach or trainer. The referee usually trains alone. The level of play that the referee is responsible for dictates the volume and intensity of training needed. International referees and referees of high-level professional matches, have fitness standards that must be met in order to maintain their status and good nutrition will help them to achieve this.

There are published programmes that a referee can follow that will adequately prepare for match competition. Referees of lower level matches will not likely need to train to that level and for many, refereeing multiple matches each week may be sufficient training stimulus for their level of competition.

Competition issues

Referees run a similar distance to that of the players they are watching. Thus, they should follow similar guidelines for daily nutrition, food choices for training, pre-match nutrition, and hydration. Essentially, the referees should follow the nutritional guidelines for the level of play they are officiating.

Special issues and eating strategies

A particular issue surrounds fluids during competition. The players may have support on the sidelines, helping them to hydrate when possible during a match. The referee has no such support. The referee is also usually in the middle of the field, far from the sidelines and access to drinks. At higher levels of play, the 4th official might be able to assist the referee during normal play stoppages. The referee's assistants are already on the sidelines and can place fluids along their running path. In lower levels of play, referees must take care of their own fluid needs. As normal stoppages of play frequently involve the referee, those opportunities may be few. One

suggestion for the referee would be to wear a 'camelback' device worn by cyclists and carry only enough fluids for one half, refilling between halves or before overtime.

Fluid and nutrition suggestions for the referee

Follow the pre-match meal suggestions for the players.

Plan ahead for easy and quick access to fluids during matches. Water, sports drinks and carbohydrate replacement solutions are viable drink options.

At half-time, drink a sports drink to provide water to minimise dehydration and some carbohydrate to delay fatigue. You can eat solid food if you find that you can tolerate this.

After the match, follow the player suggestions for early replenishment of glycogen, especially when games are close together.

During periods of heavy and frequent travel, consider suggestions for eating on the road.



Special needs when playing on the road

Most serious players are well-seasoned travellers, and will spend much time travelling and living far away from home. These trips are often short, but may involve longer spells of travel for tournaments or pre-season tours. Competition is usually organised in a national or regional league that requires weekly or bi-weekly travel to matches. Frequent travel over long distances can pose a number of challenges:

- Disruptions to the normal training routine and lifestyle while the player is en route
- Changes in climate and environment that create different nutritional needs
- Jet lag after crossing multiple time zones
- Changes to food availability including absence of important and familiar foods
- Reliance on hotels, restaurants and takeaways instead of home cooking
- Exposure to new foods and eating cultures
- Temptations of an “all you can eat” buffet-style dining hall
- Risk of gastrointestinal illnesses due to exposure to food and water with poor hygiene standards
- Excitement and distraction of a new environment



Some keys points for eating well while travelling include:

Planning ahead

Investigate food patterns and availability at your destination before leaving home. This may help in plan-ning useful food supplies to take on trips that can replace missing and important items.

Contact the catering organisers at the destination to let them know of special needs for meal timing and menus. Make an eating plan for travel that incorporates the best of the available food supplies (e.g. airline catering, restaurants en route) as well as self-supplied snacks.

Eat and drink well while on the move

Recognise that enforced rest while travelling will reduce energy needs, but create more opportunities for high-energy intake if the player succumbs to “boredom eating”. Be aware of eating only when there is a real need.

When moving to a new time zone, adopt eating patterns that suit your destination as soon as the trip starts. This will help to adapt your body clock. Be aware of unseen fluid losses in air conditioned vehicles and pressurised plane cabins. Have a drink plan that helps maintain hydration.

Be wary of food and water hygiene

Find out whether it is safe to drink the local water supply. If risky, stick to sealed bottles of water and other drinks or hot drinks. Be wary of ice added to drinks – it is often made from tap water.

In high-risk environments, stick to food produced in good hotels or well-known restaurants. Avoid eating food from local stalls and markets, however tempting it is to have an “authentic cultural experience”.

Stick to food that has been cooked well, and avoid salads or unpeeled fruit that has been in contact with local water or soil.

Choose well from local cuisine and supplement with non-perishable food supplies brought from home

Ideas for portable supplies for the travelling player

- Breakfast cereal and powdered milk
- Cereal and breakfast bars
- Rice cakes
- Spreads – honey, jam, peanut butter
- Powdered sports drinks and liquid meal supplements
- Sports bars
- Dried fruit and nuts

Use clever tactics in restaurants, “all you can eat” dining halls, and when choosing takeaways

Stick to an eating plan based on what is normally eaten at home or what meets new nutritional needs rather than be mesmerised by all the food available.

Be assertive in asking for foods to be prepared to individual needs – for example, with low-fat cooking methods, or with an added carbohydrate serving.

Avoid hanging around in restaurants or dining halls for entertainment – it can often lead to unplanned and unnecessary eating.

Remember that normal eating patterns probably involve well-timed and well-chosen snacks. If new catering arrangements provide only for main meals, ensure that the menu at meals includes some items that can be taken away for snack needs.



References for further reading

NUTRITION FOR FOOTBALL is based on information discussed at the FIFA/F-Marc International Consensus Conference on Nutrition for Football, held at FIFA House in Zurich in September 2005. The papers presented at that meeting will be published as a special issue of the Journal of Sports Sciences in 2006.

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