

# Module 4. Sports nutrition for women's football

## Unit 4.1 Women's football

Interest in women's football has grown and continues to grow significantly. The financial investment from the Union of European Football Associations (UEFA) has tripled and participation has increased by a third over the last decade (Manson et al., 2014). Globally, the Fédération Internationale de Football Association (FIFA) has committed to increasing the number of women players from approximately 13 million (2019) to 60 million by the year 2026.

The physical demands of elite women's football are well documented. With respect to the volume of training and matches, as well as mental demands that players experience, sports nutrition is of central importance to maintaining and optimizing performance (Randell et al., 2021). The objective for the sports nutritionist is to ensure players' dietary intake is well balanced and meets the recommended macro- and micronutrient intakes (Course Macronutrients and Fluid for Football and current course). In addition, the diet should contain those foods to cover the energy demands of training and match-play (Moss et al., 2021). Maintaining energy balance is important as our research has shown that some elite players experience times of energy deficit during the season (Moss et al., 2021). If this negative energy balance persists it can lead to low energy availability and negatively impact a players' health and performance (Ackerman et al., 2019).

The purpose of this unit is to understand the sports nutrition requirements for women's football. Female players should not be considered a "special" population. Instead, the sports nutritionist should simply be aware of the specific nutrition requirements these players require. A brief history and introduction to women's football will be provided before discussing potential nutritional challenges and solutions.

### 4.1.1 Brief history of women's football

Women's football can be traced back to the early eighteenth century in Scotland, where football matches were played annually as a ritual between married and single women (Williamson, 1991). During World War I, women's football became popular in England when games were organised by factory workers to raise money for charity. In 1920, it was reported that a match was played in front of 53 000 spectators (Newsham, 1997). However, by the next year (1921), the English Football Association ruled that clubs had to gain permission to organise women's matches and subsequently prevented women from playing altogether. The English FA declared football "quite unsuitable for females and



should not be encouraged” (Williamson, 1991). Due to British influence, this injustice spread across Europe and subsequently the world. In Brazil, it was illegal for women to play football from 1941 to 1979.

It was not until 1971 that the ban on women’s football was lifted. Today, women’s football is one of the fastest growing sports in the world. FIFAs Women’s Football Survey reports that there are currently over 13 million females playing football worldwide. Data published by the Union of European Football Associations (UEFA) reported that the number of professional and semi-professional female players in Europe grew by 120 % since 2012-13, increasing from 1,303 players to 2,853 in 2016-17 (UEFA, 2016). In Europe, there are 45 professional women’s football leagues, with each one comprising approximately 10 teams. The increase in the number of professional players has driven competition. There is now more focus on performance and hence the increased demand for sports nutrition support.

### **Physical demands**

The collection of physical training and match performance data is common practice within professional women's football. A typical week for a professional women's team would likely consist of one to two competitive matches and five to six training sessions, with the intensity and duration of the training sessions dependent on the number of matches.

The pattern of women’s football is “stop and go”. Research has shown that, domestically, professional female players typically cover approximately 10 km during a competitive match (Krustrup et al., 2005; Krustrup et al., 2010; Bradley et al., 2014). Elite International female players cover approximately the same average total distance as their male counterparts; however, females cover less distance at high-speeds and by sprinting (Datson et al., 2017).

The distance covered at high speed has been reported to range from 350 m to 2900 m (Mohr et al., 2008, Randell et al. 2021). However, it is important to note that the high speed running distances are determined by applying specific speed thresholds. In the literature, these speed thresholds are either generic or individualized to the player (Scotta and Lovell, 2018; Datson et al., 2017). An individualized approach is intuitively superior, as players will likely have different maximal sprint speeds. The absence of a universal approach in identifying high intensity running actions, makes it difficult to generate a detailed consensus of the high-intensity demands on players.

Distances covered during training are less than in matches (~ 4.5 km) (Gabbett and Mulvey, 2008). A single bout of sprinting can be classified as 3 sprints, with less than 21 seconds recovery between sprints. Female players are required to complete nearly five times more sprint bouts during a match in comparison to training. This data shows the



difference of physiological demands between match play and training sessions in professional women's football.

Skeletal muscle metabolism and changes in repeated sprint performance during match play have been investigated in elite women outfield players. After competitive matches, 80 % of Type 1 and 69 % of type 2 muscle fibres were glycogen depleted, which likely contributes to the observed decline in repeated sprint performance (Krustrup et al., 2022). Therefore, appropriate carbohydrate fuelling strategies will ensure glycogen availability does not limit performance (Course 1 and 2; Rollo and Williams, 2023).

### **Physical capacities**

The maximal oxygen uptake ( $VO_{2max}$ ) of international female players has been reported to range from 46.8 – 57.6 ml/kg/min. The highest values have been reported in Danish players (following an intervention). A similar range in  $VO_{2max}$  (43.5 – 56.9 ml/kg/min) has been reported amongst National League players from various regions (Todd et al., 2002; Krustrup et al., 2005). In general, the  $VO_{2max}$  of female players is believed to remain consistent over the duration of the season (Haugen et al., 2014). However, this will depend on the training status of the player and also be influenced by potential injuries (periods of immobilization).

Valid measures for football specific performance include the Yo-Yo Intermittent Recovery (YYIR) and Yo-Yo Intermittent Endurance (YYIE) tests. Specifically, both tests are highly correlated with distance covered during matches and the total amount of high intensity running. The average distance completed by international female soccer players when running the YYIR is 801 – 930 m (Mujika et al., 2009). Midfield players have superior performance of the Yo-Yo Intermittent Recovery tests in comparison to other positions.

The ability to exert force rapidly is also of high importance due to the numerous sprints and changes of directions executed during a match. The countermovement vertical jump (CMJ) is a widely accepted measure of lower body power, which has been correlated with acceleration and maximal sprint velocities. Countermovement jump height (CMJ) (no arms) ranges widely between players 24.5 – 51.0 cm (Davis and Brewer, 1993). This physical attribute can be improved by training (Sedano et al., 2009b). Interestingly, research suggests that goalkeepers appear to consistently record the lowest CMJ values and are also the slowest players in a women's football squad (Sedano et al., 2009a). Sprint times of national and international female players have been reported to range from 1.67 – 2.31 s over 10 meters and 3.17 – 3.59 s over 20 m (Ingebrigtsen et al., 2011).

#### **4.1.2 Female player physique**

There is no single "optimal" physique for a female football player. The anthropometric details have been reported in female football players across a variety of competitive



levels, including international, national, professional leagues and college/university level. Therefore, the reported anthropometrics of female players is summarized below.

The stature (height) of international female football players ranges from 162.0 – 172.0 cm, with the lowest values being reported from the Japanese national team and the highest values from both Sweden and Germany national teams (FIFA, 2012). The stature of the players per se is not associated with successful performances. For example, although the semi-finalists were amidst the tallest teams at the competition, Japan were world champions despite being the smallest team at the tournament. Goalkeepers are consistently the tallest players in international teams, followed by defenders (Sedano et al., 2009a). Thus, there is not an ideal height for female football players, but a higher stature may be advantageous in certain positions.

Body mass values of international female football players have been reported to range between 56.5-64.9 kg (FIFA, 2012). The body fat of female players is higher in comparison to male players. The body fat percentage of international players has been reported to range 19.5-25.9 % (Todd et al., 2002; FIFA, 2012). The range increases with a lower playing level (13.6-30.8 %). Absolute values of absolute fat mass and fat free mass have been reported to range 10.9-14.5 kg and 45.6-47.2 kg, respectively, for international and national standard female players. The body fat (as well as lean mass) of a female player is of key importance to the sports nutritionist. An “excess” in fat can impair performance; however, too low values can compromise the player’s health and performance.

In women's football, appropriate physique management programs (Course An Introduction to Football Metabolism and Nutrition, Module 3) can inform health and performance relevant outcomes. This data can also be used to evaluate the effectiveness of training and dietary interventions. It is fundamental that players opt in for body composition assessments. The sports nutritionist should work with the sports medicine team and coaches to emphasize the potential problems that could arise with an overemphasis on body mass or body composition scores. This is because studies which have interviewed professional players revealed accounts of being “over tested”. These insights have been suggested to alter eating habits, and specifically the avoidance of carbohydrates after intense training sessions (Culvin, 2019). It is unknown how prevalent this experience is. It is the role of the sports nutritionist to develop and maintain best practices around player physique management that maintain or improve long-term player health and performance (Ackerman et al., 2020).

### **Carbohydrate intake during training and matches**

To date, although more female specific research is required, there is no evidence that carbohydrate recommendations should differ for women's football. Carbohydrate strategies have been covered extensively in previous modules. Nonetheless, recommendations for female players are summarized below.



During matches, players should consume 30 g of carbohydrate (with ad-libitum fluid intake) before each half, to support high-intensity running capacity and skill performance (Rodriguez-Giustiniani et al., 2019). In addition, players should be encouraged to consume fluid and carbohydrate during unscheduled breaks in play (injury, substitutions), to limit performance decrements during the final stages of a match.

Recovering the depleted muscle glycogen stores after high-intensity training and matches is essential for sustaining performance. The recovery time available between matches and training sessions will determine the refueling strategy. In cases where exercise bouts are taking place in quick succession (4–8 hours recovery time), acute strategies are recommended by ingesting ~1 g carbohydrate per kg body mass per hour in the 4 hours post exercise (Thomas et al., 2016). In these situations, sports nutrition products provide convenient options for rapid refueling, followed by a carbohydrate-rich meal. The quantity of carbohydrate ingested is more important compared to the type, format or timing of intake to optimize glycogen resynthesis. When the duration between training (>8 hours) and matches (>3 days) is increased, daily carbohydrate intake can be modified to the individual goal of the player and demands of daily training (Course Macronutrients and Fluid for Football).

### **Fluid requirements: sweat rates**

Sweat rates will vary significantly between players in women's football. Sweat rates will be primarily influenced by the intensity of exercise, environmental conditions and acclimation status. In a study with the Barcelona women's first team, we reported that compared to training, match play leads to greater body mass losses (>0.83 %), sweat rates (+0.36 L/h) and sodium losses (Tarnowski et al., 2022). Furthermore, greater body mass losses and sweat rates are observed in hot (25.0 °C) versus temperate conditions (14.8 °C) (Broad et al., 1996).

Sweat rates have been studied across different phases of the menstrual cycle. This is because compared to the follicular phase, a higher core temperature threshold for regional sweat initiation occurs in the luteal phase (Kuwahara et al., 2005). However, sweat rate does not differ between the different phases of the menstrual cycle (Freemas et al., 2023). Therefore, there is no need for menstrual cycle phase specific recommendations.

### **Did you know?**

#### **Mean sweat rate L/hour (range) of elite women's players**

**Training: 0.47 (0.20-0.90)**

**Match: 0.85 (0.54-1.30)**



Sweat rates are generally lower in female players, in comparison to male players because of lower body mass and absolute work rates. Nevertheless, female players are still at risk of experiencing significant hypohydration during training and matches. Therefore, appropriate guidelines with regard to drinking during training and matches should be followed (Course Macronutrients and Fluid for Football). Sweat testing and individual fluid guidelines are recommended for each player to follow before, during and after training and matches.

### **4.1.3 Energy requirements and nutrition considerations**

The same principles of energy balance discussed in previous courses apply to women's football. However, female players have unique energy and nutrition considerations in comparison to male players. In general, the nutrition demands focus on achieving adequate energy to meet the energy demands of training and matches, activities of daily living, and reproduction. Female players must ingest the appropriate foods in the appropriate quantities to obtain the nutrients necessary to support high levels of performance, but also the remodeling of bone, muscle as well as overall health. Thus, the sports nutritionist working in women's football is recommended to monitor energy and nutrition intakes to help prevent any health-related issues, whilst optimizing physique and performance.

Based on observations in professional clubs, professional women's teams may be expected to train and compete for 6-10 hours per week. Studies suggest that female players engaging in this volume of activity would require appropriately equal to or more than 2500 kcal per day to maintain body mass (Hand et al., 2016). It is unlikely that female players would exceed this level of physical activity. Nevertheless, if players are engaged in intensive pre-season training, or if completing additional self-led exercise (in addition to team activities), then activity may be increased to over 10 hours per week. Under these circumstances, a female player may require over 3000 kcal per day (Melin et al., 2015).

In a cohort of twenty-four professional players completing an international training camp, total energy expenditure ranged from 2105 to 3507 kcal/day (Morehen et al., 2022). The camp environment was conducive to also recording energy intake, which ranged from 1639 to 2172 kcal/d. Interestingly, carbohydrate intake was below that which is recommended for intense training ( $3.3 \pm 0.7$  g/kg body mass). Therefore, when assessed, 88 % of players were categorized as having low energy availability (threshold of <30 kcal/kg FFM) (Morehen et al., 2022).

Should female players fail to match their energy intake to the energy required for training and matches, their energy intake is likely to be inadequate. In this situation, players can be described as either having "low" energy availability (EA) (Nattiv et al., 2007) or having "relative energy deficiency in sport" (RED-S) (Mountjoy et al., 2014). An inadequate energy intake in female players increases risk of suboptimal nutrient intake, reduces the benefits



of training, negatively affects performance and may result in health issues. Relative energy deficiency in sport describes a condition where an energy deficit occurs relative to the balance between energy intake (kcal/day) and total energy expenditure (kcal/day). The fundamental cause of RED-S is low energy availability. Relative energy deficiency in female players can be calculated by subtracting exercise energy expenditure (EEE, kcal/d) from the total energy intake (kcal/d). As a guide, “optimal” and “low” energy availability can be classified as follows:

**Optimal energy availability = > 45 kcal/kg fat-free mass/day**

**Low energy availability = < 30 kcal/kg/fat-free mass/day**

It is important to note that significant individual sensitivities to energy availability will exist. Although the sports nutritionist is encouraged to work with the individual player to establish individualized thresholds, the values provided here should be considered as a good “guide”.

In general, if female players have a low overall energy intake then EA is also likely to be low. It is important to recognise that a female player may have an energy intake that seems to match energy expenditure but still has low EA. In this circumstance, the resting metabolic rate of the player may be reduced as a consequence of the energy restriction. Although the assessment of energy availability would seem simple, it is challenging to get accurate measures of the variables required for the calculation. For example, energy intake needs to be measured ideally (observation, weighed food records, food pictures) over 7-10 days during a competitive phase of the season. Travel commitments, changes to the playing schedule, as well as team results can impact on the players adherence to the data collection. In addition, if energy intake is under reported (as typical in food recording), then the assessment of EA will not be accurate. On the other side of the equation, resting metabolic rate and energy expenditure of exercise should ideally be measured and not estimated. This is because estimations introduce further measurement inaccuracies when calculating energy availability. Finally, due to the changing energy demands of competition over a 38-week season, it is highly likely that energy availability will fluctuate significantly (Reed et al., 2013).

Players may experience RED-S unintentionally or through inappropriate calorie intake (dieting) with or without disordered eating or eating disorders. As a consequence of RED-S, players may experience fatigue (increasing the risk of injury), illness (unavailable for training/team selection), poor bone health (injury risk), no development (lack of performance improvement) and menstrual dysfunction. Furthermore, female players' metabolic rate may be lowered, protein synthesis (recovery) reduced and immune function suppressed (Mountjoy et al., 2014). Finally, it is important to note that a player's psychological state may be impaired with greater disturbances in mood and lack of motivation (figure 1).

It is of critical importance for performance and the player's long term health that the sports nutritionist is able to determine if a player is consuming enough foods to meet energy demands (Stellingwerff et al., 2021). The early identification of female players at risk for energy deficiency is vital. To this end, it is recommended to routinely screen the players every 2-4 weeks for low energy availability risk factors (see screening below).

Particular attention should be paid to player intake of carbohydrates. This is because daily carbohydrate intakes in elite players range from 3–5 g kg body mass per day (Moss et al., 2021). These values fall within the lower end of recommended intakes and are below the recommendations for a two-match week and a single-match week (Course Macronutrients and Fluid for Football). Interestingly, our research has found that players typically fail to periodise carbohydrate intake according to the changing exercise demands (Moss et al., 2021). A substantial number of professional players reported carbohydrate intakes of <3 g kg body mass per day on a double-training session day (62 %) and matchday (39 %) (Moss et al., 2021), which are likely to result in impaired training and match performance due to insufficient glycogen availability.

### **Exercise associated menstrual dysfunction**

If players have continued low energy availability, they may experience irregular menstrual cycles (periods). This may be particularly prevalent during the season (Nattiv et al., 2007). Players may also experience the absence of their period (amenorrhea, no period for longer than 3 months). Irregularities or cessation of a period is an indicator that the player's body is not receiving enough energy to maintain training and match activities, the demands of daily living, as well as reproductive function. Low energy availability is likely to be the primary contributor to exercise associated menstrual dysfunction (Nattiv et al., 2007). Evidence suggests that an increase in body mass may predict the renewed reproductive function (Cialdella-Kam et al., 2014). Nevertheless, it will take an undefined duration for the reproductive function to return, following the restoration of energy balance. Should a player remain in low EA and the menstrual dysfunction remain unaddressed, it could also result in poor bone health (Nattiv et al., 2007).

A case study followed a professional internationally capped player's two-year journey from eumenorrhea, through injury, to amenorrhea, detailing the challenges faced by the player as well as the sports nutritionist (Parker et al., 2022). Three key themes to emerge from the case study were:

(i) A belief that not having a period was beneficial for performance and unsure of possible health implications.

(ii) A belief that a one-day bleed indicated a regular menstrual cycle



(iii) A reluctance to waste the practitioners time discussing menstrual issues and nervous to discover actual health issues

Based on these insights it is crucial that players feel comfortable in discussing their menstrual status with practitioners to support their performance and long-term health (Parker et al. 2022). The sports nutritionist is recommended to work with the medical team and coaching staff to create environments where conversations on the menstrual cycle are normalized. Providing education around the topic and providing opportunities for players to come forward with questions or concerns will help shape this environment.

### **Did you know?**

**The model of the “female athlete triad” is the scientific rationale and clinical consequences associated with low energy availability (with or without disordered eating), menstrual dysfunction and poor bone health (figure 1).**

#### **Body mass loss**

Sustained body mass loss during the season is a clear indicator that the player is in a “negative” energy balance, and therefore, has low energy availability. Should a physique management objective be to reduce body fat, then it is advised to do this during a time of the season when energy demands are lower and there is time to make appropriate changes to the dietary intake (Manore, 2013). The sport nutritionist should regularly assess the players body composition to monitor “how” the body mass is being lost. i.e. fat mass and/or lean mass. The emphasis should be to preserve lean muscle mass and reduce fat mass.

#### **Frequent injuries/illnesses**

Should a player suffer recurring illness or injury, this may indicate low energy availability. The Female Athlete Triad established the link between low energy availability, menstrual dysfunction and bone health issues in women (Nattiv et al., 2007). Frequent illnesses may also be a sign of a weakened immune system due to inadequate energy intake and the nutrients important for immune health. The nutritionist should ensure they work with the medical team to record episodes and severity of illness for the player over the season. Over time, this insight may help players better understand their energy demands over the season as well as help the nutritionist to implement strategies to support immune function.

#### **Psychological factors**

Providers in the field of sport nutrition and clinical sport psychology have noticed an increase in women football players seeking treatment for disordered eating or eating

disorders in recent years. The physical and mental demands of football are associated with numerous risk factors for disordered eating and eating disorders.

If a player has low energy availability, they may find it difficult to concentrate during training and matches. This can be visually evident if a player begins to make frequent “uncharacteristic mistakes”, and in extreme situations they may begin to “shake”. At an acute level, this may be caused by players not eating breakfast before a long, hard training session, or a player not adequately refueling after exercise. Problem solving may become difficult and on-and-off pitch conflicts with teammates and opposition may become frequent.

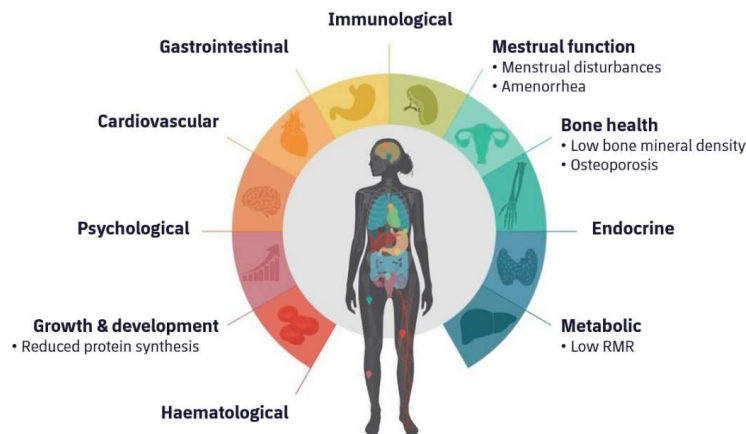
Eating disorders (anorexia nervosa, bulimia nervosa and binge eating) are clinical mental illnesses, characterized by severe and persistent disturbances in eating behaviours and associated distressing thoughts and emotions (American Psychiatric Association, 2016). Unfortunately, women footballers can and do experience eating disorders. The sports nutritionist is not qualified to appropriately support players with an eating disorder. If identified or suspected, the sports nutritionist has a duty of care to report to the team's medical doctor so appropriate action can be taken.

It is important to emphasize that the sports nutritionist can work to reduce the risk of eating disorders by implementing appropriate education strategies, regulate or remove harmful physique assessment practices, create processes for safe reporting and finally include the player(s) in decision-making processes.

## **Observation**

Building trust and a professional relationship with players is key to understanding their nutritional habits as well as obtaining early indicators of low energy availability. Routine assessment of physique accompanied by nutritional consultations provides the opportunity for the player to share any potential issues they may be experiencing with regard to food. In addition, being present during meal times, i.e. in the player's canteen/restaurant, allows the nutritionist to observe the player's behaviour. The nutritionist may observe any food avoidance, low energy choices or small (inappropriate) portion sizes. If observed, it is advised that the player is not approached publicly (in front of teammates). Instead, the player should be approached on a 1:1 to discuss any concerns and to provide appropriate guidelines. Finally, the nutritionist should also be aware if players remove themselves from social engagements and team activities, especially surrounding food. Frequently missing meals, without valid “excuse” and isolation from teammates may also indicate the player is in low energy availability.

**Figure 1. Health implications of low energy availability in women's football**



Source: own elaboration.

## Screening

The Low Energy Availability in Females Questionnaire (LEAF-Q) is a brief, 25-items, questionnaire which focuses on self-reported physiological symptoms linked to persistent energy deficiency (with or without disordered eating) (Melin et al., 2015). The LEAF-Q is quick to complete, and should therefore be considered by the sports nutritionist to use routinely within women's football. It is suggested that the questionnaire may be used during the first consultation with a player and then administered routinely over the duration of a season. The use of the LEAF-Q may provide a valuable screening tool in order to promote early detection and treatment of players with low energy availability.

### 4.1.4 Practical note

As with all nutrition interventions, an interdisciplinary approach is recommended for optimal results. The sports nutritionist is advised to meet with the interdisciplinary team (coach, physical trainer, psychologist, medical doctor) to discuss any early indicators of low energy availability. In the event of any intervention strategies, the sports psychologist should be involved at the early stages, and team members should be informed to support dietary strategies put in place with the player (Rollo et al., 2021).

## Macronutrients

The cause of players not meeting macronutrient requirements is likely because players are simply not eating sufficient quantities of food (energy intake). This certificate has discussed the importance of carbohydrates for football performance. Avoiding carbohydrates and not meeting body mass specific guidelines before, during and after exercise, as well as daily requirements, will put the player at increased risk of low energy

availability. Maintaining carbohydrate availability (muscle glycogen concentrations) may also help limit the post-exercise compromise in iron absorption by attenuating exercise-induced inflammation and subsequently minimizing post-exercise hepcidin levels. It should be recognised that some players anecdotally report that it is difficult to consume large amounts of “complex” carbohydrates. This is because these dietary carbohydrate sources increase the player’s satiety and feelings of “fullness”. In these situations, the sports nutritionist should work with the player to introduce “simple” carbohydrate options into the player’s diet, to meet carbohydrate requirements.

Ten days of low energy availability impairs muscle protein synthesis in trained females performing exercise training, compared to maintaining sufficient energy availability (Oxfeldt et al., 2023). Therefore, adaptations to training and matches would be blunted in female players with low energy availability. In addition, female players with low energy availability are also at greater risk of not meeting protein intake requirements (Gillen et al., 2016). Together, these factors would cause a reduction in lean mass and physical performance.

Current recommendations are for female players to consume 1.6-2.2 g protein per kg of body weight per day (Collins et al., 2021). Players with greater risk of low protein intake may be vegan or vegetarians who have chosen to remove animal products from their diet. One simple strategy is to provide the players with “recovery shakes” post training and matches to help contribute to the daily protein (and carbohydrate) requirements.

## **Micronutrients**

The micronutrient intakes of female players may also be low with low energy availability. Micronutrient deficiencies may be particularly prevalent if 1) whole food groups are removed from a player’s diet; 2) the player is vegetarian or vegan; 3) the player begins to follow “fad” or “popular media” diets; or 4) diet contains high content of “processed foods”.

The other micronutrients that may need additional consideration in a player’s diet include zinc, vitamin B12 and folate. Food sources rich in these micronutrients include meat (red meat and chicken) and fish. Whole grain foods, fortified cereals, dark greens, and grains are high in folate. Female players are also at risk for anemia (table 1), particularly if they have low intake of heme iron (found in meat), together with increased iron losses through menstruation. Female players may be advised to consume iron from food sources with high bioavailable (haem iron) such as meat and seafood. Vitamin C should be co-ingested with non-haem iron sources to enhance absorption, and foods or fluids that impair iron absorption such as tea and coffee should be avoided around meal times (module 1).



**Table 1. Haematological assessments of iron deficiency and iron anaemia for female players**

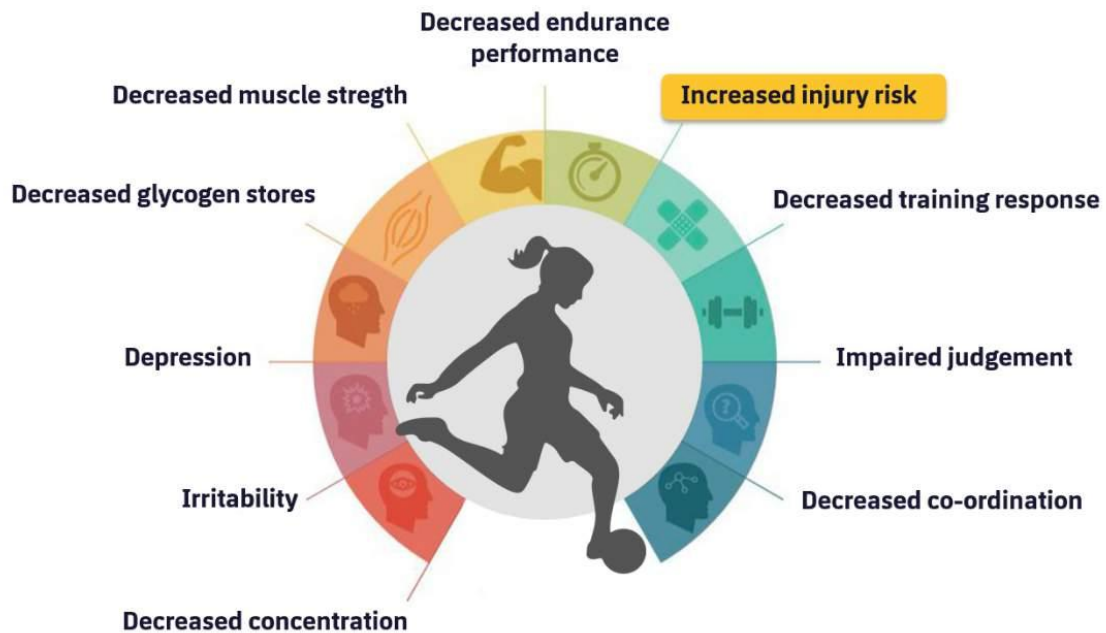
	<b>Normal</b>	<b>Deficiency</b>	<b>Anaemia</b>
Serum ferritin (µg/L)	>35	<35	<12
Haemoglobin (g/L)	120-155	115-119	<115
Transferrin saturation (%)	20-40	16-19	<16

Source: own elaboration based on Peeling et al., 2008.

Female players may also be advised not to omit dairy foods from their diet as dairy foods are a good source of calcium and vitamin D. Female players may have low vitamin D status, especially if routinely playing indoors or throughout the winter months (module 1). Assessment of micronutrient status was discussed in module 1. In summary, if micronutrient status is low, the health and performance of the player will be compromised. When correcting any micronutrient deficiencies through dietary supplementation the appropriate guidelines should be followed (module 1 and 2). If deficiency has been clinically diagnosed, dietary supplementation may be considered above the recommended daily allowance, following consultation with a qualified medical practitioner. The dietary supplementation strategies discussed in module 2 (vitamin D, caffeine, creatine, beta-alanine and nitrates) are all applicable to women’s football. However, it is important to acknowledge that we lack the depth of studies that have directly assessed the efficacy of various dietary strategies in female specific populations (Sheridan et al., 2022).



Figure 2. Performance implications of low energy availability in women's football



Source: own elaboration.

### Summary

- Professional female players cover approximately 10 km during a competitive match.
- Fluid losses through sweating will vary between players but are likely to be higher during matches in comparison to training.
- Daily carbohydrate intake (3.0 - 5.5 g carbohydrate / kg body mass per day) could be insufficient to support the demands of high-intensity training and matches.
- Players should aim to match their energy intake to the energy demands of training and matches as well as the energy cost of daily living. This dietary approach should maintain the players' performance, reduce risk of illness and maintain reproductive function.
- Low energy availability will limit the player's capacity to repeatedly train and compete at high intensity and may negatively influence long term health.

## Unit 4.2 Sports nutrition for the academy (youth) player

Most professional football teams have programmes for talented player development (academies). The aim of football academies is to produce players for the first team squad or alternatively to sell for financial gain (Elferink-Gemser et al., 2012). Indeed, the value of football players has increased significantly and the sale of just a single player may be sufficient to sustain or grow an entire academy system. The development of academy or youth players (under 18 years of age) is multifactorial, with an emphasis on improving technical, tactical, physical and psychosocial capabilities of the player. As such, providing appropriate general and sports nutrition advice is critical to ensure youth or academy players cope with the demands of training and matches.

A key objective for the sports nutritionist is to educate the players on the importance of the food in their growth, health, performance, recovery, training, and body composition. This approach will increase the likelihood of the player developing career (and life) long habits, which support good nutritional choices. This unit discusses those sports nutrition needs for the youth player. First, the physical demands of youth football will be summarized before introducing methods to assess the player's maturity. The main macronutrient and micronutrients will be covered before sharing relevant educational approaches for youth players.

#### **4.2.1 Physical characteristics**

The "youth player" may be considered as any player under the age of 18 years of age participating in regular football activity. This could include structured training and matches, as well as non-supervised "play" such as at a park, the school, or street games. The diversity of this group would make it impossible to cover all "youth football" situations. Thus, this Unit will focus on players who have entered the professional club "academy" systems. The "academy" structure will vary, depending on the club and country of origin. Typically, football players may begin with a football academy from the age of 8 years (under 9) and continue through the age groups to under 18, when if offered a contract, they may transition to the senior squad. Alternatively, players may be "let go", where they will either seek another club or cease to pursue a professional career.

#### **Did you know?**

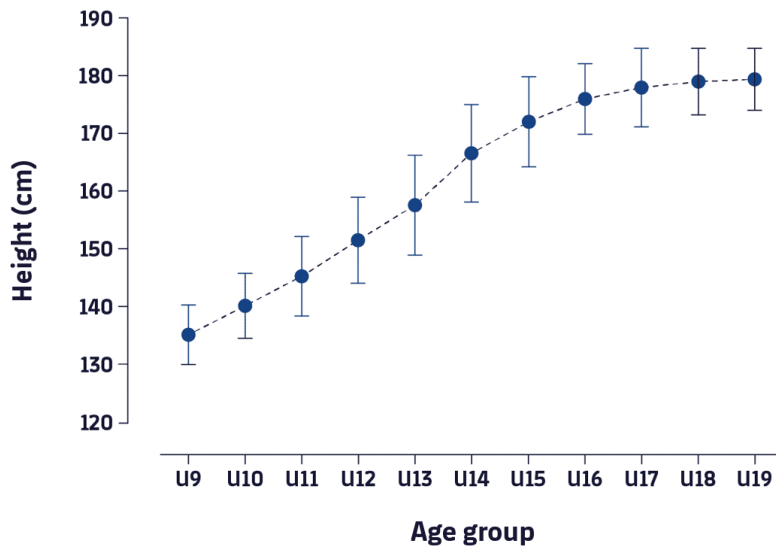
**Most professional clubs have youth academies. An academy is a specific training structure targeted at the development of youth players. Academies may also be referred to as "centers of excellence".**

Data from English professional football club academies has been collated from 2247 elite, male footballers from 10 age groups (U9 – U18) (Hulse, 2010). Figure 3 shows how the stature of male youth players increases as they mature. Body mass also follows this pattern. Figure 4 shows the greatest change in body mass occurs at the age of 13 to 14, which may highlight a need for additional attention to the player's diet to support the



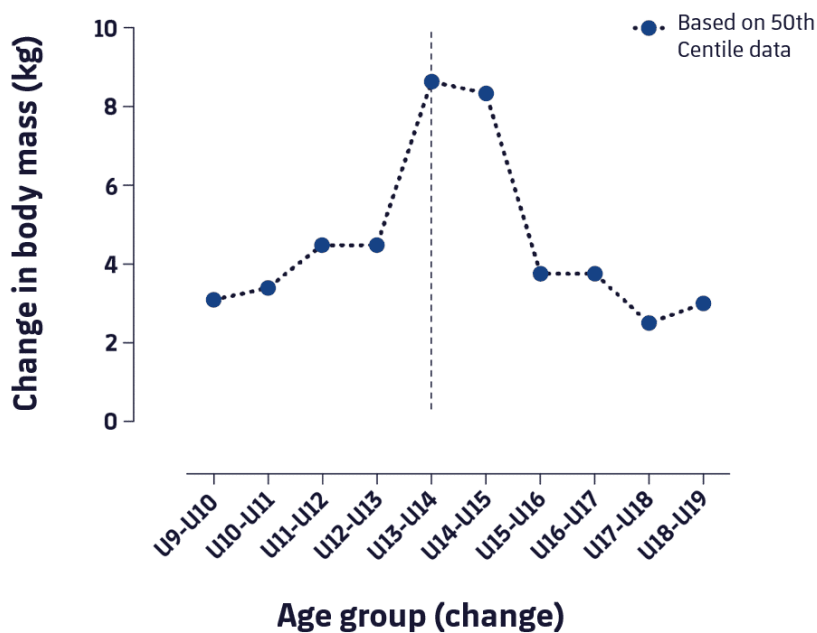
growth demands at this age —i.e. to ensure players are in a positive energy balance (unit 1).

**Figure 3.** The stature (height in cm) of 2247 young elite footballers from 10 age groups (U9 – U18). Data from 12 English professional football club academies



Source: own elaboration based on Hulse, 2010.

**Figure 4.** The change in body mass (kg) of 2247 young elite footballers from 10 age groups (U9 – U18). Data from 12 English professional football club academies



Source: own elaboration based on Hulse, 2010.

## Physical demands of youth football matches

The duration of match play as well as the distance covered during match play may change significantly depending on the age of the youth player (table 2). This is likely to be a consequence of the developing physical characteristics and the increased pitch size experienced as the player matures. The benefits and disadvantages of pitch area and match duration specifically for the youth player is beyond the scope of this course.

**Table 2. Age, mean playing time and distance covered by male academy football players**

Number of participants, chronological age, mean playing time, total distance covered during a match and total distance covered per hour (N= 127, mean ± SD) from each squad.									
	N	Chronological age (years)		Mean playing time (min)		Total distance (m)		Total distance (m·h <sup>-1</sup> )	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
U9	22	9.2	0.2	55.9	4.3	4356	478	4675	311
U10	12	9.8	0.4	50.9	5.2	4056	541	4788	466
U11	23	11.3	0.2	70.4 <sup>b</sup>	9.3	5668 <sup>ab</sup>	917	5647 <sup>ab</sup>	383
U12	14	12.1	0.3	55.2	10.7	5415 <sup>ab</sup>	928	5912 <sup>ab</sup>	347
U13	14	13.2	0.3	57.9	9.5	5853 <sup>ab</sup>	1029	6072 <sup>ab</sup>	437
U14	13	14.0	0.3	54.3	8.1	5652 <sup>ab</sup>	969	6240 <sup>abc</sup>	306
U15	13	14.9	0.2	63.7	12.5	7127 <sup>abc*d*</sup>	1310	6727 <sup>abcdef</sup>	268
U16	16	15.9	0.3	70.4 <sup>a*bd*f</sup>	13.2	7697 <sup>abcde*f</sup>	1546	6564 <sup>abcd</sup>	448

a = p < 0.01 vs. U9, b = p < 0.01 vs. U11, d = p < 0.01 vs. U12, e = p < 0.01 vs. U13, f = p < 0.01 vs. U14. \*P < 0.05

Source: own elaboration based on Goto et al., 2015a and Goto et al., 2015b.

The total distance covered during matches involving U9-U16 elite youth players ranges from approximately 4-8 km. The majority of this distance is covered at walking, jogging and low-speed running pace. Older players (U11-U16) have been reported to walk less and complete more relative high-speed running in comparison to younger players (U9 and U10) (Goto et al., 2015a; Goto et al., 2015b).

There has been less analysis of youth football in comparison to the adult game. Players under the age of 15 years may play on a regular sized pitch; however, the duration is commonly reduced (two x 30-minute halves). In an 11-a-side match (two 30-minute halves) played on a regular size pitch, international youth players (Brazilian, U15) have been reported to cover an average of 7077 m (Pereira Da Silva et al., 2007). Analysis has been completed during a 60-minute match (30 minutes each half) involving Italian national youth players, 14 years of age (Castagna et al., 2003). In this study, the speed categories defined by global positioning satellite (GPS) were defined as follows.



0-0.4 km/h: standing

0.5-3.0 km/h: walking

3.1-8.0 km/h: jogging

8.1-13.0 km/h: medium-intensity running

13.1-18.0 km/h: high-intensity running

> 18.0 km/h: sprinting

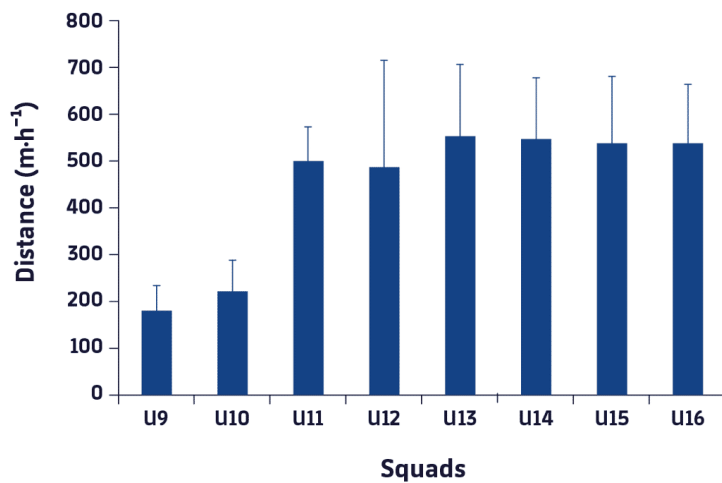
The total distance covered during the match was 6173 m. Players covered 508 m by walking, 2981 m by jogging, 1694 m by medium intensity running, 741 m by high-intensity running and 234 m by sprinting (Castagna et al., 2010). In youth age groups of 12-14 years of age, studies have reported that standing and walking accounted for approximately 42 % of the match duration (using manual video coding analysis). Players spend approximately ~30 % of the match duration jogging and the remaining duration engaged in high-intensity running, including sprinting (Stroyer et al., 2004).

Research indicates that differences in match activities between the first and second halves exist in elite youth soccer players. This is likely to depend on the half duration, with shorter 20-30-minute halves reducing the risk of fatigue in comparison to longer “standard” 45-minute halves, where permanent fatigue will manifest.

In a professional football academy, a typical week for players involves four training days, a match day and two rest days. The external loading of 76 male youth players from the under 12 to under 18 age groups of an English Premier League academy has been reported over a competitive season (Hannon et al., 2021). The mean accumulative weekly duration and total distance, respectively, was similar in the U12 ( $329 \pm 29$  min;  $19.9 \pm 2.2$  km), U13 ( $323 \pm 29$  min;  $20.0 \pm 2.0$  km) and U14 ( $339 \pm 25$  min;  $21.7 \pm 2.0$  km) players. The accumulative weekly duration and total distance was significantly higher for in U15 ( $421 \pm 15$  min;  $26.2 \pm 2.1$  km), U16 ( $427 \pm 20$  min;  $25.9 \pm 2.5$  km) and U18 ( $398 \pm 30$  min;  $26.1 \pm 2.6$  km) age groups. Thus, the absolute weekly training volume in an English Premier League football academy increases as players progress through the academy pathway (Hannon et al., 2021).

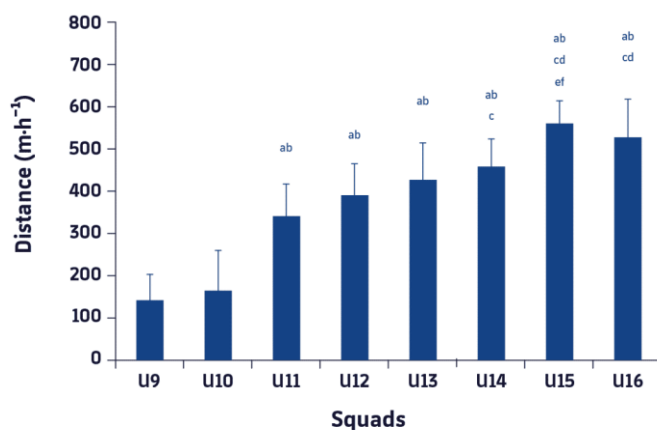


Figure 5. Total distance covered by high-speed running in youth player squads



Source: own elaboration based on Goto et al., 2015a; Goto et al., 2015b.

Figure 6. Total distance covered (meters per hour) in youth player squads



Source: own elaboration based on Goto et al., 2015a; Goto et al., 2015b.

### Did you know?

The youth players' bone age is a better indicator of their biological and structural maturity status in comparison to chronological age, calculated based on the date of birth. The most common modality used to calculate bone age is radiography of the hand and wrist (Manzoor Mughal et al., 2014).

## 4.2.2 Player maturity

When youth players join a club or academy appropriate records of basic physical characteristics are usually kept by the sports medical team. As a guide, these include,



stature and body mass for U9-U16 age groups and physique assessments for players 16-18 years of age. These measurements should be recorded adhering to strict ethical guidelines, which will be detailed in later courses.

A key challenge when planning the nutrition for youth players is that the player's biological maturation may not necessarily reflect their chronological age in years. The biological maturity of the player is a key factor influencing the body size and respective physical performance (endurance, power, speed and strength). This is particularly evident in adolescence. As such, there has been a trend in elite youth football for players born early in the competition year to be selected more compared to their peers who were born later in the same year (Malina et al., 2004). Nevertheless, players who mature "later" may still progress into the professional game. It has been reported that the age at which maturation occurred (early vs. late) did not result in a difference in the percentage of players in each category who subsequently became professional players (Carling et al., 2009). Thus, a key consideration for coaches would be not to rate players based on physical characteristics, considering this population is likely to have a large variation in maturity level. It is not always common for clubs to assess the maturity of their players. However, it is important for the nutritionist to be aware of common methods to assess biological maturity, which include:

- dental age,
- secondary sexual maturation,
- skeletal age,
- prediction of chronological age at peak height velocity.

The method or technique used will depend on the resource available to the club. The assessment of secondary sexual maturation can only be used for adolescents. Whilst this test was traditionally used by medical specialists to assess sexual maturity, due to ethical concerns, it is recommended for the player to complete the assessment themselves. Self-reporting using this assessment has been shown to be accurate and reliable (Petersen et al., 1988).

In summary, the sexual maturity of youth age groups can be self-assessed using stages of genital development and pubic hair development (Tanner, 1962). It is advised to explain this assessment in full to the players, and it is also advised that this information is provided by a practitioner/medical professional of the same gender. Practitioners or medical professionals should work in teams and never be left alone with youth players during assessments.

Players should have the opportunity to ask questions. One method is to show the players posters presenting the different stages of the genital development and pubic hair



development. Players can then be provided an envelope containing separate pictures of the stages of development. In a private room, alone, players can complete the self-assessment of their own stage of development. Players may write “A” on the side of the picture, which was the closest to their stage of genital development and pubic hair development and to write “B” on the side of the picture, which was the second closest to their stage of genital development and pubic hair development. These responses can be placed back in the envelope and provided to the medical team when complete. It is very important to emphasise the confidential nature of the data. Player names should be replaced by codes. Players should not participate if they feel uncomfortable about the procedure.

The criterion method to assess maturity is considered to be skeletal maturity (Malina et al., 2004). This method may be appropriate if a player does not have appropriate birth certification or their date of birth is unknown. However, this method is costly and requires specialised equipment.

The chronological age at peak height velocity can be calculated by recording multiple standing height measurements over years (Malina, 1988). Additional measurements, including sitting height, body mass and chronological age collected from a single session allows an estimation of chronological age at peak height velocity. This method may be used on players with a known or estimated chronological age of 7-18 years (Mirwald et al., 2002).

The player’s estimated chronological age can be calculated by a method reported by Mirwald et al. (2002). This method was reported to predict chronological age at peak height velocity with a reasonable degree of accuracy ( $R^2 = 0.89$ ) and can then be used to group youth players as early maturers or late maturers.

**The formula for the estimation is displayed below:**

**Estimated chronological age at PHV =**

**Chronological age -  $[-9.236 + (0.0002708 \cdot \text{leg length} \cdot \text{sitting height}) + (-0.001663 \cdot \text{chronological age} \cdot \text{leg length}) + (0.007216 \cdot \text{chronological age} \cdot \text{sitting height}) + (0.02292 \cdot (\text{body mass} / \text{standing height}) \cdot 100]$**

In general, it could be considered that bone age is important in understanding the anthropometric differences between players, and sexual maturation is more important to understand motor performance differences between youth players. In elite women’s football, a longitudinal study was conducted by the German Football Federation to identify talent in youth players (Leyhr et al., 2020). Football specific skill (dribbling, passing and target shooting) and physical fitness (20 m sprints and a slalom agility run without the ball) variables were evaluated over a 4-year period in adolescent players.



Four years after the testing the players' footballing progress to either professional (6.2 %) or non-professional (93.8 %) clubs was evaluated. Players who were ultimately signed by professional clubs were approximately 1 second faster on the sprint, passing and agility drills than their peers who progressed to non-professional teams. These differences were apparent from U12 and through to U15. The rate of improvement for these measures in both groups over time was non-linear, suggesting motor performance had prognostic relevance over the final football destination of these adolescent players (Randell et al., 2021). However, it is important to note that these metrics did not have sufficient predictive power to determine success in adult football.

### **4.2.3 Energy demands of youth players**

It is important to recognise the energy requirements of academy footballers and develop specific strategies to ensure energy requirements are met. Using the gold standard for measuring energy expenditure (doubly labeled water) the total daily energy expenditure of twenty-four highly trained male academy soccer players was calculated over a two week period in the season (Hannon et al., 2021). In this study players from the under 12/13, under 15, and under 18 age groups were assessed. The total energy expenditure increased progressively as players transitioned through the academy pathway. Specifically, the total energy expenditure was greatest for the U18 player ( $3586 \pm 487$  kcal/d), compared to the U15 ( $3029 \pm 262$  kcal/d) and U12/13 players ( $2859 \pm 265$  kcal/d) (Hannon et al., 2021). This increase in energy demands is consistent with the observed increase in accumulative weekly duration and total distance covered across the academy pathway. However, of particular interest is the range in energy requirements reported for the U18 players. Some players had over double the total energy requirements ( $5172$  kcal/d) compared to peers playing in the same age group ( $2542$  kcal/d). This observation highlights the importance of making personalized sports nutrition recommendations even within the academy system.

#### **Macronutrient considerations for the youth player**

As a general rule, the nutrition demands should follow the demands of training. Therefore, many of the nutrition related body mass specific guidelines, based on exercise intensity and duration, detailed in previous courses may be applied to the youth player.

Specifically, the intake of carbohydrate can be divided into daily and acute intakes. The daily intake of carbohydrate should be provided relative to the player's body mass, and thus, similar to their "adult" counterparts. For the youth player, carbohydrate intake should be modified depending on the training load and fixture schedule. For low to moderate training, carbohydrate intake may range 3-6 g/kg body mass per day. As training demands are elevated, the intake of carbohydrate may be increased to 6-8 g/kg BM. Interestingly, elite youth players have been reported to ingest less carbohydrate than current recommendations (Naughton et al., 2016, Collins et al. 2021).



Carbohydrate should be ingested to optimize endogenous glycogen stores and deliver glucose as energy for the high intensity repeated sprints and performance. During long training sessions and matches greater than 1 hour in duration, some carbohydrate ingestion is appropriate. Drinking a carbohydrate-sports beverage (6 % carbohydrate) has been shown to shift substrate metabolism to the exogenous intake of carbohydrate in both temperate and hot (38 °C) conditions (Timmons et al., 2007; Leites et al., 2016). Thus, carbohydrate ingestion should maintain carbohydrate availability to the players muscle and central nervous system, which may delay fatigue, improve performance, as well as contribute to overall energy intake.

It is likely that the player's protein needs will increase as they enter adolescence and with intensive football training. Youth players should be encouraged to maintain a positive protein balance. As a guide, an appropriate intake would equate to up to 1.6 g of protein per kg of the youth player's body mass per day. These protein intakes may be achieved through the ingestion of food. Studies have reported that, similar to adults, the distribution of protein ingestion is typically skewed in that intakes are higher with dinner, which is greater than lunch, which is higher than breakfast (Naughton et al., 2016). Thus, as the sports nutritionist, in football an emphasis should be on balancing the distribution of protein over the player's day. Youth players at risk of low protein intake are those undertaking restrictive or vegetarian diets. These players should be individually evaluated and encouraged to ingest protein rich foods as part of their overall energy intake (Desbrow et al., 2014).

### **Carbohydrate/protein education**

Players should be educated that carbohydrate is a key nutrient for football performance as well as the role of protein in growth and repair. However, the key challenge for players is to identify common foods, which represent the best dietary sources of these nutrients. As a suggested activity, the nutritionist may lead small group exercises where common foods are laid out on a table. Players should then be challenged to divide the foods into "carbohydrate" or "protein" rich categories or "good" or "bad" carbohydrate choices or "choose" or "avoid" in the preparation for matches. Examples are displayed in tables 3 and 4. It is advised to use "real" food rather than labels or lists, so the player can get "hands-on" experience with the foods. Once foods are correctly categorised, conversation can then be guided as to "when" and "how" much should be ingested.



**Table 3. Example of food categories that may be used with youth football education sessions. Foods to “choose” or “avoid” when preparing for a match**

<b>Choose</b>	<b>Avoid</b>
<b>High in carbohydrate/moderate protein: supports performance</b>	<b>High fat, high fibre foods: may cause stomach upset</b>
Fruit	Cheese burger
Breads	French fries/Chips
Cereals	Muffins
Smoothies	Ice cream
Poached egg on toast	Fried foods
Lean meat wrap	High fat foods, cheese

Source: own elaboration.

**Table 4. Example of food categories that may be used with youth football education sessions. Foods that are “carbohydrate” or “protein”**

<b>Carbohydrate foods</b>	<b>Protein foods</b>
Banana	Lean meats
Breads	Fish
Cereals	Poultry
Couscous	Tofu
Rice	Nuts
Fruit juice	Greek yoghurt

Source: own elaboration.



This exercise may also be used by the sports nutritionist to introduce specific guardrails with regard to the ingestion of foods. For example, common foods in the player's diet may be colour coded "green", "amber", "red", with the classification below.

- Green = choose often, high nutrient value. Example: fruit, vegetables.
- Amber = choose sometimes, moderate nutrient value. Example: fruit juices.
- Red = choose less often, low nutrient value. Example: ice cream, chocolate.

## **Fats and micronutrients**

There is no evidence or justification for increasing the dietary intake of fats in youth players. The main concern is that players may restrict fat intake in the fear of becoming "over-weight". A consequence of restricting fat ingestion may be deficiencies in certain micronutrients, including iron, calcium, and fat-soluble vitamins A, D, E and K (module 1). Milk is a great choice for youth players. Milk provides calcium (~300 mg/250 ml serving) which is critical for bone mineral growth and player health. The intake/requirements of daily calcium may be doubled (1200-1500 mg) in comparison to adult recommendations (Collins et al., 2021). Milk also offers a cheap and readily available recovery beverage, providing micronutrients, fluid, carbohydrate and protein.

## **Fat and micronutrient education**

The youth player's micronutrient intake should be met by ingesting a variety of different foods. Players should be encouraged to ingest 5 different types of fruit and vegetables per day. As a guide, pictures can be placed on restaurant walls or sent to player's phones to provide example meal plates, so they can visually see what the nutritionist is asking them to select on their dinner plate. Colour on the plate should be encouraged, aiming for at least three to four "bright" or different colours on a plate. Small group sessions can be provided to educate the player on fats to "choose" and "avoid" similar to the session detailed on carbohydrates above.

As players mature, they become more independent, and part of that process is to begin preparing meals for themselves. Players will have varying culinary skills, which are typically passed on by the player's family. From the age of 16 years, it is appropriate to begin providing players with basic kitchen skills. This can be achieved by hosting sessions either at the player's home with parents, at the club facilities, or if available, at local research institutions (colleges or universities). The aim of these sessions should be to give the player confidence in the kitchen, ensure they are aware of the health and safety of food storage and preparation and finally equip them with 2-3 basic breakfast, lunch and dinner recipes.

## **Fluids**



The impact of hypohydration on football performance also applies to the youth player (Wilk et al., 2014). Moderate (body mass losses equalling 1-3 %) and severe (body mass losses equalling >5 %) hypohydration has been reported to impair performance in young males (Dougherty et al., 2006; Wilk et al., 2014).

Youth players have a higher energy cost of performing physical activities. Children produce more metabolic heat per unit body mass in comparison to adults (Bar-Or, 1989). Unless this extra heat is dissipated, core body temperature will increase; if extreme, this storage of heat in the body may induce heat-related illness. The additional concern when playing in the heat is that hypohydration will further exacerbate hyperthermia and the risk of exertional heat illness. Youth football players have been reported to arrive for training and matches hypohydrated (Meyer et al., 2012). In a study involving 306 adolescents aged 12 to 16 years, urine analysis prior to an official match revealed 65 % of players were hypohydrated ( $\rightarrow 1.020$ ) (Fernández-Álvarez et al., 2022). In the same study 10 % of players failed to drink any fluid during the match.

Simple education efforts that may be completed to improve the hydration status of youth players involving pre and during exercise fluid intake advice. As an example, before exercise provide each player with a transparent urine container. Ask all players to provide a urine sample before exercise and to bring the pitch with them. Before training begins, ask the players to arrange themselves in a line in order from the “darkest” colour urine to the “lightest”. This is a fun activity, which does not take long and will not interfere with the coaching session. This helps the nutritionist to provide education on how the “colour” of the urine is an indicator of hydration status as well as see who and how many of the squad are commencing exercise “hypohydrated”. Any urine containers should be kept away from beverages, disposed of via the nearest toilet, and players should wash their hands after this exercise.

Similarly, during exercise, provide all players with individualized drinking bottles where the volume of fluid can easily be seen. Towards the end of a training session, at an agreed drink break with the coach, ask the players to arrange themselves in order from the smallest to highest volume of fluid consumed. This again highlights the variation in drinking in the squad and may highlight some players at risk of significant hypohydration during training.

Ensure the drinks are near the players. Especially on hot days, discuss with the coach leading training to agree on the number of drinks breaks that are appropriate for the duration and intensity of exercise. Providing the drinks chilled (approximately, 10 °C (50 °F)) will make the beverages more palatable than a drink at environmental temperature. Both the proximity of the beverage to the player and the cooling of drinks will aim to increase in voluntary consumption of fluid by the youth player. Finally, on hot days the provision of water-based ice lollies provides an excellent post-exercise strategy to begin the replacement of lost fluids. This can also be used and is popular with adult players.



## Did you know?

**Asking key members of the senior 1st team to either appear on posters, attend a meeting, or record a message for youth players is a powerful tool to reinforce nutrition messages.**

### Dietary supplements

The use of dietary supplements should be discouraged in youth players. The only exception being if the team doctor individually evaluates and identifies specific requirements (module 2). Even so, it has been reported that dietary supplement use is prevalent in adolescents (Herriman et al., 2017). The use of dietary supplements is often initiated by popular media and misinformation provided by peers and/or coaches.

A dietary supplement considered in module 2 was caffeine. Specific caffeine supplementation would not be recommended to the youth player. Nevertheless, caffeine is most likely, widely and frequently consumed by the youth population. This is because caffeine is present in many common day-to-day foods and it is also abundant in “energy” drinks commonly targeted at adolescents. A summary of the caffeine contained in common foods is displayed in table 5. Caffeine content of food is relevant as performance advantages of caffeine ingestion has been reported when provided in both food “coffee” and “supplemental caffeine” form (Hodgson et al., 2013). However, the caffeine content of foods and beverages can only be approximated. This is because the caffeine content varies widely (51-162 % of manufactures reports) even in products stating the caffeine content (Desbrow et al., 2019).

Knowledge of the caffeine content of foods is important as, through interview or dietary analysis, it helps identify those players with a habitual high caffeine intake. For example, players who regularly drink tea and coffee throughout the day or who regularly ingest caffeine containing “energy beverages”. Caffeine ingestion is not considered a health risk to the youth player, unless it is ingested too frequently or in high dosages. Thus, although exact values cannot not be advised, in general, excessive caffeine intake should be discouraged. Players should be encouraged to avoid caffeine intake around meal times to facilitate the uptake of iron (module 1) and avoid caffeine prior to bed to promote good sleep.



**Table 5. Caffeine content of common foods and beverages**

<b>Food/beverage</b>	<b>Approximate serving size (1 cup = 250 ml)</b>	<b>Approximate caffeine content (mg/<sub>serv</sub>)</b>
Coffee	1 cup	120-180
Energy drinks	1 cup	80-125
Cola/diet colas	1 cup	35-50
Black tea	1 cup	30-50
Dark chocolate (dark)	1 bar (~30 g)	20-60
Milk chocolate	1 bar (~30 g)	6-10

Source: own elaboration.

## **Alcohol**

Alcohol is associated with team sport (football) culture as well as experimentation during adolescent years. The ability for a player to consume alcohol will be governed by their respective country or state laws, regarding legal age of ingestion. As players approach the legal age to consume alcohol, they should be educated that excess alcohol intake leads to poor dietary choices and may negatively impact their ability to recover from training or matches (Burke et al., 2003). In general, teenage players should be advised to delay the consumption of alcohol as late as possible, to protect the brain and body as they mature and grow. The sports nutritionist or club may have a policy on alcohol ingestion. In this case, using a senior player from the first team squad can be a powerful tool in player education and reinforcing messages about sensible alcohol ingestion.

### **4.2.4 Key nutritional influencers for youth players**

It is important to note that parents and coaches may also have erroneous beliefs/education on sports nutrition and may offer inaccurate advice, as well as supply the player with dietary supplements (Manore et al., 2017). Parents and coaches can be the main provider of nutritional advice for the player. To this end, education programs for both groups are vital as part of supporting a youth team's nutritional programme (Carney et al., 2023).

#### **Coaches/trainer/manager**



The coaches of youth footballers have an important role in educating the player and their parents about sports nutrition for football. This is because the coach is often viewed as the most trusted source of nutrition advice. The sports nutritionist can help here by firstly educating the coach. It is advised that information is shared verbally and then reinforced by written materials. The nutritionist should not be too precious about allowing the coach to talk about nutrition, the nutritionist may educate the coach on the appropriate nutrition strategies and then produce nutrition specific materials for them to distribute to players. The information should contain the nutritionist's contact details offering the player or parent the opportunity to ask any questions.

### **Key point**

**When generating education materials for parents and players keep it simple. Use pictures and minimal text. There is no need to include the scientific references to underpin the recommendation.**

### **Parents/guardians**

It is important to note that parents may be guarded or protective about the current foods they provide their children. Parents may also feel "threatened" if being provided with information which contradicts their current practice. This may be common if asking questions regarding foods to the parents in group situations.

Interestingly, it has been reported that parents believe there are few healthy food and beverage options available in sport settings, whereas unhealthy options are widely available (Thomas et al., 2012). It is therefore advised to begin with a food first approach, and the promotion of a health balanced diet, before moving on to exercise specific recommendations. Common barriers to good food choices by parents were "time", i.e. limited time to prepare foods and "low availability" of foods perceived to be "healthy" options (Thomas et al., 2012). Therefore, when working with parents, understanding the challenges that they face, as well as their nutritional knowledge, are the priorities.

It is important to note that players/parents do not eat "carbohydrate", "proteins", "vitamins" and "fats", they eat "food". When communicating food choices to parents, aim to simplify the message by grouping the macro and micronutrients into food categories. For example, vitamins and minerals are "fruit and vegetables", protein "meats/beans" and carbohydrates "grains".

### **Summary**

- The physical demands of academy football are different compared to senior players.



- The energy requirements increase as players progress through the academy system.
- There will be large differences in the energy required for players between age groups and within the same age group.
- Good sports nutrition may help youth football players: performance, recovery, growth/maturation, physique management and injury avoidance.
- Education of the player and key influencers such as the coach and the parents/guardians for youth players is critical for the success of a sports nutrition programme.
- Establishing good nutrition knowledge and sports nutrition practice in youth players should encourage a healthy lifestyle and enjoyment of food, which extends into their professional careers and adult life.

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