



## 65.1 Characteristics of the Sport

Early variants of football dates to the second and third century BC, but the milestone of modern football (or soccer) is the founding of the Football Association in England 1863, becoming the sport's first governing body. With almost 300 million active players, football is currently the most widely played sport in the world. In the beginning of the twentieth century, football was played exclusively by men. Currently, however, 10% of the active players are women, and this number is growing fast (Fig. 65.1). The first men's World Cup was arranged already in 1930, but the first women's World Cup was not arranged until 1991. These tournaments are now arranged every 4 years, and other large-scale continental championships are also regularly organised.

Football is played through all ages, ranging from "football fun" during pre-school to amateur and elite/professional football during adulthood,

and nowadays even so-called walking football for sedentary players over 50 years of age who are not able to play the game in its original form. The standard playing surface is natural grass, but newer generation artificial turf is getting more common not only in countries with colder climate. Match duration, ball size, pitch size and number of players involved are adjusted to player age and capacity (Table 65.1).

Physical, tactical and psychological demands of the players are high. Sprinting, kicking, heading, cutting and tackling are natural parts of the game. As a result, injury is not uncommon, in particular among adolescent and adult players.

## 65.2 Physiological and Biomechanical Demands on Athletes

Various playing levels have different physiological demands. For example, a men's senior professional team will play approximately 60 matches per year depending on the setting and the success of the team, while an amateur or youth team will play considerably less. The demands of a player depend on several factors, e.g., the player's physical capacity, technical qualities, playing position and style of play (individually and of the team). Furthermore, style of play of the opponent players and team as well as importance of the game,

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**Fig. 65.1** Female football is growing rapidly. (Photo: Lennart Weber with permission)



**Table 65.1** General characteristics for different age groups (some national modifications may exist)

Age (years)	No. of players	Duration of match (min)	Pitch size (m)	Ball size/mass (g)
6–7	3 vs. 3	4 × 3	15 × 12	3/300
8–9	5 vs. 5	3 × 15	30 × 15–20	3/300
10–12	7 vs. 7	3 × 20	50–55 × 30–35	4/350–390
13–14	9 vs. 9	3 × 25	65–72 × 50–55	5/410–450
15–	11 vs. 11	2 × 45	100–110 × 64–75	5/410–450

seasonal period, playing surface and environmental factors will influence the performance.

Football is a strenuous activity. Depending slightly on the playing position, the average male professional outfield player runs between 10 and 13 km in a match; approximately 700 m of this is at high intensity (19.8–25.1 km/h) and approximately 250 m at sprint intensity (>25.1 km/h). Similar but slightly lower numbers are seen for the female counterparts. Importantly, particularly in demanding periods of a match, the player might be required to perform a high-intensity action every 15 s. Also, the peak heart rate can reach 85–98% of maximum values during a football match.

The physical demands on a football player require good strength and stability of the core (lumbo-pelvic) muscles as well as the major muscle groups of the lower limb. Also, good neuromuscular coordination and control are impor-

tant physical and biomechanical attributes for a football player. Early football specialisation in youth players is of growing concern, since this may contribute to less developed general athletic skills and increased risk for overuse injury, especially during or just after puberty. Conversely, there is some recent evidence supporting that a more diverse approach with participation also in other sports may in fact lead to better football-related performances in adulthood.

### 65.3 Epidemiology of Injuries

The injury rate in children's football up to 12 years of age is low and without relevant sex-related differences. However, the injury rate increases with age and is about the same in late adolescence as that seen in adults.

The vast majority of all injuries in football are located to the *lower extremity* where the most common injury types are *strains, sprains and contusions*. The most common injury locations are *knee, ankle, thigh and groin*. Historically, ankle sprain was the most frequent football injury, particularly recurrences, but nowadays hamstring muscle injury—most often involving the long head of the biceps femoris—is really *the football injury*, at least in high-level adult players of both sexes.

Importantly, the injury rate during match play is substantially higher than during training—this pattern is seen both overall and for all major injuries. Approximately two-thirds of football injuries side-lining a player are acute or traumatic in their nature, and the remaining one-third are associated with gradual onset of symptoms related to overuse. Unfortunately, *recurrent injury*, usually defined as an injury of the same type and at the same site as the index injury, is fairly common in football. Re-injuries are encountered particularly in youth players and low-level adult players who do not have access to medical support that can guide the return to play process. Similar to the overall injury panorama, the most common traumatic re-injury types are ankle sprain and hamstring muscle injury.

The first generations of *artificial turf* were introduced in football during the 1970s but were associated with bad reputation and probably a higher injury rate. The newer generation turfs have, however, attributes more similar to natural grass. As a result, no difference in overall injury rates has therefore been found when comparing these surfaces with natural grass among players of different age, sex and playing levels.

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#### 65.4 Specific Rehab and Return to Play

The transition from final rehabilitation to clearance for return to play is complex and many times a delicate task. In general, it is recommended that a multimodal rehabilitation approach is undertaken, independent of whether the primary treatment is surgical or non-surgical.

Recent and emerging evidence suggests that some common issues are important for a safe return to play with a low risk of early re-injury. First, *shared decision-making* where the player, coach and treating clinician agree on when return to play should be expected. Second, *time-based and criterion-based models* should be combined to ensure sufficient tissue healing and restoration of neuromuscular properties before return to play. Third, even if the player is physically fit again after injury, the player must also be *mentally ready* when returning to play. Fourth, the *workload* needs to be monitored, and managed, to make sure that the player is ready to return to play.

Access to qualified medical practitioners differs between playing levels. This may therefore influence the diagnosis and treatment of injuries as well as the rehabilitation and return to play decisions. Elite players often have medical support readily available in their clubs for all kinds of health issues, while players at lower levels may have to rely on public health care or self-treatment. Notably, women's elite football players outside the most prominent European clubs have a lower level of medical support in their clubs, and this needs to be improved in the near future. The availability of medical support in youth football is even more troublesome, where injury evaluation and return to play decisions often rely completely on advice from coaches and parents who often lack sufficient medical knowledge.

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#### 65.5 Specific Aspects in Different Subpopulations

Although the overall injury panorama is fairly similar regardless of the setting, there are also some important differences. First, elite/professional adult players have a higher *match injury rate* than semi-professional/amateur adult players. Conversely, the *recurrent injury rate* is higher among amateur players than in elite players. Second, female players have higher rates of *concussion, anterior cruciate ligament injuries and stress fractures* than male players. Particularly,

female adolescent players 14–18 years of age are most prone to suffer both first-time and subsequent anterior cruciate ligament injuries. Conversely, *groin injuries* are consistently reported to be more common among male players. Third, players under 15 years of age suffer more *injuries to the upper extremity* as well as more *contusions and fractures* than adult players. Conversely, adult players suffer more *strains and sprains* than youth players.

### 65.6 Prevention Strategies

Injury causation is multi-factorial and risk factors in football have traditionally been divided into *intrinsic* (player-related), such as age and sex, and *extrinsic* (environmental-related) ones. Injury risk factors can, however, also be categorised into *non-modifiable* (unalterable) and potentially *modifiable* (alterable) factors which might be more relevant from a prevention perspective (Table 65.2). Among the listed risk factors, previous injury stands out as one of the most important ones.

Fortunately, many of the most common and/or most severe football injuries can be reduced by means of different preventive measures regardless of the age, sex and skill of the player. Some examples of successful preventive approaches are bracing and balance board training for recurrent ankle sprains, neuromuscular training for both injuries in general and for specific injuries such as anterior cruciate ligament injuries of the

knee, and eccentric strength training for hamstring injuries (especially re-injuries).

### 65.7 Equipment and Protection Considerations

Football is a sport with little need for equipment compared with some other popular team sports such as American football or ice hockey and is thereby widely accessible at low cost.

*Shin guards* is basically the only mandatory equipment to be used by all players except for proper clothing and footwear. Their main function is to protect the soft tissues and bones in the lower leg from external impact. Shin guards have been found to prevent both minor injuries such as lacerations and contusions as well as serious injuries such as fractures. It is therefore highly recommended that approved shin guards are used also in training and not only during matches where it is mandatory.

*Headgear* made of soft material is allowed, but has not been shown to be effective in reducing head-to-ball impact. On the other hand, headgear may be helpful in reducing the force of other impacts to the head such as a head-to-head clash or a head-to-ground fall. Universal use of headgear may, however, cause more aggressive heading and head challenges, leading to increased risk of injury as well as a feeling of “false safety” for a player with previous concussion. Headgear is thus generally not recommended.

*Face masks* made of soft material (or padded with) are also allowed to use in competition and may be considered in order to protect the player after return to play following a nose or facial fracture.

**Table 65.2** Examples of candidate non-modifiable and modifiable risk factors for football injuries

	Non-modifiable	Modifiable
Intrinsic	Sex	Strength
	Age	Flexibility
	Previous injury	Fitness level
	Leg dominance	Psychological factors
Extrinsic	Playing level	Workload and congestion
	Playing position	Rules and regulations
	Playing activity	Equipment
	Time of season	Playing time
	Weather conditions	Playing surface and footwear

### 65.8 Other Health Aspects and Diseases

The downside of football is not only injuries, but also illnesses and other medical conditions that results from, or otherwise interfere with, playing.

*Iron deficiency and anaemia* are relatively common in high-level female football players if not

screened for periodically. *Relative energy deficiency in sport* (RED-S) is not as common in football as in several other sports, but signs of menstrual dysfunction, eating disorders and stress fracture are important to recognise and follow up closely.

The scarce literature related to *mental health problems* among football players indicate that such problems are at least as frequent as among the general population, maybe even slightly higher. This may be related to stressors such as pressure to achieve sporting and financial success as well as public and media interest in players on and off the pitch. Another common stressor is injury, posing a threat to the player's career in both the short and long term. Post career stressors may include an "identity crisis" as the regular structure of everyday life as an athlete, and part of a team is discontinued, and attention from media and public is decreased.

Football is, however, also associated with health-promoting activities. First, football on a recreational basis in middle-aged players is associated with several positive general health aspects ("*football is medicine*"). Examples of improved health parameters include a better cardiovascular profile with increased maximum oxygen uptake, decreased blood pressure and better lipid profile as well as increased bone mineral density which is of importance for avoiding fractures later in life. Second, initiatives such as the "*FIFA 11 for Health*", a football-based educational programme about common health issues for school children. The programme is promoted by prominent football players and has so far been successfully implemented in more than 20 countries in Africa and South America.

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## 65.9 Match Rules with Medical Importance

The International Football Association Board (IFAB) is the universal decision-making body for the Laws of the Game. This body compiles, adjusts and monitors that the rules are applied worldwide and are updated annually.

According to the Laws of the Game, it is mandatory to have a qualified doctor on the bench

during competitive matches in international and top-level national competitions. The team physiotherapist or another medical practitioner around the team often accompany the doctor on the bench and may be the only medically trained in sub-elite settings. The team's medical personnel must, however, only enter the field upon signal from the referee. If the referee suspects a serious injury, such as a concussion or a neck injury, this should be done immediately. A quick medical assessment of the injury can usually be done on the field, but treatment should be done outside the field. There are a few specified exceptions to these rules:

- When a goalkeeper is injured.
- When players from the same team have collided and need immediate attention.
- When a severe injury has occurred (such as unfree airway, unconsciousness and broken leg).

Any player bleeding from a wound must leave the field of play. He may not return until the bleeding has stopped and there is no blood on worn clothes.

Unlawful play renders a free-kick or a penalty kick; the player committing a foul can be handed a yellow card (warning) or a red card (being sent off). Successful examples of rule changes to decrease player injuries over the last two decades are:

- Direct red card for active elbow-to-head contact in order to decrease head trauma rate (2006).
- Direct red card for fierce tackles from behind in order to decrease severe injuries to the lower limb (1998).

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## 65.10 Fact Box

- Football is a health-promoting activity for all ages and both sexes, but professional football is associated with a high injury rate compared with other non-sports occupations.
- Shin guards and appropriate footwear and clothes are the only required basic equipment, making football a fairly inexpensive and readily available sport.

- Thigh muscle injury, and particularly a partial tear of the biceps femoris in the hamstrings muscle group, is the most common injury in adult football.
- Female players are more susceptible to sustain anterior cruciate ligament injury, concussion and stress fracture than male players.
- Children are more susceptible to sustain contusions, concussions and fractures of the upper extremity than adults.
- Preventive programmes for the major football injuries, with solid scientific support, is widely available, but sometimes challenging to implement on the field.
- Return to play after injury should be considered a shared decision-making process involving the injured player, the treating medical practitioners and the coaching staff.
- The governing bodies should promptly work to increase the medical support in youth and female football in order to increase the safety of the sport.

## Recommended References

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