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Playing too Many Matches is Negative for both Performance and Player Availability – Results from the On-Going UEFA Injury Study

Negative Auswirkungen auf Leistung und Einsatzfähigkeit bei Sportlern mit erhöhter Spielanzahl – Ergebnisse der aktuellen UEFA-Verletzungsstudie

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ZUSAMMENFASSUNG

Ziel: Präsentation einiger Ergebnisse der aktuellen Studie über männliche Profifußballer in Europa, die UEFA Champions League (UCL)-Verletzungsstudie. Vorgehensweise: 27 Mannschaften aus zehn Ländern und 1500 Spieler haben zwischen 2001 und 2012 während elf Saisons an dieser Studie teilgenommen. Das Konzept variiert je nach Konsens der FIFA-UEFA Verletzungsbestimmungen und Datenerfassungsverfahren. Ergebnisse: Insgesamt wurden 800 Verletzungen registriert. Die durchschnittliche Verletzungshäufigkeit beim Spitzensfußball beträgt drei bis fünf Verletzungen in 1000 Trainingsstunden und 25 in 1000 Spielstunden. Durchschnittlich kann eine Mannschaft mit 25 Spielern ca. 50 Verletzungen pro Saison erwarten. Die Verletzungsrate ist während dieser Elf-Jahres-Periode nicht gestiegen. Sie variiert bei europäischen Ländern mit einem erhöhten Risiko an LCA-Verletzungen (ligamentum cruciatum anterius), aber einem insgesamt geringeren Verletzungsrisiko in Ländern mit mediterranem Klima. Als häufigste Einzelverletzung tritt die Verletzung der ischiocruralen Muskulatur auf. Radiologische Begutachtungen durch MRT oder Ultraschalluntersuchung gehen mit Ruhephasen einher. 70% aller ischiocruralen Muskulaturverletzungen, die beim Profifußball datiert werden, haben eine Einstufung in radiologischer Sichtweise von 0 oder 1. Dies bedeutet keine Faserrisse bei der Bildgebung, aber immer noch Ursache der meisten Abwesenheitstage. Fast alle männlichen Spitzensfußballer mit LCA-Verletzungen kehren zum Vollzeitfußball zurück, aber erst nach 6-7 Monaten. Stressfrakturen kommen unter Fußballern nicht häufig vor, sind allerdings langwierig im Heilungsprozess. Das Verletzungsrisiko ist auf Kunstrasen ähnlich hoch wie bei Spielen auf natürlichem Rasen. Eine erhöhte Spielanzahl führt zu negativen Auswirkungen auf Leistung und Einsatzfähigkeit bei Sportlern.

Schlüsselwörter: Fußball, Häufigkeit, ischiocrurale Muskulaturverletzung, Kunstrasen, ligamentum cruciatum anterius, Klima, MRT.

SUMMARY

Objective: To present some results from the on-going survey on male professional football players in Europe, the UEFA Champions League (UCL) injury study. Methods: A total of 27 clubs from ten countries and 1500 players have been followed prospectively during eleven seasons between 2001 and 2012. The design harmonizes with the FIFA-UEFA consensus statement on injury definitions and data collection procedures. Results: In total, 800 time-loss injuries were recorded. The mean incidence of injury at top level football is 3-5 injuries per 1000 training hours and 25 per 1000 match hours. On average, a team of 25 players can expect about 50 injuries each season. The injury risk has not increased during the eleven year period. The injury risk varies between countries in Europe with a higher risk of ACL (anterior cruciate ligament) injuries but less overall injury risk in countries with a Mediterranean climate. Hamstring muscle injury is the most common single injury. Radiological grading by MRI or ultrasonography is associated with lay-off times. Seventy per cent of hamstring injuries seen in professional football are of radiological grade 0 or 1, meaning no fibre disruption on imaging, but still cause the majority of absence days. Almost all male top level footballers with ACL injuries return to full football play, but it takes 6-7 months. Stress fractures are not common in footballers but take long time to heal. The injury risk is similar when playing on football turf as when playing on natural grass. Playing too many matches is negative for both performance and player availability.

Key Words: Football, soccer, incidence, hamstring injury, artificial turf, anterior cruciate ligament, climate, MRI.

INTRODUCTION

Although the positive health effects of physical activity are well documented, sports participation is associated with a certain injury risk. The risk of injury in professional football is substantial; it has been estimated that the overall risk of injury is about 1,000 higher than for typical industrial occupations generally regarded as high-risk (3). Injuries also affect performance in a negative way and teams that can avoid injuries have greater success as evaluated by the final position in the league system (1,5). Hence, prevention of injury in football is of utmost importance, and conducting an injury surveillance study is the fundamental first step in the sequence of prevention (19).

In 2001, UEFA (Union of European Football Associations) initiated a research project with the aim to reduce the number and severity of injuries and increase safety in football accordingly.

This on-going study, the so called UEFA Champions League (UCL) study, has so far involved 27 European top level football clubs from 10 different countries over eleven seasons.

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The data shows that a male professional football team can expect about 50 injuries causing time-loss from play each season, equalling two injuries per player (9). Even though half of these injuries are minor where a player resumes full training and match play within one week, 37% are moderate (absence 1-4 weeks) and 16% are severe injuries, resulting in absence more than four weeks. The impact of injuries on football performance can thus be considerable, and, on average, 12% of the squad is unavailable due to injury at any point during the season.

The objective of this article is to present some results from the on-going survey on male professional football players in Europe, the UEFA Champions League (UCL) injury study.

MATERIALS AND METHODS

Study population

A prospective cohort study of men's professional football in Europe has been carried out since 2001 (9). A total of 27 clubs from ten countries and 1500 players have been followed during eleven consecutive seasons between 2001 and 2012. The design harmonizes with the FIFA-UEFA consensus statement on injury definitions and data collection procedures (16), and the general methodology has been reported in detail previously (17).

Inclusion criteria and definitions

All players belonging to the first team squads each season were invited to participate. Players who left their club before the end of a season were included for as long as they participated. An injury was defined as any physical complaint sustained by a player that occurred during a football training or match and which lead to the player being unable to participate in future football training or match play (i.e. time loss injury) (16, 17). The player was considered injured until the club medical staff allowed full participation in training or match play. All relevant definitions are outlined in Table 1.

Table 1: Operational definitions.

Training session	Team training that involved physical activity under the supervision of the coaching staff.
Match	Competitive or friendly match against another team.
Injury	Injury resulting from playing football and leading to a player being unable to fully participate in future training or match play (i.e. time-loss injury).
Rehabilitation	A player was considered injured until team medical staff allowed full participation in training and availability for match selection.
Re-injury	Injury of the same type and at the same site as an index injury occurring no more than two months after a player's return to full participation from the index injury.
Minimal injury	Injury causing absence of 1-3 days from training and match play.
Mild injury	Injury causing absence of 4-7 days from training and match play.
Moderate injury	Injury causing absence of 8-28 days from training and match play.
Severe injury	Injury causing absence of over 28 days from training and match play.
Traumatic injury	Injury with sudden onset and known cause.
Overuse injury	Injury with insidious onset and no known trauma.
Foul play injury	Match injury resulting from foul play according to the decision of the referee.
Injury incidence	Number of injuries per 1,000 player hours [$(\Sigma \text{injuries} / \Sigma \text{exposure hours}) \times 1,000$].

Data collection

Anthropometric data and playing position were reported by the club medical staff for each player at inclusion. A member of the medical or coaching staff in each club registered individual exposure in minutes during all club and national team training sessions and matches. All injuries were recorded immediately after the event by a club medical officer. Injury cards and attendance records were sent to the study group once a month. The injury form provided information about the diagnosis, nature and circumstances of injury occurrence. All injuries resulting in a player being unable to fully participate in training or match play (i.e. time-loss injuries) were recorded, and the player was considered injured until the team medical staff allowed full participation in training and availability for match selection. All injuries were followed until the final day of rehabilitation. Each injury was coded according to a modified version of the Orchard Sports Injury Classification System (OSICS) 2.0 (20).

Presentation of results and feedback to clubs

Each season of the audit, all participating clubs receive two reports (half season and post season) summarizing the results for their club together with the average for all participating clubs (without revealing other club names). These reports enable club medical and coaching staff to work proactively with injury prevention. Clubs can study variations in injury incidence and characteristics during and in-between seasons and get an instrument to evaluate the effect of any preventive measures implemented in the club.

Ethics

The study design was approved by the UEFA Medical Committee and the UEFA Football Development Division. Written informed consent was collected from all players.

RESULTS

In total, 8000 injuries were recorded in 27 UCL teams during an exposure of around 1 million hours.

The overall injury incidence is 3-5 injuries per 1000 training hours and around 25 per 1000 match hours. This means that a team of 25 players can expect about 50 injuries each season. Half of these injuries will be slight or minor, causing absence less than a week but a team can each season expect six to nine severe injuries causing absence more than four weeks.

The injury risk has not increased during the eleven year period

The injury risk has remained stable over consecutive seasons in the UCL study (9), see Figure 1.

The injury risk varies between countries in Europe

Waldén et al. (26) studied the influence of climate type on injury epidemiology in men's professional football in Europe. They reported that teams located in the northern Europe with milder summers and cooler winters (teams from England, Scotland, Germany, Holland, Belgium, northern France and northern Italy) had a higher injury incidence in general compared to teams from southern Europe with a Mediterranean climate (teams from Spain, Portugal and middle or southern Italy). The injuries that followed this general trend included both traumatic injuries and overuse injuries. However, the ACL (anterior cruci-

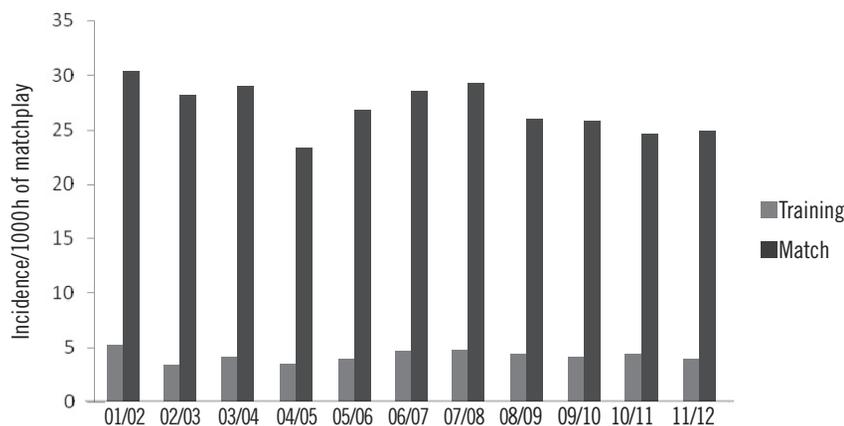


Figure 1: Incidence of injury per season for UCL teams across 11 seasons (injuries/1,000hrs).

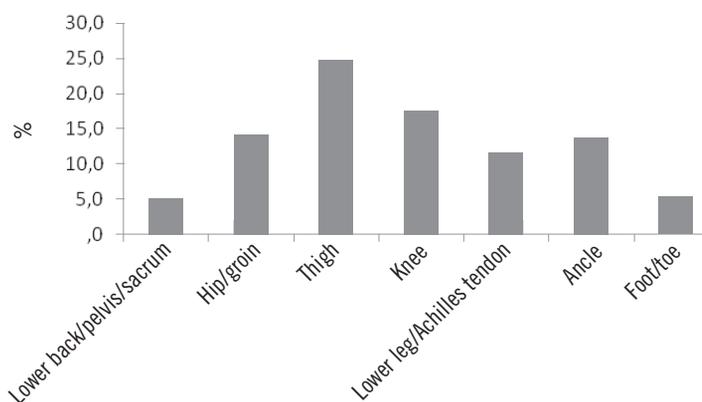


Figure 2: The most common location of injuries (UCL seasons 2001/02 to 2011/12).

ate ligament) injury incidence, in particular for the non-contact injury, followed the reverse trend and was significantly higher in teams with Mediterranean climate. The authors suggest that reason for the higher risk of ACL injuries in Mediterranean countries could be a higher shoe-surface traction because of a warmer climate.

The thigh is the most common injury location

Figure 2 shows the distribution between various locations of injury. An average of 85-90% of all injuries are to the lower extremity, the most common sites among male elite players being the thigh (25%), knee (18%), hip/groin and ankle (14% each).

The majority (70%) of injuries are due to trauma but almost one third (30%) of injuries are due to overuse and typically affect hamstrings, groin, knee and lower leg.

As seen in Figure 3, muscle and tendon injuries are dominating among elite level players, compromising almost half of all injuries (both traumatic and overuse injuries included). Concussions and laceration/skin injuries are rare at elite level, each compromising 0.8% of all injuries.

Muscle injuries – the most common at elite level

Muscle injuries are a substantial problem for players and their clubs. They constitute almost one third of all time-loss injuries in men's professional football, and 92% of all injuries affect the four big muscle

groups in the lower limbs (8,9,23). Hamstring muscle injury is the most common single injury, probably reflecting the velocity of elite level football. A team with 25 players in the squad can expect an average of 15 muscle injuries per season, around 6-7 of them affecting the hamstrings. The average lay-off time for all muscle injuries is around 16 days but there are large variation depending on which muscles are involved, the type and size of injury etc.

MRI can be helpful in verifying the diagnosis of a hamstring injury and to prognosticate layoff time. Radiological grading (grading of severity of muscle injuries by analyzing MRI images taken 1-2 days after a muscle injury) is associated with lay-off times (6). Seventy per cent of hamstring injuries seen in professional football are of radiological grade 0 or 1, meaning no signs of fibre disruption on MRI, but still cause the majority of absence days.

The risk of muscle injury is 6 times higher in matches compared to training and muscle injuries are more frequent towards the end of each half, fatigue might be an explanation. Further, the risk of injury to the hamstring and calf muscles increases with age.

Almost all male top level footballers with ACL injuries return to full football play, but it takes 6-7 months

The UCL injury study also includes some sub studies of specific injuries, ACL injuries being one of them. Waldén et al. (25) have reported that under ideal circumstances it is possible

to achieve an outcome in excess of 90% in terms of return to football at the same high level as before the injury. Injuries to the ACL in the knee only constitute around 1-2% of all time loss injuries but cause long lay-off-times. A male elite team with a squad of 25 players can expect an average of one ACL injury every second season. Female players have a 2-3 times higher ACL injury risk compared to their male counterparts. Females also tend to sustain their ACL injuries at a younger age than males. Around 19 out of 20 elite football players that sustain an ACL injury are reconstructed (having a new ACL through surgery), suggesting a common opinion at elite level that a player with ACL rupture needs surgery to be able to return to top level football. It is normally not possible to play football or participate in other pivoting sports without a good function of the ACL.

The caretaking of ACL injuries at elite level represents the optimal situation: the players are supported by a highly qualified medical team, the diagnosis of an ACL injury is quickly established (as a mean 8 days), the surgery was performed at an optimal phase by very experienced surgeons and the intensive, individual rehabilitation after surgery was supervised by highly experienced physiotherapists (4). Under these ideal circumstances it is possible to achieve an outcome in excess of 90% in terms of return to football at the same high level as before the injury.

However, even under ideal caretaking, the rehabilitation is long after an ACL injury. The mean lay-off before return to full team activi-

ty after ACL surgery was between 6-7 months and the mean absence before match play was almost 8 months (82% returned to match play within 8 months).

The fact that it was possible for almost all elite level players to return to football after ACL surgery does not necessarily mean that return-to-play is always ideal from a medical point of view. Many elite football players suffer from swelling and other overuse injuries shortly after their comeback to football, possibly indicating premature return (24).

Jumper's knee – an overuse injury with a high recurrence rate

Although mainly mild in nature, patellar tendon injuries are fairly common in elite football, representing around 1.5% of all injuries. The recurrence rate is high with around 20% being early recurrences (injury of the same type and at the same site as an index injury occurring no more than two months after a player's return to full participation from the index injury). Exposure to artificial turf did not increase the prevalence or incidence of injury. Increased body mass and high total amount of exposure were identified as risk factors for patellar tendon injury (18).

Groin injuries – we need a consensus of how to diagnose and treat these injuries

This sub study of UEFA Injury Study recorded hip/groin injuries from 23 male professional clubs, followed a varying number of seasons from 2001/02 to 2007/8 (27).

Groin injuries are common in professional football, representing 12-16% of all injuries, the incidence studied over several seasons being consistent.

Re-injuries in the hip/groin region are common (15%) and cause longer absence than the index injury. Diffuse symptoms make diagnosis of groin injury difficult, and recognised diagnostic criteria are lacking. Diagnosis of groin injury still relies to a large extent on clinical examination. The value of radiological examinations and the use of independent radiologists to further sharpen diagnostics need be investigated further.

Stressfractures are not common in footballers but take long time to heal

A team of 25 players can't expect one stress fracture every third season. All fractures affected the lower extremities and 78% the fifth metatarsal bone. Stress fractures to the fifth metatarsal bone, tibia or pelvis caused absences of 3-5 months (12).

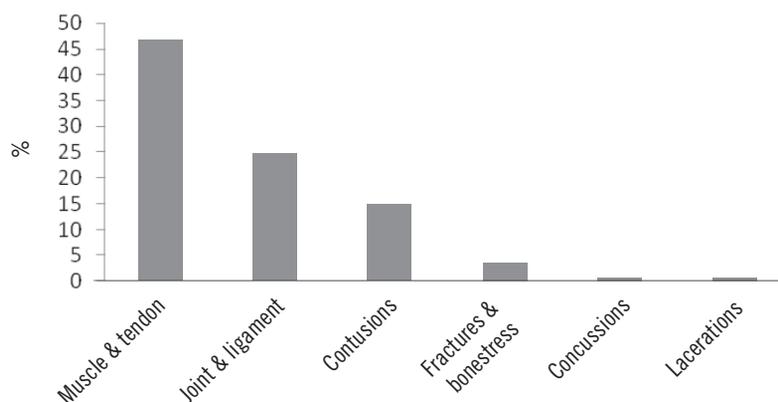


Figure 3: The most common types of injuries (UCL seasons 2001/02 to 2011/12).

sal bone. Stress fractures to the fifth metatarsal bone, tibia or pelvis caused absences of 3-5 months (12).

No increased risk of playing on football turf compared to playing on natural grass

The latest generation of artificial turf surfaces is increasingly being installed and used within European football. These new pitches offer football-specific features that are similar to those found with well-maintained natural turf pitches. Consequently, FIFA (Fédération Internationale de Football Associations) in 2004 decided that matches may be played on artificial surfaces, according to the rules of the competition. The Laws of the game (FIFA 2009) state: "Where artificial surfaces are used in either competition matches between representative teams of member associations affiliated to FIFA or international club competition matches, the surface must meet the requirements of the FIFA Quality Concept for Artificial Turf or the International Artificial Turf Standard, unless special dispensation is given by FIFA". The FIFA Quality Concept is an evaluation programme with laboratory and field tests aiming to set high quality standards and criteria for artificial surfaces. FIFA and UEFA have introduced the terminology of "football turf" for artificial turf pitches meeting the criteria of the FIFA Quality Concept criteria.

Playing football on the older generations of artificial surfaces had disadvantages; for example, they changed the performance characteristics and the injury pattern of the sport (10). Despite the wide use of football turf pitches by non-elite players and despite their obvious advantages such as increased pitch utility and the possibility of providing a good year-round quality pitch irrespective of climate conditions, acceptance is limited by elite teams.

The risk of injuries and the injury pattern when playing on football turf in comparison when playing on natural grass has been studied on male and female elite level (2,7,11), as well as on amateurs (14,15), in youths (22) and in tournaments (21).

All these studies found that there were no major differences in the overall injury risk between the two surfaces, neither in training nor in matches, neither in men nor in women and neither at adult elite level nor at amateur youth level.

However, there might be differences in the pattern of injury sustained on these two surface types. Indications of a lowered risk of muscle strains when playing on the new generation of artificial turf pitches compared to playing on natural grass, as well as a tendency to a higher risk of ankle sprain have been reported.

Playing too many matches – negative for both performance and player availability

Ekstrand et al. (13) studied the correlation between match exposure for professional footballers participating in UEFA Champions League study and their performances and injuries during the 2002 World Cup. Players that had a tight match schedule before the World Cup were more likely to underperform and sustain injuries in the World Cup. The number of matches during a season varied between 40 and 76 for the different countries. The individual player played an average of 36 matches during the season, meaning that even if the team played many matches, the individual players did not, mainly because of rotation of players and big squads. However, top players (world cup players) played many matches

(average 46 vs 33 per season), especially at the end of the season (due to many important matches).

These top players did not show any increased risk during the season. A top player can cope with a congested match calendar for a short period. However, every second year, the leagues season is followed by a World Cup or a European Championship, meaning little time for relaxation and restitution for top players. Players that had played many matches (>1/week) during the last 10 weeks of the season 2001/02 sustained more injuries and underperformed during the following WC 2002 when compared to players playing less matches at the final league play period. A similar result was found during the 2003/04 season and the following Euro 2004. A period of match congestion can lead to player fatigue, which may result in injury and/or underperformance during the following period.

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