Incidence of Injury in Gaelic Football: A 4-Year Prospective Study

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Incidence of Injury in Gaelic Football

A 4-Year Prospective Study

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Background: Gaelic football is a national sport of Ireland. While predominantly played in Ireland, it is recognized in North America, the United Kingdom, Europe, and Australasia. Its high-velocity, multidirectional, and high physical contact elements expose players to a risk of injury. To date, prospective injury data for Gaelic football has been of short duration.

Purpose: To describe the incidence and nature of sport-related injuries in elite male Gaelic football players over 4 consecutive seasons.

Study Design: Descriptive epidemiology study.

Methods: Over the period 2007 to 2010, a total of 851 Gaelic football players were tracked. Players were members of county-level teams who volunteered to be included in the study. Team injury, training, and match play data were submitted by the team physiotherapist on a weekly basis through a dedicated web portal to the National Gaelic Athletic Association (GAA) injury database. Injury was defined using a time loss criterion, in accordance with consensus statements in sports applicable to Gaelic games.

Results: A total of 1014 Gaelic football injuries were recorded. Incidence of injury was 4.05 per 1000 hours of football training. Match-play injury rates were 61.86 per 1000 hours. Muscle was the most frequently injured tissue (42.6%) and fractures accounted for 4.4% of Gaelic football injuries. Lower extremity injuries predominated (76.0%). Hamstring injuries were the single most common injury overall, representing almost one quarter (24%) of all injuries and over half of muscle injuries. Anterior cruciate ligament (ACL) injuries accounted for 13% of knee injuries. The majority of injuries were defined as new injuries (74.7%), with recurrent injuries constituting 23% of all injuries. The majority (59%) of match play injuries occurred in the second half of the match. Eighty six percent of injuries caused over one week's absence from play.

Conclusion: These findings illustrate injury patterns in Gaelic football using a prospective methodology, over 4 consecutive seasons. Comparison with published literature suggests that Gaelic football match play injury risk is greater than soccer but less than rugby union.

Keywords: injury; GAA; football; surveillance; epidemiology

Gaelic football is one of Ireland's most popular field games, drawing crowds of over 80,000 spectators for the elite-level intercounty competitions. Although concentrated in Ireland, the sport is recognized internationally with competitions in the United Kingdom, Europe, North America, and Australasia. Teams from London and New York compete in the All-Ireland Senior Football Championship, the highest level of the game.

It can be described as a high-intensity, high-velocity, multidirectional, contact field game requiring speed, strength, and agility.[28] One of the main attractions of Gaelic football is the speed at which it is played.[44] Characterized by intermittent short and fast movements such as sprinting, turning, jumping, catching, and kicking, it also involves high levels of physical contact between players. Matches at the elite level are of 70 minutes' duration, where teams of 15 players compete on a rectangular playing field, with an area greater than that of both soccer and rugby pitches. The aim is to score either a goal, under the crossbar, or a point, over the crossbar. It is played with a round leather ball that is passed to a teammate by foot or by hand. The ball spends the majority of the time in the air; therefore, overhead skill is a unique defining aspect of the game. Tackling is regulated by a referee, limiting unfair play. The aim of the tackle is to prevent the opponent from passing the ball to another team member or to prevent a score being obtained. A player may make a shoulder to shoulder charge on an opponent who is in

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possession of the ball, who is playing the ball (other than when kicking it), or when both players are moving in the direction of the ball to play it.[19]

Although Gaelic football is an amateur game, governed by the Gaelic Athletic Association (GAA), it is recognized that the level of commitment shown in terms of number of hours training at elite level suggests a professional attitude to the game.[8]

Gaelic footballers are subject to considerable biomechanical stresses and contact forces, which expose the player to risk of injury. As with other sports, Gaelic game injuries have a major significance for the player who experiences trauma, pain, and loss of function that may affect both sporting and daily life.[29]

Despite the popularity of Gaelic football, it has received relatively little attention with regard to prospective injury epidemiology or injury prevention research. There have been some prospective and retrospective injury studies,[8,11,30,41,44] all of which provide valuable information on player injury in county and club standard teams. However these have been, in general, of short duration.

More recently, the GAA identified the need to establish a systematic year on year database to measure and monitor injury in elite Gaelic games. Such a prospective longitudinal design is the keystone for further scientific research, where the effect of changes in rules of play, coaching methods, training or rehabilitation protocols, as well as modification of external factors may be measured in terms of player injury levels.[3,6,31,39,43] The teams included in this elite level database are intercounty representative teams who compete in the highest grade, senior league, and championship competitions. Only limited preliminary data from this database have been presented, at international conference, to date.[2] The purpose of this study is to describe the results of the first 4 years of Gaelic football injury surveillance, providing data on the largest prospective study of Gaelic football injury to date.

METHODS

The competition season for these elite Gaelic football players runs over 9 months, commencing with preliminary cup and shield competitions in January, each year. These are followed by a National Football League and then the All-Ireland Football Championship. The latter is considered the premier competition in the sport, culminating in the All-Ireland Final in September of each year. This was a prospective cohort study, which followed enrolled teams weekly, from January 2007 until the team was eliminated from competition (generally between June and September of that year). Data collection then ceased for the off-season and recommenced in January of the following year. The data from 2007 to 2010 were included in this analysis.

All teams at the senior intercounty grade were eligible for inclusion provided that they had a medical practitioner or chartered physiotherapist present at every match and training session who could verify injury occurrence and diagnosis. Teams volunteered participation. Data were collected through a dedicated secure web portal, designed for this purpose, which registered information to the National GAA Injury Database hosted at UCD Dublin. Player exposure to match play and training was also recorded.

The participants were male senior county-level footballers. Players for these county representative teams are selected by the county team manager and selection officials based on performance at club competition and county trials. Eligibility to play for a given county is limited geographically to players affiliated with the clubs within that county boundary.

Ethical Approval

Players were informed of the purposes and methods of the study and were given the opportunity to decline submission of their data as part of anonymous team reports. Players were automatically assigned a unique identifier code and player identity was concealed, ensuring that player anonymity was maintained and there was compliance with data protection legislation. Ethical approval was received by UCD Human Research Ethics Committee.

Definitions

Injury definitions were derived by consensus with the GAA Medical, Scientific and Player Welfare Committee following a review of international best practice guidelines and consensus statements for other sports.[4,14,16] A time loss injury definition from training or match play was used due to the weekly variability in competition fixtures.

Injury was defined as "any injury that prevents a player from taking a full part in all training and match play activities typically planned for that day, where the injury has been there for a period greater than 24 hours from midnight at the end of the day that the injury was sustained" (adapted from Brooks et al[3,4]). A player was deemed to have returned to full fitness when able to take a full part in training activities and be available for match selection. Return to partial fitness was designated when the player was able to partake in training but was not match fit.

A *recurrent injury* was defined as "an injury of the same type and at the same site as an index injury and which occurs after a player's return to full participation from the index injury." Further subclassification according to duration since initial injury was introduced in 2008. A recurrent injury occurring within 2 months of a player's return to full participation was referred to as an *early recurrence*, one occurring 2 to 12 months after a player's return to full participation as a *late recurrence*, and one occurring more than 12 months after a player's return to full participation as a *delayed recurrence*.[16]

Other agreed definitions included classification into acute injuries, overuse injuries, or chronic injuries similar to the description used by Van Mechelen et al.[38] Severity of injury was determined by calculating mean time loss from sport for key injury types.

Procedures

The team physiotherapist or doctor recorded the baseline data, including player demographic details and both past and current injury history. Position of play, involvement in other levels of competition, and use of protective equipment were also recorded. Age was defined in years as of January 1 of that year. Thereafter, the team physiotherapist or doctor recorded data on a weekly basis regarding new injuries to players and progression of injured players. This specifically required an update of the status of prior injured players into still injured, partial fitness, or full fitness. The required data for each new injury included date of injury, mechanism of injury, body region, main tissue injured, side of injury, whether recurrent or new, severity of injury, and clinical diagnosis. Time of injury in game was recorded if appropriate, as were weather conditions.

Analysis

The data were analyzed by calculating percentages and injury rates per 1000 hours, with 95% confidence intervals (CI). Percentages were calculated from available totals, namely, percentage of all injuries, unless otherwise specified. Risk ratios (RR) and 95% CI were used to compare injury rates. Chi-square tests were used to compare proportions. Computations were calculated using PASW 18,[24] the Confidence Interval Analysis Package v2.1.2,[1] and VRP Injury Software (University of North Carolina, Chapel Hill, North Carolina).[40]

RESULTS

Participants

Twenty-three male senior intercounty football teams were followed over the 4 seasons; 5 in 2007, 8 in 2008, 3 in 2009, and 7 in 2010. In total, 851 players were tracked: 183 in 2007, 296 in 2008, 119 in 2009, and 253 in 2010. A further 7 teams were recruited, having met the inclusion criteria and expressed willingness to participate. However these teams could not comply with the ongoing requirements and they dropped out within the initial 2 weeks, 1 in 2008, 5 in 2009, and 1 in 2010. The response rate was, therefore, 77% (95% CI, 60.25-85.75) across the 4 seasons overall. The median panel (squad) size per week was 35 players (Interquartile range = 33-37), with 15 of these players taking to the field for each game. Only 15 players from the team are allowed to play at one time but there are 5 substitutions allowed during each game. Mean age of players was 24.9 years (95% CI, 24.7-25.1). Age ranged from 18 to 36 years.

Injury Incidence

A total of 1014 injuries were reported from a total of 106,885 hours of participation in Gaelic football activities. Of these, 950 (94%; 95% CI, 92.02-95.02) were directly attributed to either match play or field training, with 64 (6%; 95% CI, 5.0-8.0) not attributed to a single match or training session, having insidious onset. The resultant incidence rate was 61.86 injuries per 1000 hours of match play and 4.05 injuries per 1000 hours of training activities, when the 4 seasons of data collection were considered (Table 1).

TABLE 1
Exposure and Injury Rate Gaelic Football, 2007-2010

	Exposure Time, h	Number of Injuries	Injuries per 1000 h	95% Confidence Interval
Training	97,950	397	4.05	3.82-4.27
Match	8940	553	61.86	57.80-65.92
Other	—	64	—	—

TABLE 2
Percentage of All Players and Injured Players Across Age Groups[a]

	All Players, %	Injured Players, %	Ratio Injured: All Players
18-20 years	11.3	6.4	0.57
21-24 years	40.0	40.2	1.01
25-29 years	39.2	41.7	1.06
30 years and older	9.5	11.5	1.21

[a]Comparison between age groups; $\chi^2 = 8.08$, $df = 3$, $P = .044$.

Match play incurred an incidence of injury that was markedly higher than in training (RR = 15.3; 95% CI, 13.4-17.3). The participating teams spent almost 11 times more hours training than they spent in matches. There were occasional rest weeks from training, but during the training weeks the median number of training hours was 4.5 (range, 1-12). Fifty nine percent (95% CI, 55.5-62.5) of match play injuries occurred in the second half of the match. Split into quarters, 11.8% (95% CI, 9.72-14.34) of injuries occurred in the first quarter, 29.1% (95% CI, 26.0-32.43) in the second, 35.9% (95% CI, 32.56-39.40) in the third, and 23.1% (95% CI, 20.27-26.29) occurred in the fourth quarter.

These 1014 injuries occurred in 587 of the 851 players, so the overall percentage of players sustaining injury was 69% (95% CI, 65.8-72.0). The rate of injury per player was 1.19 (95% CI, 1.12-1.26).

Relationship Between Age, Position of Play, and Injury

Players were stratified into 4 age groups: 18-20 years, 21-24 years, 25-29 years, and 30 years and older. The age of the player was also recorded for each injury sustained and subclassified into the same age groups (Table 2). The greatest proportion of injuries occurred in the 25-29 years age group, followed closely by the 21-24 years age group, but these were also the age groups with the highest

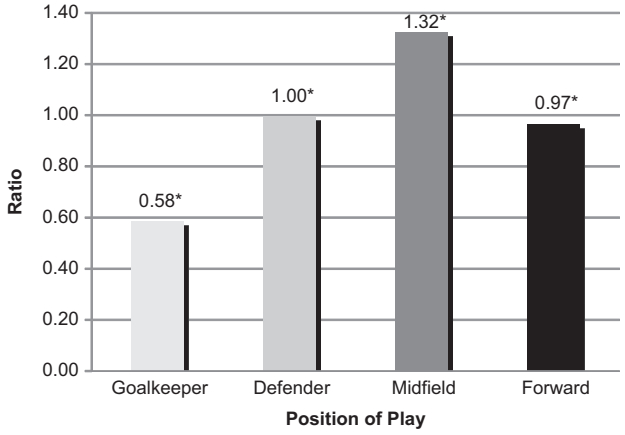

Figure 1. Comparison of players injured according to position (χ^2 = 10.29, *df* = 3, *P* = .016). *Comparison of observed versus expected percentage of players injured in each playing position expressed as a ratio of all players.

TABLE 3
Regional Distribution of Injury

	n	%	95% Confidence Interval
Pelvis and groin	95	9.4	7.7-11.3
Hip	31	3.1	2.2-4.3
Thigh	338	33.3	30.4-36.2
Knee	115	11.3	9.35-12.25
Shin	10	1.0	0.5-1.8
Calf	53	5.2	4.0-6.8
Ankle	101	10.0	8.16-11.84
Foot and toes	28	2.8	1.9-4.0
Shoulder	63	6.2	4.9-7.9
Elbow	12	1.2	0.7-2.1
Forearm	3	0.3	0.1-1.9
Wrist	10	1.0	0.5-1.8
Hand and fingers	15	1.5	0.9-2.4
Thumb	10	1.0	0.5-1.8
Head/neck	37	3.6	2.7-5.0
Trunk	80	7.9	6.4-9.7
Unspecified	13	1.3	0.8-2.2
Total	1014	100	

percentage of players. When the ratio of injured players to total players across the age groups are compared, it is evident that there is a positive stepwise relationship between age and injury, being lowest in the youngest age group and highest in the oldest, *P* = .044 (Table 2).

In a game of Gaelic football, there is only one goalkeeper playing at any stage during a game for each team, while there are 6 defenders, 6 forwards, and 2 midfielders. For this reason, frequency of injury was also standardized by giving a ratio of injuries to the number of players registered to each position. The ratio of injuries sustained, according to position of play, is shown in Figure 1. A chi-square test was performed to compare observed against expected percentage of players injured in each playing position. This showed significant difference in proportions (χ^2 = 10.29, *df* = 3, *P* = .016). Those in the midfield position had a higher relative proportion of injury while the goalkeeper had the lowest.

Type and Location of Injury

Player-to-player contact injuries accounted for 32.2% (95% CI, 29.32-35.08) of all injuries while noncontact mechanisms of injury were more prevalent. These included sprinting (26.8%; 95% CI, 24.07-29.53), turning (12.0%; 95% CI, 10.0-14.0), and landing (7.1%; 95% CI, 5.52-8.68). Kicking was reported as a mechanism in 4.5% of cases (95% CI, 3.22-5.78).

The most frequently injured tissue was muscle (42.6%; 95% CI, 39.56-45.64), followed by ligament (13.2%; 95% CI, 11.12-15.28) and tendon (9.2%; 95% CI, 7.42-10.78). Fractures amounted to 4.4% (95% CI, 3.13-5.57) of the total injuries over the 4 years. Average time lost for muscle injuries was 19.7 days (95% CI, 16.1-23.2), ligament (excluding anterior cruciate ligament [ACL]) injuries 25.3 days (95% CI, 16.9-3.7), and tendon injuries 32.4 days (95% CI, 21.3-43.6). The more severe fractures resulted in players being unable to return to play during that same season. The remaining fractures included facial and skull fractures as well as undisplaced injuries to the metacarpals and clavicle. For these fractures, where the player did return to play within the season, the average time loss was 38.7 days (95% CI, 19.9-57.6).

Over three quarters of all injuries affected the lower extremity (76.0%; 95% CI, 73.37-78.63), while 11.1% (95% CI, 9.16-13.04) involved the upper extremity. Injuries of the trunk (7.9%; 95% CI, 5.24-9.56) and the head or neck (3.6%; 95% CI, 2.45-4.75) were less numerous. Data are further broken down in Table 3.

The most frequently injured body part was the thigh (33.3%; 95% CI, 30.4-36.2), followed by the knee (11.3%; 95% CI, 9.35-13.25) and ankle (10.0%; 8.16-11.84) (Table 3). For the thigh, hamstring injury was the most prevalent, emerging as the single most common injury overall. The hamstring accounted for 24% (95% CI, 21.37-26.63) of all injuries over the 4 years, representing almost 52% of muscle injuries. ACL injuries accounted for 13% (95% CI, 8.1-20.4) of knee injuries. This represents 1.5% (95% CI, 0.9-2.4) of all injuries and was the most severe injury in terms of time loss. Exact time loss data for ACL injuries was not collected, but we know none of the players with ACL injury returned to play within that same season. In the ankle, the most commonly reported injury was ligament sprain to the anterior talofibular/lateral ligament complex (33.8%; 95% CI, 24.0-45.2), accounting for 3.6% (95% CI, 2.5-5.3) of all injuries.

Recurrence and Severity of Injury

The majority of injuries were defined as new injuries (74.7%; 95% CI, 71.0-77.4), with recurrent injuries constituting 23% (95% CI, 20.5-25.7) of all injuries. Recurrent injuries were further subclassified as early recurrent

TABLE 4
New and Recurrent Injury (N = 1014)

	n (%)	95% Confidence Interval
New	758 (74.7)	71.0-77.4
Recurrent	233 (23.0)	20.5-25.7
Early (<2 months)[a]	47 (29.0)[b]	22.6-36.4[b]
Late (2-12 months)[a]	72 (44.4)[b]	37.0-52.1[b]
Delayed (>12 months)[a]	43 (26.6)[b]	20.3-33.8[b]
Unspecified	23 (2.3)	1.5-3.4

[a]Subclassification of recurrent injury not recorded in 2007.
[b]Percentage and 95% confidence interval calculated out of available total.

(6.9%; 95% CI, 5.2-9.0), late recurrent (10.5%; 95% CI, 8.4-13.0), and delayed recurrent (6.3%; 95% CI, 4.7-8.2), as outlined in Table 4.

The severity of the injury sustained was predicted according to time lost from match play or training. It emerged that when the time lost was calculated that 13.2% (95% CI, 10.1-17.1) were mild, 45.2% (95% CI, 40.1-50.4) were moderate, and 41.6% (95% CI, 36.6-46.8) were severe.

DISCUSSION

This is the largest study performed on Gaelic football injuries to date and the results presented here give an overview of injuries sustained in the sport, using internationally comparable injury definitions. Only injuries that caused matches or training to be missed were recorded. It is argued that using this definition may cause some important injuries to be missed.[25,36] However, a "time loss" definition from training or match play was adopted in this study, in line with international best practice guidelines and consensus statements for other sports.[4,14,16] Therefore, these results provide benchmark data using an internationally accepted definition of injury, allowing elite Gaelic football to be compared with other football codes.

Injury Incidence

Injuries were sustained by 69% of the players, so 31% escaped injury within that season. This is comparable with the 66% reported in an earlier elite Gaelic football cohort where there was a rate of 1.46 injuries per player.[30] Here there were 1.19 injuries for every player registered, so for a squad of 34 players, just over 40 injuries can be expected in a season of average duration. Furthermore, over 86% of these injuries will result in absence from match play for more than a week, highlighting the burden of injury for both the players and the team.

The main findings of this study are that the injury rate for participation in match play was 61.86 per 1000 hours and 4.05 per 1000 hours for training. The training load for each player was shown to be substantial, with up to 15 hours training per week (median 4.5 hours overall), illustrating the near professional status of players at this level. However, while over 11 times more hours were spent in training than match play, the relative risk of injury was 15.3 (95% CI, 13.4-17.3) greater during games than in training, confirming that the highly competitive match play situation is where most of the injuries occur. This is not unexpected since not all time spent in training replicates the intensity of match play, focusing on noncontact skill sessions and lower intensity player contact. This difference between training and match injury risk is common to other sports, but it was interesting to note that training hours in club Gaelic football players was only 5 times that of match play[44] compared with the 11-fold difference here in the elite player cohort.

Comparison Across Other Football Codes

In Gaelic football, there are only 2 earlier prospective studies conducted on club[44] and county[30] players. In these the match play injury rates were 51.3 per 1000 hours for club and 64 per 1000 hours for county players compared with the 61.86 per 1000 hours found here, while the training injury rates were somewhat higher (5.5 and 5.8/1000 hours) compared with our results (4.05/1000 hours).[30,44] The evidence base for injury prevention has also grown over recent years, so the lower rate seen here in this most recent study might reflect the implementation of this knowledge into training practice at the elite level. However, it may not be appropriate to compare our current findings with these as there are some differences in injury definition and our results are based on a larger cohort over a far longer duration, which corrects for the season-to-season variability which often exists.[7] Furthermore, club level players may also have differences in intensity of the physical demands, support structures, and injury prevention resources at their disposal, making direct comparison difficult.

The existing data on soccer injury afford an interesting comparison with Gaelic football. The Union of European Football Associations (UEFA) injury study involving 23 first team European male squads from 2006 to 2008 found an injury incidence of 27.5 per 1000 hours for match play and 4.1 per 1000 hours for training.[10] The match play rate in the European Championship was subsequently reported to be somewhat higher (41.6/1000 hours).[23] A study on Swedish premier league male soccer clubs found a match play incidence of 28.1 per 1000 hours and training incidence of 4.7 per 1000 hours.[21] Another study on soccer injury in American collegiate men reported incidence rates of match play (25.43 injuries/1000 player hours on artificial turf and 23.92 on grass) and training injuries (3.34 injuries/1000 player hours on artificial turf and 3.01/1000 hours on grass).[13] A recent report of the 2010 Fédération Internationale de Football Association (FIFA) world cup reported an incidence of 40.1 match and 4.4 training injuries per 1000 hours[9]; however, direct comparison cannot be made due to differences in injury definition. Comparisons can be drawn with the aforementioned studies that used similar injury definitions and reporting methods. All of these data suggest that while training injury is similar across these 2 football

codes, Gaelic football match play injury is 1.5 to 2.6 times greater than that reported in soccer.

When compared with rugby union, the match play injury incidence in Gaelic football is 68% to 74% of that in rugby, while Gaelic football training injury rates are higher than reported in rugby. Brooks and colleagues,[5] from whom we adopted our GAA injury definition, reported an incidence of 2 injuries per 1000 hours' training and 91 injuries per 1000 hours' matches[4] in professional rugby union, while results from the rugby union 2007 men's world cup showed an injury incidence of 83.9 per 1000 match hours and 3.5 per 1000 training hours.[15]

In rugby league, the injury rate in a combined sample of division 1 and 2 teams was 405 per 1000 match playing hours,[27] while professional team training injuries have been reported to have an incidence of 20.7 per 1000 hours.[18] Training incidence in the preseason training was lower (6.9/1000 training hours) for professional players.[26] Authors in these studies used the injury definition "any pain or disability that occurred during participation in a rugby league training activity that was sustained by a player, irrespective of the need for training time loss or medical attention," explaining why these reported injury rates are far greater than Gaelic football or any other football code and why direct comparisons cannot be made.

Similarities in mechanics, movement patterns, and physical demands have been highlighted anecdotally between the Australian Football League (AFL) and Gaelic football. Origins of Australian football have been linked to the Gaelic game. Close links between the 2 organizational bodies means that an International Rules game takes place annually, in which AFL players compete against Gaelic football players in a game of compromised rules. With associations like this it is interesting to compare the incidence of injury between these sports. The AFL annual injury report provides comprehensive data on injury incidence. An early study reported an overall rate of 62 injuries per 1000 hours in AFL,[37] while a review of elite AFL teams between 1997 and 2000 found an injury incidence of 25.7 injuries per 1000 player hours. These were not subdivided into training and match incidence rates.[33] Furthermore, the incidence is expressed as seasonal injury incidence measured in units of new injuries per club per season (where a club is defined as 40 players and a season is defined as 22 rounds),[32] thus direct comparison with our data was not possible.

When drawing comparisons between the different codes, we must be cautious and ensure that similar definitions and injury reporting methods are used. Looking only at the papers mentioned (where trained medical personnel have reported injuries according to a time loss definition similar to ours), we can deduce that Gaelic football carries a match play injury risk that is greater than soccer but less than rugby union. These games all have similar training injury incidence, but it is in the competitive game situation that differences emerge. This is not surprising given the robust tackles and player-to-player contact seen in rugby. This is permitted to a lesser extent in Gaelic football, but is a defining feature of the game and is reflected in the higher injury incidence than soccer.

Type and Location of Injury

In common with prior research in Gaelic football, and other football sports, lower limb injury predominated. Over 76% of injuries here were to the leg, compared with 71% as reported in earlier research in senior club and county players, respectively.[30,44] Similarly, 73% of injuries in UEFA soccer were to the lower limb.[10] Hägglund et al[22] estimated the lower limb injuries range from 87% to 89% of all injuries recorded.

Thigh injuries account for one third of all injuries in this study, compared with 12% reported in club players.[44] The ankle was the most commonly injured site in club players,[44] 13.3%, compared with 10% in the current study. In a study of both Gaelic football and Hurling injuries,[42] they found ankles constituted 12.7% of all injuries recorded.

Hamstring injury was the most prevalent injury sustained by our study population overall, 24%. In Australian Football League,[34] hamstring injuries accounted for only 17% of all injuries over a 10-year period. This may indicate the need to address hamstring injury prevention and management in Gaelic football. A Cochrane review[20] could draw no conclusions on the effectiveness of interventions used to prevent hamstring injuries in people participating in football. However, Petersen et al[35] have recently confirmed findings by Gabbe et al[17] that eccentric training protocols for the hamstring can decrease the rate of hamstring injuries. Research is required to empirically test such interventions in this population.

ACL injury accounts for 1.5% of injuries in this study, while in sports with similar physical demands of jumping and landing such as the AFL their percentage incidence is 2.0%.[34] Because of the severity and the lengthy rehabilitation required with this injury, as well as the cost of ACL repair, an improvement in ACL incidence would be valuable to the sport. Although Gaelic football shows a lower percentage incidence for ACL injury, prevention methods must be optimized to ensure that occurrences of these severe injuries are minimized.

Tissue Injured

Muscle trauma was responsible for 42.6% injuries in this cohort. Combined muscle and tendon injuries were 52.8%. These figures are higher than prior Gaelic football research where 27.1% was reported for muscle injury,[44] with figures of 31.1%[44] and 42%[30] for combined muscle and tendon injury. Ekstrand et al[10] reported that muscle injuries accounted for 31% of all injuries in professional soccer football. The same study reports that hamstring injuries were the most prevalent muscle injury (37% muscle injuries). In contrast, our findings indicate that hamstring strains represent over half of all muscle injuries and almost a quarter of the total injuries in Gaelic football. Given this high incidence and the substantial time loss that results from muscle trauma (average of 19 days), further focus on these injuries is warranted.

Recurrence of Injury

Almost a quarter of all injuries (23%) were recurrent, with 29% of these recurring within 2 months of the index injury, highlighting the implications for prevention of recurrent injuries within this population. This might be due to premature return to play, therefore these recurrent injuries warrant more investigation.

Mechanism of Injury

Although there is a clear risk of contact injuries associated with this game, the principal mechanisms of injury were noncontact in nature, involving sprinting, turning, and landing. These actions reflect the mechanisms already identified for hamstring, knee, and ankle injuries.

To date there has been little investigation into the landing and cutting mechanics of Gaelic football, nor have intrinsic and extrinsic risk factors for injury been systematically investigated. Some associations between injury incidence, older age, midfield position, and second half of match play have emerged here, but these relationships should be interpreted with caution since further exploration is required to identify independent predictors in multivariate models.

CONCLUSION

The results presented here provide an overview of the incidence of injury in Gaelic football, highlighting the most common and serious injuries for players and teams. The findings provide standardized injury rates using consensus injury definitions and classifications. Quantifying incidence of injury is the first step in injury prevention models and thus is the theoretical basis for the science of sports injury prevention.[12,38] Injury definitions and methods used in this study were in line with international best practice guidelines and consensus statements for other sports,[4,14,16] meaning this study provides information with which international research in other football codes can be compared. Given the high proportion of lower limb muscle and ligamentous injury, further, more detailed exploration of lower limb injury mechanisms, recurrence, and associated risk factors are required as the second step in injury prevention research.[12,38] From this, injury prevention protocols may be developed and empirically tested.

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