ORIGINAL ARTICLE

A 6-month prospective study of injury in Gaelic football

F Wilson, S Caffrey, E King, K Casey, C Gissane

Br J Sports Med 2007;41:317–321. doi: 10.1136/bjsm.2006.033167

See end of article for
authors' affiliations

Correspondence to:
Ms F Wilson, School of
Physiotherapy, Trinity Centre
for Health Sciences, St James
Hospital, James's Street,
Dublin 8, Ireland; wilsonf@
tcd.ie

Accepted 8 November 2006
Published Online First
29 November 2006

Objective: To describe the injury incidence in Gaelic football.

Methods: A total of 83 players from three counties were interviewed monthly about their injury experience, during the 6 months of the playing season.

Results: The injury rate was 13.5/1000 h exposure to Gaelic football (95% CI, 10.9 to 16.6). There were nearly twice as many injuries during matches (64.4%, 95% CI, 54.1 to 73.6) as in training (35.6%, 95% CI, 26.4 to 49.5). The ankle was found to be the most commonly injured site (13.3%, 95% CI, 7.8 to 21.9). The musculotendinous unit accounted for nearly 1/3 of all injuries (31.1%). The tackle accounted for 27.8% of the injuries sustained (tackler 10%, 95% CI, 5.4 to 17.9; player being tackled 17.9%, 95% CI, 11.2 to 26.9). Of total match injuries, 56.9% (95% CI, 46.1 to 67.1) were experienced in the second half as opposed to 39.7% (95% CI, 29.8 to 50.5) in the first half.

Conclusions: Gaelic footballers are under considerable risk of injury. Greater efforts must be made to reduce this risk so that players miss less time from sport due to injury. Risk factors for injury in Gaelic football must now be investigated so that specific interventions may be established to reduce them.

Gaelic football is the national game in Ireland.^{1,2} The game has 15 players on each side, and is played with a round leather ball that is slightly smaller than a soccer ball but weighs slightly more. The pitch is 130–145 m long and 80–90 m wide. H-shaped goalposts, similar to those used in rugby, are located centrally at either end of the field. The aim of the game is to outscore the opposing team by putting the ball over the bar (1 point) or in the net under the crossbar (3 points). The ball can be carried for a distance of four steps before it has to be bounced once or toe-tapped (kicked to oneself).³ It is passed to a team mate either with the foot or by hand. Each team has one goalkeeper, six defenders, two midfielders and six attackers. A game is 60 min long at club level and 70 min at county level. One of the main attractions of Gaelic football is the speed at which it is played. This, when coupled with much physical contact, acceleration, deceleration and turning, is likely to result in a significant rate of injury in the game.⁴

Despite the popularity of Gaelic games, and in particular football, Gaelic football has received relatively little attention. Studies examining injuries in Gaelic football have mainly concentrated on the presentation of injuries in accident and emergency departments,^{5–8} or have been carried out retrospectively.⁴ Those that have been conducted prospectively have concentrated on specific injuries, such as ankle injuries.⁹ Given the paucity of available information, the purpose of this study was to conduct a 6-month prospective study of injuries in Gaelic football.

METHODS

The study design was a prospective cohort study, carried out over a 6-month time period on Gaelic footballers participating at senior club level. Data were recorded monthly by telephone interview. Ethical approval was sought and received for this study from the Faculty of Health Sciences Ethics Committee, Trinity College, Dublin.

Subjects

The subject group examined in this study were male Gaelic footballers playing at senior club level. These players were recruited from the provinces of Ulster, Leinster and Connacht.

It was hoped that this would give a more accurate representation of the wider football population in Ireland. Players from seven teams participated in the study and these teams were selected from counties Cavan (two), Dublin (one) and Galway (four). To be eligible for this study, players had to be >18 years of age, have played at senior level the previous season, and be attending at least one scheduled training session a week.

Footballers involved with their respective county panels were excluded owing to their inconsistent attendance at club training sessions and matches. Those players playing other sports competitively (ie, with registered teams in official competitions) were also excluded to avoid distorting risk factors for injury in Gaelic football and to prevent players reporting injuries that might have occurred as a result of another sport. Participants in the study first signed a consent form confirming their enrolment and acknowledged the confidentiality of their personal details.

MEASUREMENT QUESTIONNAIRE

Procedure

Each player was assigned to one of the investigators, who called them every month for the 6 months to conduct a brief telephone interview concerning Gaelic football exposure and injury experience during that month. Each interviewer contacted their group of players during the first week of each month for information regarding injury rate in the previous month. If the investigator was unable to contact the player during that period, it was noted and the player was contacted again at the beginning of the next month. Each interviewer called the same players each month to facilitate interviewer–player rapport. During the same period, the manager of each team was contacted for the number of training sessions the team had that month and an average time for each training session. This was carried out to allow injury rates per 1000 training hours to be calculated.

The monthly questionnaire used in this study was modelled on that used by the Rugby Injury and Performance Project.¹⁰ The monthly questionnaire comprised three sections and was preceded by a section noting the relevant details of the interview including the day, date and time of the interview and how long it took to complete the interview.

Table 1 Injuries sustained while playing and training for Gaelic football

	Playing	Training	Total
Number of injuries	58	32	90
Exposure(hours)	1133	5525.1	6658.1
Injury rate/1000 h	51.2	5.8	13.5
95% CI	38.9 to 66.2	4 to 8.2	10.9 to 16.6

The first section detailed information on the training and matches the player took part in during the previous month. At the start of the section there were definitions given for strength, endurance, interval, flexibility and skill training so that all the players would be given the same description of each. The section went on to account for the number of games played, protective equipment worn and training/matches missed because of injury. It also noted the warm up, warm down and stretching routine the player used before and after exercise during the previous month. Finally, it accounted for any training/matches missed for a reason other than injury.

The second section detailed whether or not the player experienced any injuries during the previous month. If injuries were attained during the previous month, this section established whether or not they were as a result of Gaelic football and if they warranted further documentation in section 3. If the player experienced an injury in the previous month, and if it was as a result of playing or training for Gaelic football, the details of the injury were recorded in section 3. This section detailed all aspects of the injury. It accounted for the time, date and location of occurrence of the injury (ie, training/match); the nature, site, mechanism and severity of the injury; the position the player was playing when he received the injury; treatment received; and details regarding previous injury to the same site.

Injury definition

For the purpose of this study, an injury was defined as one that caused a player to miss one training or match or that required at least one treatment. All injuries were recorded over the 6-month study period. However, only injuries sustained while training for or playing Gaelic football were recorded.

Statistical analysis

The results were analysed by calculating percentages and injury rates per 1000 h, with their respective 95% CI. All computations were calculated using the Confidence Interval Analysis Package.¹¹

RESULTS

Of the 88 subjects who agreed to take part in the study and filled out the contact details and consent forms, five did not qualify to participate in the study. Of the 83 who were eligible for the study, 61 were contacted and interviewed during all 6 months of the study (73.5%, 95% CI 63 to 81). There were no data for 64 of the 498 interview months (13%, 95% CI 10 to 16). This is a significantly small number of missed months ($Z = 16.5$, $p < 0.001$).

There were 90 injuries reported during the 6 months of the study, during which time the subjects spent 1133 h playing matches and 5525.1 h training. The injury rate per 1000 h exposure to Gaelic football was 13.5 (95% CI, 10.9 to 16.6). There were nearly twice as many injuries during matches (64.4%, 95% CI, 54.1 to 73.6) as during training (35.6%, 95% CI, 26.4 to 49.5). Injuries occurred 10 times as frequently in matches (51.2 per 1000 h) as in training (5.8 per 1000 h) (table 1).

Site of injury

Figure 1 lists the injuries received by players. Of the injuries sustained, most were lower limb injuries (71.1%, 95% CI, 62.7 to 78.3). The ankle was found to be the most commonly injured site (13.3%, 95% CI, 7.8 to 21.9) followed by the anterior and posterior aspects of the thigh (both 12.2%, 95% CI, 7 to 20.6). In addition, it was found that ankle injuries were five times as common in matches as in training. The most commonly injured area of the upper body was the chest/ribs (4.4%, 95% CI, 1.7 to 10.9), whereas 7.8% of injuries were to the head and face region (95% CI, 4.3 to 13.8).

Type of injury

Bruises/contusions were found to be the most common type of injury (27.8%, 95% CI 19.6 to 37.8), followed by muscle strains at 23.3% (95% CI 15.8 to 33.1) and ligament sprains at 17.8% (95% CI 11.2 to 26.9). When muscle and tendon strains were grouped together, the musculotendinous unit accounted for nearly a third of all injuries (31.1%). Fractures resulted in 10% of all injuries (95% CI 5.4 to 17.9; fig 2).

Figure 1 Site of injury, with 95% CI.

Figure 2 Type of injury, with 95% CI.

Mechanism of injury

Figure 3 shows the situations in which players were injured. Tackling accounted for 27.8% of the injuries sustained (tackler 10%, 95% CI, 5.4 to 17.9; player being tackled 17.8%, 95% CI, 11.2 to 26.9). The next most common mechanisms of injury were sprinting (14.4%, 95% CI, 8.6 to 23.2) and turning (13.3%, 95% CI 7.8 to 21.9).

Injury severity

Table 2 shows the severity of injuries received; moderately severe injuries were the most common (6.45 per 1000 h, 95% CI, 4.67 to 8.69). The rate for severity of training injuries was similar (mild 1.81, 95% CI, 0.86 to 3.32; moderate 2.17, 95% CI, 1.12 to 3.79 and severe injuries 1.63 95% CI, 0.74 to 3.09). Injuries attained during matches were more likely to be moderate (27.36, 95% CI 18.59 to 38.84) or mild (16.77 95% CI, 10.10 to 26.19) as opposed to severe (7.06, 95% CI, 3.05 to 13.91) per 1000 match hours). Only one injury of the 90 ended a player's season.

Time of injury

Table 3 shows the time in a match at which players were injured. There was a rise in the number of match injuries reported as the game ran its course. Of the total match injuries, 56.9% (95% CI, 46.1 to 67.1) were experienced in the second half as opposed to 39.7% (95% CI, 29.8 to 50.5) in the first half. The fourth quarter of the game had the most injuries (29.3%, 95% CI, 19.2 to 42). One injury each was reported during the warm up and warm down of a match and these were included as match injuries.

Injuries by player position

Figure 4 lists the injuries caused by player position. There was no substantial difference in injury rates among the outfield players who took part in the study. Injury rates varied from 6.06 injuries per 1000 h played for half forwards (95% CI, 2.6 to 11.9) to 5.05 injuries per 1000 h played for half backs (95% CI, 2.4 to 9.5). The highest injury rate was among goalkeepers (7.14 injuries per 1000 h played, 95% CI, 0.4 to 20.7).

Figure 3 Mechanism of injury, with 95% CI.

Table 2 Match and training injury severity, rate per 1000 h with 95% CI

	Mild (1–7 days)	Moderate (8–21 days)	Severe (>21 days)	Concluded season	Total
Training	1.81 (0.86 to 3.32)	2.17 (1.12 to 3.79)	1.63 (0.74 to 3.09)	0.18 (0 to 1.01)	5.79 (3.96 to 8.18)
Match	16.77 (10.10 to 26.19)	27.36 (18.59 to 38.84)	7.06 (3.05 to 13.91)	0	51.19 (38.87 to 66.18)
Total	4.35 (2.91 to 6.25)	6.45 (4.67 to 8.69)	2.55 (1.49 to 4.08)	0.15 (0 to 0.84)	13.52 (10.86 to 16.60)

DISCUSSION

Over the duration of this investigation, the subject group was exposed to 1133 h and 5525.1 h of match play and training, respectively. Ninety injuries were experienced by the players during this time, which corresponded to an injury frequency rate (IFR) of 13.5 injuries per 1000 h exposure to Gaelic football. In only one previously published study has IFR in Gaelic football been established. This was in a study by Watson¹² on the injury profile of schoolboy Gaelic footballers, which reported an IFR of 7.1 injuries per 1000 h. This is a considerably lower IFR than that found in our study, especially in view of the fact that Watson's injury definition was much broader; it recorded injuries as those that restricted activity to any specified extent.

To compare the injury incidence in this study with the injury incidence in the only published study on senior Gaelic footballers, we must express the injury rate in terms of injuries per calendar year. Cromwell *et al*⁴ published an incidence rate of 1.78 injuries per player per calendar year, which is lower than the 2.2 injuries per player per calendar year produced in this current study. The IFR of 13.5 injuries per 1000 h exposure established in this study seems to be higher than was thought previously in Gaelic football. This may be due to the fact that the both studies quoted above were retrospective in nature. As the IFR for senior Gaelic football has not been previously investigated prospectively, it was necessary to compare the IFR in this study with those found in similar ball sports. Using a similar injury definition to that used in the current study, Bird *et al*¹³ reported an IFR of 72 injuries per 1000 h exposure in rugby union while Seward *et al*¹⁴ reported an IFR of 62 injuries per 1000 h and 139 injuries per 1000 h in Australian rules and rugby league, respectively.

The higher IFRs found in both rugby league and union could be testament to the more physical nature of both sports. Australian rules permit a rugby-style tackle, which is not accepted in Gaelic football. Lower IFRs have been reported in soccer. Hawkins and Fuller¹⁵ found an IFR of 8.5 injuries per 1000 h while Hagglund *et al*¹⁶ found an IFR of 7.8 injuries per 1000 h. Soccer is a sport that is played mostly with the lower extremities, which may account for the lower IFR found in the sport. The use of shin guards in the sport may also play a role in this lower IFR.

The size and weight of players may also have an influence on the rate of injury in a sport. Gaelic footballers have been shown by Watson⁹ to be heavier and taller than soccer players. Greater size and weight increases the momentum involved in physical contact and therefore increases the risk of injury.

Table 3 Stage of match when injury occurred

Stage	Frequency	Per cent	95% CI
1st quarter	10	17.24	9.6 to 28.9
2nd quarter	13	22.41	13.6 to 34.7
3rd quarter	16	27.59	17.8 to 40.2
4th quarter	17	29.31	19.2 to 42.0
Warm up	1	1.72	0.3 to 9.1
Warm down	1	1.72	0.3 to 9.1
Total	58	100.00	

The effect of professionalism on injury rates should not be underestimated. Rugby league, rugby union, Australian rules and soccer are all professional sports while Gaelic football is not. Senior club footballers may not receive the same conditioning and preparation as professional athletes and may be more predisposed to injury than professional athletes as a result. It is conceivable that professional athletes are more likely to report injury and receive treatment, taking into account that sport is their livelihood.

This study found that with an IFR of 6.5 injuries per 1000 h, moderate injuries were the most common degree of injury severity (42% of injuries overall). This is a slightly higher percentage than that reported by Cromwell *et al*,⁴ which found that 42% of injuries were moderate in severity. The significance of this information on injury severity is that, of the 13.5 injuries per 1000 h exposure experienced by Gaelic footballers, almost half of these will lead to an absence from the sport for about 8–21 days. This indicates the value of remaining injury free to the coach who wishes to have his players available for as many games during the season as possible. It is also of value to the player who wishes to enjoy sporting success without regular limitations caused by injury.

This study established that subjects were spending almost five times more time in training as in competition. However it was in matches (64%) where most injuries were attained, with almost twice as many reported than were reported in training (32%). Expressed as a rate, the training and matches IFR in this study are 5.8 injuries and 51.2 injuries per 1000 h respectively.

Soccer,^{16–19} rugby^{13–14} and Australian rules¹³ have all reported results that show a considerably higher rate of injuries in matches than in training. The higher match IFR may be explained by the greater intensity, competitiveness and desire to win displayed in matches.

A large proportion of injuries in this study were to the lower limb (71.1%). This statistic is not surprising as Gaelic football is a sport where a large percentage of the playing time is spent without possession. Activities used to gain possession such as

Figure 4 Injury rate by position, with 95% CI.

What is already known about this topic

- There is a paucity of studies examining injury in Gaelic football.
- Studies to date have concentrated on the presentation of injuries at accident and emergency departments or have been retrospective in nature.

What this study adds

- This is the first study to prospectively collect injury data in Gaelic football.
- The study provides information regarding injury rate according to exposure in training and playing Gaelic football.

running, turning and jumping all focus on the lower limbs, possibly leading to a higher injury rate in the region.

April and June showed the highest injury rates over the course of the season. These months correspond to the beginning of the competitive season and the beginning of the championship respectively and this may account for the raised IFR in both these months. A similar high IFR in the early season was reported in soccer and Australian rules by Woods *et al*²⁰ and Braham *et al* respectively.²¹ Braham *et al*²¹ suggest that this early season increase in IFR may be a result of inadequate physical fitness, which may be the case in this study. Nonetheless Braham *et al*²¹ admit that other contributing factors must also be considered, such as match intensity, motivation of players and environmental conditions including ground condition.

The most common injuries in this study were ankle sprains, hamstring strains and quadriceps contusion. The high proportion of contusions found in this study is indicative of the physical nature of Gaelic football. To reduce the number of bruises affecting footballers it may be necessary to reduce physical contact with rule changes, or introduce protective equipment such as shin guards and padding, which are already used to protect players in soccer and rugby respectively.

This study has shown that there is an increased risk of injury as the match proceeds. Substantially more injuries were recorded in the second half of matches than the first. This finding has been previously reported in Gaelic football by Cromwell *et al*.⁴ A number of factors may contribute to this finding. The countdown to the end of the game may increase the intensity of the match as the players realise time is running out and they concentrate their efforts to achieve a match-winning lead. Woods *et al*²² and Hawkins and Fuller¹⁷ found an increase in injury rates towards the end of both halves and suggested fatigue as a causative factor. This could also be suggested in Gaelic football. If this is the case, possible solutions include the introduction of four quarters into a match or the introduction of rolling substitutes, which would provide recovery periods for those most affected by fatigue.

A similar amount of contact and non-contact injuries were reported in this study. The high percentage of contact injuries is not surprising in a sport with a degree of physical contact. It is in the tackle that most of these contact injuries were suffered. These injuries were predominantly contusions but sprains were also common. As mentioned previously, a change in ruling may be necessary to reduce injury rates in the tackle or perhaps even the introduction of protective equipment such as padding, ankle bracing and/or shin guards.

The percentage of injuries owing to foul play (10%) was greater than the 6% reported by Cromwell *et al*.⁴ Measures can be taken to reduce injuries due to foul play such as empowering the umpires and linesmen with more authority and more frequent and widespread use of video evidence.

The current study, found that considerably more Gaelic football injuries were treated by physiotherapists than by any other health professional. The most striking statistic from this study was that less than half of the injuries sustained received treatment whereas another 31.3% of injuries were self-treated. As a result <20% of injuries sustained received treatment from a health professional.

All injured players treated by physiotherapists resumed activity within 3 weeks while most self-treated injuries required in excess of 3 weeks to heal. This may be a reflection that self-treated were greater in severity. It is more likely, however, to reflect that professional treatment resulted in a quicker return to sport after injury.

Authors' affiliations

F Wilson, S Coffrey, E King, K Casey, Department of Physiotherapy, Trinity College Dublin, Dublin, Ireland

C Gissane, Department of Human Sciences, St Mary's College, Strawberry Hill, Twickenham, Middlesex, UK

Competing interests: None declared.

REFERENCES

- 1 McIntyre MC, Hall M. Physiological profile in relation to playing positions of elite college Gaelic footballers. *Br J Sports Med* 2005;**39**:264–6.
- 2 Strudwick A, Reilly T, Doran D. Anthropometric and fitness profiles of elite players in two football codes. *J Sports Med Phys Fitness* 2002;**42**:239–42.
- 3 Gaelic Athletic Association. Central Council of the GAA 2003 official playing rules [online]. Available from http://www.gaa.ie/files/official_playing_rules.pdf (accessed 19 January 2006).
- 4 Cromwell F, Walsh J, Gormley J. A pilot study examining injuries in elite Gaelic Footballers. *Br J Sports Med* 2000;**34**:104–8.
- 5 O'Sullivan ME, Curtin J. "Hand injuries in Gaelic football". *Ir J Med Sci* 1989;79–81.
- 6 Cuddihy B, Hurley M. "Contact sports and injury". *Ir Med J* 1990;**83**:98–100.
- 7 Carroll S, Jawad M, West M, *et al*. One hundred and ten sports related facial injuries. *Br J Sports Med* 1995;**29**:194–5.
- 8 Murphy AW, Martyn C, Plunkett PK, *et al*. Sports injuries and the accident and emergency department—ten years on. *Ir Med J* 1992;**85**:31–3.
- 9 Watson AWS. "Ankle sprains in players of the field-games Gaelic football and hurling". *J Sports Med Phys Fitness* 1999;**39**:66–70.
- 10 Waller AE, Feehan M, Marshall SW, *et al*. "The New Zealand injury and performance project: 1. Design and methodology of prospective follow up study". *Br J Sports Med* 1994;**24**:223–8.
- 11 Altman DG, Macken D, Bryant TN, *et al*. *Statistics with confidence*, 2nd edn. London: BMJ Books, 2000.
- 12 Watson AWS. Sports injuries in Gaelic football, a study over one season. *Ir J Med Sci* 1996;**165**:12–16.
- 13 Bird YN, Waller AE, Marshall SW, *et al*. The New Zealand Rugby and Performance Project: V. Epidemiology of a season of rugby injury. *Br J Sports Med* 1998;**32**:319–25.
- 14 Seward H, Orchard H, Hazard H, *et al*. Football injuries in Australia at elite level. *Med J Aus* 1993;**159**:298–301.
- 15 Hawkins RD, Fuller CW. A prospective epidemiological study of injuries in four professional English football clubs. *Br J Sports Med* 1999;**33**:196–203.
- 16 Hagglund M, Walden M, Ekstrand J. Exposure and injury risk in Swedish elite football: a comparison between seasons 1982 and 2001. *Scand J Med Sci Sports*, 2003;**13**:364–70.
- 17 Hawkins RD, Fuller CW. An examination of the frequency and severity of injuries and incidents at three levels of professional football. *Br J Sports Med* 1998;**32**:326–32.
- 18 Hagglund M, Walden M, Ekstrand J. Injury incidence and distribution in elite football—a prospective study of the Danish and the Swedish top divisions. *Scand J Med Sci Sports*, 2005;**15**:21–7.
- 19 Ekstrand J, Walden M, Hagglund M. Risk of injury when playing in a national team. *Scand J Med Sci Sports*, 2004;**14**:34–8.
- 20 Woods C, Hawkins R, Hulse M, *et al*. The Football Association Medical Research Programme: an audit of injuries in professional football: an analysis of ankle sprains. *Br J Sports Med* 2003;**37**:233–8.
- 21 Braham R, Finch CF, McIntosh A, *et al*. Community level Australian Football: a profile of injuries. *J Sci Med Sport* 2004;**7**:96–105.
- 22 Woods C, Hawkins RD, Maltby S, *et al*. The Football Association Medical Research Programme: an audit of injuries in professional football—analysis of hamstring injuries. *Br J Sports Med* 2004;**38**:36–41.