

## Musculoskeletal Injury in Referees That Officiate Over Ladies Gaelic Football and Camogie

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### Abstract

#### **Aim**

Ladies Gaelic football and Camogie are leading female sports in Ireland. Referees are essential to the game, however, no research has examined injury in referees that officiate over female Gaelic games to date. Therefore, this study aims to retrospectively examine the musculoskeletal injury profile and injury prevention practices of referees that officiate over female Gaelic games.

#### **Methods**

A retrospective anonymous questionnaire examined injuries that occurred in the previous 12 months in currently active Ladies Gaelic football and Camogie referees (n=170). Incidence and repeat incidence proportions were calculated along with descriptive statistics.

#### **Results**

In 2019, 42.9% (n=73) of referees sampled sustained an injury with 27.4% (n=20) sustaining two or more. Injuries primarily occurred to the lower extremity (79.6%,n=78), particularly the lower leg (20.4%,n=20) and knee (18.4%,18). Muscle strains and cramps (55.1%,n=54) were most frequent and injuries predominantly occurred during games (71.4%,n=70). Referees largely completed a warm-up but just 30.6% (n=52) conducted a cool-down. Over half had undertaken injury prevention education but only 37.6% (n=64) incorporated injury prevention elements into their training.

#### **Conclusion**

Just over two in five referees that officiate female Gaelic games became injured in the previous year, however their utilisation of injury prevention strategies, beyond completing a warm-up, is lacking. Thus, a referee specific injury prevention programme should be developed and if found to be effective, incorporated into a comprehensive injury prevention strategy by the governing bodies.

## **Introduction**

Ladies Gaelic football and Camogie are two of the leading female sports in Ireland.<sup>1,2</sup> These high-speed field sports are governed by the Ladies Gaelic Football Association and Camogie Association.<sup>1,2</sup> Fifteen players compete to score a point (over the bar) or a goal (under the bar) during a 60-minute game with two halves of 30-minutes each.<sup>1,3</sup> Referees are critical members of organised sports<sup>4</sup> and ensure that games are undertaken safely and fairly in an enjoyable manner.<sup>4,5</sup> Referees are expected to maintain the same pace as the game<sup>6</sup> and recent research has reported that male Gaelic football and hurling referees cover 9.4km per game,<sup>7</sup> similar to professional soccer and rugby referees.<sup>8,9</sup> The majority of the distance is at a low intensity, however, referees sprinted for 10% of the total distance.<sup>10</sup>

Injuries have been found to be common in Ladies Gaelic football and Camogie players,<sup>1-3</sup> reflecting in part the intensity of the sports. Identifying the frequency and profile of common injuries is an important first step in their prevention.<sup>11,12</sup> Injuries are common in referees in elite male Gaelic games, with 52% sustaining an injury; primarily to their lower extremity during running and sprinting.<sup>13</sup> However, this research was in referees in elite male Gaelic games only and injury data was gathered in 2005. Previous research has found that Camogie players had less high speed running and sprint distance than male hurlers<sup>14</sup> and the overall demands experienced by top-class soccer referees during a female World Championship were similar to the requirements of moderate-standard male refereeing.<sup>15</sup> To the authors knowledge, no research to date has examined injuries in referees that officiate Ladies Gaelic football or Camogie games.

Therefore, the primary aim of this study was to retrospectively examine the musculoskeletal injury profile of referees that officiate female Gaelic games in the previous 12 months. A secondary aim was to establish referees' current utilisation of injury prevention practices.

## **Methods**

A retrospective anonymous questionnaire that examined injuries that occurred in the previous 12 months was utilised and was made available online via Google Forms (Google forms. Google Inc. Available from <https://docs.google.com/forms>).

Ethical approval was granted by the university's research ethics committee and informed consent was required prior to taking part in the survey. The questionnaire consisted of 36 questions in four sections. Section one queried their personal demographics, including age, gender, and sporting experiences. Section two examined their refereeing experiences, including years' experience, level and amount of refereeing they officiate at and whether they warm up and cool down. Their training history, previous education and use of injury prevention was examined in Section three. Finally, previous engagement in pre-participation screening and injury history was queried in Section four. If they had suffered a musculoskeletal injury whilst refereeing in the previous 12 months, they were asked to detail the type of injury, how the injury occurred and its impact. The injury definition was adapted from O'Connor et al.<sup>2</sup> and was defined as one that caused them pain, loss of function, and/or bleeding. Injuries that did or did not prevent them from training or refereeing were included. Injury severity was defined as minor ( $\leq 7$  days), moderate (8-21 days) and severe ( $> 21$  days).<sup>16</sup> The mode of onset was classified as acute (sudden onset) or gradual onset. The questionnaire was then piloted with ten referees and took 6-8 minutes to complete. Face validity was examined using a modified Delphi approach with five experts (two Certified Athletic Therapists, an inter-county referee, a researcher in Gaelic games referees and a representative from the Camogie Association).

A convenience sample of currently active Ladies Gaelic football and Camogie referees from all four provinces and at all levels of play were recruited for this study. The questionnaire was distributed to all LGFA county secretaries and provincial Camogie secretaries to distribute to their referees. Social media and word of mouth was also utilised to advertise the questionnaire. The questionnaire was open for four weeks in March and April 2020.

Data were imported from Google Forms to Microsoft Excel. Data were checked for errors. Descriptive statistics were calculated including frequencies, proportions, means and standard deviations. Injury incidence proportion (number of injured participants/total participants\*100) and repeat incidence proportion (number of repeat injured participants/injured participants\*100) were calculated.<sup>17</sup> Their 95% confidence intervals were calculated using OpenEpi: Open Source Epidemiological Statistics for Public Health version 3.01.<sup>18</sup>

## Results

### *Demographics*

One hundred and seventy referees completed the questionnaire. Participants were primarily male (77.1%, n=131), with 22.4% of participants' female (n=38) and one participant preferred not to report their gender. Referees had a mean age of  $41.5 \pm 12.2$  years. The referees had  $9.9 \pm 7.4$  years officiating experience. Two in five referees also currently played sport (n=68), 27.1% (n=46) regularly attended the gym and 32.9% (n=56) did not take part in any sport or gym.

### *Training history and Injury prevention experiences*

Referees took part in a mean of  $4.5 \pm 3.3$  hours training per week, with  $2.9 \pm 1.8$  games per week and  $72.1 \pm 55.8$  games per year. Referees reported that they were fit (48.8%, n=83), somewhat fit (29.4%, n=50), very fit (19.4%, n=33) and unfit (2.4%, n=4). Referees primarily took part in aerobic training (85.9%, n=146), followed by resistance training (42.4%, n=72), interval training (39.5%, n=67), mobility (31.8%, n=54), and multidirectional running (21.2%, n=36). Participants primarily trained in order to stay healthy (88.8%, n=151), for game preparation (72.9%, n=124) or for the mental well-being (72.4%, n=123).

While the majority of participants completed a warm up prior to games (87.6%, n=149) and lasted on average  $9.0 \pm 4.8$  minutes, just 30.6% (n=52,  $7.0 \pm 4.6$  minutes) undertook a cool down. Fifty-five percent of participants had been previously educated on injury prevention (n=94), but only 37.6% (n=64) incorporate injury prevention elements into their training routine. Of those that implemented injury prevention practices, flexibility and mobility work was predominantly employed (51.6%, n=33), followed by strength training (29.7%, n=19), a good warm up (12.5%, n=8) and proprioception exercises (6.3%, n=4).

Just 15.9% (n=27) previously participated in a pre-participation screening to assess any medical or physical problems that they may have that may increase their risk of injury.

### *Injury history*

Seventy-three participants suffered 98 injuries in the previous 12 months. Thus an injury proportion of 42.9% (95% CI: 35.7-50.5) and repeat injury proportion of 27.4% (95% CI: 18.5-38.6) was revealed. Injuries were more frequent in games (71.4%, n=70) than training (28.6%, n=28). Lower limb injuries predominated (79.6%, n=78), with the lower leg/shin/Achilles tendon region (20.4%), knee (18.0%), thigh (15.0%) and hip/groin (15.0%) most frequent (Table 1).

Table 1. Region and location of injury (n=98)

<b>Region of injury</b>	<b>Location of injury</b>	<b>% (n)</b>
<b><i>Head/neck</i></b>		<b>2.0 (2)</b>
	Head/face	2.0 (2)
	Neck	0.0 (0)
<b><i>Upper limb</i></b>		<b>4.1 (4)</b>
	Shoulder/scapula/clavicle	4.1 (4)
	Upper arm	0.0 (0)
	Elbow	0.0 (0)
	Forearm	0.0 (0)
	Wrist	0.0 (0)
	Hand/finger/thumb	0.0 (0)
<b><i>Trunk</i></b>		<b>14.3 (14)</b>
	Chest/sternum/ribs	0.0 (0)
	Upper back/thoracic spine	1.0 (1)
	Lower back	10.2 (10)
	Abdomen	0.0 (0)
	Pelvis/buttocks	3.1 (3)
<b><i>Lower limb</i></b>		<b>79.6 (78)</b>
	Hip/groin	15.3 (15)
	Thigh	15.3 (15)
	Knee	18.4 (18)
	Lower leg/shin/Achilles tendon	20.4 (20)
	Ankle	7.1 (7)
	Foot/toe	3.1 (3)

Most injuries were acute (78.6%, n=77) in nature. Strains or muscle cramps were the most frequently reported (55.1%) (Table 2). Most injuries occurred when running (30.6%), changing direction (19.4%) and sprinting (18.4%). Just 2.0% of injuries were contact in nature, whereby referees were struck by a ball, hurley or sliotar.

Table 2. Nature and mechanism of injury (n=98)

<b>Nature</b>	<b>% (n)</b>	<b>Mechanism</b>	<b>% (n)</b>
<b>Muscle strain or muscle spasm/cramp</b>	55.1 (54)	Running	30.6 (30)
<b>Cartilage/meniscus/labrum injury</b>	10.2 (10)	Changing direction	19.4 (19)
<b>Ligament tear or sprain</b>	8.2 (8)	Sprinting	18.4 (18)
<b>Tendinopathy</b>	8.2 (8)	Gradual onset	16.3 (16)
<b>Arthritis</b>	5.1 (5)	Unable to remember	5.1 (5)
<b>Not diagnosed</b>	4.1 (4)	Resistance training	3.1 (3)
<b>Scratch/abrasion/graze</b>	3.1 (3)	Slowing down	3.1 (3)
<b>Fracture</b>	2.0 (2)	Struck by object	2.0 (2)
<b>Cut/laceration</b>	1.0 (1)	Falling	1.0 (1)
<b>Joint dislocation/subluxation/instability</b>	1.0 (1)	Landing	1.0 (1)
<b>Joint synovitis</b>	1.0 (1)	Contact with player	0.0 (0)
<b>Tendon tear/rupture</b>	1.0 (1)	Jumping	0.0 (0)
<b>Concussion</b>	0.0 (0)		
<b>Contusion</b>	0.0 (0)		
<b>Stress fracture</b>	0.0 (0)		

The mean time-loss from refereeing was 29.7±50.8 days. In 13.3% (n=13) of injuries, the referee did not take any time off from refereeing. Of those that did take time off following injury, most were of moderate severity (8-21 days, 44.9%, n=44), followed by severe (>21 days, 28.6%, n=28) and mild (≤7 days, 13.3%, n=13). Most injuries were assessed by their GP, athletic therapist or physiotherapist (85.7%, n=84), with 74.5% (n=73) completing a rehabilitation programme and 27.6% (n=27) requiring imaging and 9.2% requiring (n=9) surgery.

## Discussion

Injuries were found to be prevalent in Ladies Gaelic football and Camogie referees, with just over two in five sustaining an injury due to refereeing in the previous 12 months. This is lower than previously reported in elite male Gaelic games referees (52%),<sup>13</sup> but higher than Brazilian (33%)<sup>19</sup> and Croatian (29%)<sup>20</sup> soccer referees. In addition, 27% of referees sustained at least one other injury that year.

The reduced injury proportion in Ladies Gaelic football and Camogie referees compared to the male comparative games may be due to the reduced intensity observed in the female games.<sup>14</sup> These findings highlight the frequency of musculoskeletal injury in referees that officiate over female Gaelic games and the importance of appropriate injury risk reduction strategies to actively tackle this issue.

The injury profile of referees that officiate over female Gaelic games was similar to Ladies Gaelic games players,<sup>1,2</sup> and referees in the elite male Gaelic games,<sup>13</sup> with match-based, acute, lower extremity and muscular injuries predominant. Participants commonly reported lower leg and thigh injuries, similar to elite male Gaelic games referees and female soccer referees.<sup>21</sup> These injuries most likely occurred during sprinting and running, which were the predominantly identified mechanisms of injury in this study, similar to previous referee research.<sup>13</sup> However, knee injuries were more frequent in this study compared to previous research in male Gaelic games referees (4%) but similar to Croatian referees (15%)<sup>20</sup> and players from Ladies Gaelic football (13%)<sup>1</sup> and Camogie (19%).<sup>3</sup> Change of direction was a commonly reported mechanism of injury in the current study, and may be related to the high occurrence of knee injuries, highlighting the importance of improving neuromuscular control at the knee and teaching appropriate movement mechanics.

The injuries experienced by referees led to a substantial time off refereeing, with a mean of 30 days. As participants reported refereeing on average three games per week, these injuries can lead to a significant impact on referee availability. Referees are vital for the success of these community sports and lack of availability can lead to cancellation or rescheduling of matches.<sup>22</sup> Referee retention is an issue across community sports internationally,<sup>22</sup> therefore minimising absence from refereeing is important. Welcomingly, referees were assessed by a relevant healthcare professional and the majority completed a rehabilitation programme.

However, a quarter of referees did not complete a rehabilitation programme, and to ensure full recovery from the injury and minimise re-injury risk, referees should be educated on the importance of completing a comprehensive rehabilitation programme prior to return to refereeing. Over a quarter of injuries required imaging and just under one in 10 underwent surgery, highlighting the potential costs associated with these injuries to the individual, governing associations and the healthcare system.

The results of the current study indicate that prioritising the prevention of musculoskeletal injury in referees that officiate over female Gaelic games is essential, not only due to injury frequency but also the substantial impact injuries have on both the referee and the associations. Injury prevention programmes, like the GAA 15+ and the Activate GAA warm up, have been developed specifically for Gaelic games and have been found to successfully reduce injury incidence.<sup>23</sup> In soccer, a FIFA 11+ programme specifically for referees reduced injury risk by 65%.<sup>24</sup> Thus, the development of an intervention programme specifically for Ladies Gaelic football and Camogie referees is warranted. Potentially adapting the already developed Gaelic games injury prevention exercise programmes, targeting muscular strength, balance and neuromuscular control may be useful or adapting referee specific injury prevention programmes already established in other sports. The effectiveness of these programmes should be examined, along with the initial uptake and long-term use by referees of these programmes.

Injury prevention strategies as a whole were not commonly conducted by those that officiate over female Gaelic games. Just under two in five referees incorporate any injury prevention elements into their training routine, under one-third complete a cool-down and just under one in six have previously completed a pre-season screening. Thus, referee education on injury prevention, including the importance of a thorough warm-up and cool down and how to complete a relevant injury prevention exercise programmes should be conducted. This can be incorporated into an overall injury prevention strategy implemented by the Ladies Gaelic football Association and Camogie Association to minimise injury risk in referees in their sports. Qualitative research to identify any barriers or facilitators to completing an injury prevention programme in referees is also recommended. Any developed injury prevention strategy should be guided and evaluated using an established framework, like the RE-AIM sports setting matrix,<sup>11</sup> to identify the real-world impact of the strategy in referees.



With regard to study limitations, the use of a cross-sectional retrospective survey may have led to recall bias. However, we minimised the effect of this by requiring referees to report injuries that occurred in the previous 12 months only. Prospective longitudinal research in a larger sample is required in this population.

The convenience sampling method employed by this survey may have also led to bias, as those more interested in injury or with previous experiences of injury may have completed the survey. We did not ask referees the particular Gaelic games sport that they refereed in so we were unable to compare injury proportion between Ladies Gaelic football and Camogie referees.

In conclusion, injuries frequently occur in Ladies Gaelic football and Camogie referees and can have substantial impact on their health and requiring time loss from refereeing. Thus, an injury prevention strategy inclusive of all those involved in female Gaelic games is required. This initial study can inform the design of future injury prevention programmes but further prospective injury surveillance is required. The LGFA and Camogie Association should consider developing a comprehensive injury prevention strategy, that includes an injury prevention programme specific to referees.

**Declaration of Conflicts of Interest:**

The authors report no conflicts of interest.

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