Self Management of Acute Soft Tissue Injuries: A Survey of Female Gaelic Football Players

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ABSTRACT
Background: Within Gaelic football, high rates of injury have been reported. The Ladies Gaelic Football Association has 100,000 members; however no injury management research currently exists within this population. The aim of this study was to survey the knowledge of senior level ladies Gaelic football club players of acute soft tissue injury management. Secondary aims were to investigate the treatments employed following injury and player awareness of potentially harmful post injury practices.

Methods: A questionnaire exploring demographic, treatment, and PRICE (Protection, Rest, Ice, Compression, Elevation) details was constructed.

Results: All six senior County Clare ladies Gaelic football club teams were sampled, and a response rate of 95% was achieved. 43.9% of respondents knew four or more of the PRICE letters. Treatments employed by respondents included ice (61.8%), physiotherapy (59.2%) and rest (36.8%). 27.6% of participants would avoid three or more of the following immediately post injury; heat, alcohol, vigorous exercise and vigorous massage. If respondents were to use ice as a form of treatment in the initial stages following injury, 85.7% of them would commence the intervention immediately after injury, and it would be applied by players every one (54.4%) or two (22.2%) hours.

Conclusion: The PRICE regime was moderately well known by this population. Poor knowledge of potentially harmful post injury practices and recommended cryotherapy application was reported. As the evidence concerning the PRICE guidelines is not conclusive, further research in this area is required.

Keywords: acute soft tissue injury, harm, PRICE, cryotherapy, ice.

INTRODUCTION
Gaelic football is one of the main national games in Ireland. It has a tradition that extends back to the foundation of the Gaelic Athletic Association (GAA) in 1884, and boasts one of the highest participatory rates in sport within the country. The Ladies Gaelic Football Association (LGFA) was established in 1974 and currently has approximately 100,000 registered members. Although Gaelic football still has amateur status, contemporary players engage in rigorous training for the competitive season. The speed at which the sport is played, coupled with much physical contact, acceleration, deceleration, and turning results in a significant rate of injury. Overall, soft tissue injuries predominate within Gaelic football. In a study of injury amongst male Gaelic football players, an incidence rate of 2.2 injuries per player per calendar year was reported. A comparable study conveyed a slightly lower rate of 1.78 injuries per player per calendar year, with a high injury recurrence rate of 35%, demonstrating that Gaelic football entails a high risk of injury. Although these studies consisted of male participants, the risk may be similar within ladies Gaelic football.

In relation to treatment, the PRICE regime (Protection, Rest, Ice, Compression, Elevation) is widely accepted in the management of acute soft tissue injuries. The most frequently employed component of the PRICE regime is ice, or cryotherapy. It is principally used immediately post injury to decrease tissue temperature and tissue metabolism, therefore minimising secondary hypoxic injury. In the initial stages following injury, there are many potentially harmful practices - including heat, alcohol, vigorous exercise and vigorous massage - that can possibly exacerbate the injury by disrupting the healing process. Whether players are aware of this danger remains unknown at this time, and is worthy of exploration. As the evidence concerning the PRICE guidelines is not conclusive, further research in this area is required.

The aim of this study was to survey the knowledge of senior level ladies Gaelic football club players in relation to their management of acute soft tissue injuries. A specific focus on cryotherapy was included due to its acceptance as a key component of acute musculoskeletal injury treatment. The main objectives were to:
- Determine what treatments are employed by ladies Gaelic football players initially following acute soft tissue injury
- Establish if this population know of the PRICE regime
- Uncover whether these football players are aware of potentially harmful practices that should be avoided post injury
- Investigate details concerning the application of cryotherapy for acute soft tissue injury.

METHODS
The University of Limerick Research Ethics Committee approved this study.
STUDY DESIGN
The study design chosen based on the research question, feasibility, time frame and resources was a self-completion group administered questionnaire. It was considered to be the most appropriate method of collecting the sought information due to its ability to reach a large sample easily and economically, and provide quantifiable answers. As there was no suitable existing work in this field to draw from, a questionnaire was created following recognised steps regarding questionnaire construction. This involved:
- Defining the information sought via a literature search
- Drafting of the questionnaire
- Piloting the questionnaire among physiotherapists (n = 5) to determine validity and user-friendliness
- Amending the questionnaire in response to the pilot feedback

The final questionnaire (available from kieran.osullivan@ul.ie) examined demographic details (Section A), injuries and treatment (Section B), and the PRICE regime (Section C). A combination of open-ended questions eliciting more detailed responses and closed-response questions providing tightly structured answers was employed.

PARTICIPANTS
The sample chosen for the study was the members of all six senior level County Clare ladies Gaelic football club teams. The six senior clubs were selected so that a relatively homogenous group could be investigated. The inclusion criteria specified that respondents must be female, a member of a senior level County Clare ladies Gaelic football club team, understand written and spoken English, and be aged 18 years or over.

PROCEDURE
A letter was sent to the chairperson of each senior level County Clare ladies Gaelic football club team, after gaining contact information for them from the Clare ladies Gaelic football County Board. The letter requested permission to arrive at the team dressing room (setting for questionnaire administration and completion) on the day of a team game. Each chairperson consented to the process and provided information concerning the dates, times and venues of their team games. Subjects were provided with information regarding the study, given an opportunity to ask questions, and provided written informed consent. The researcher was present at all times to answer questions. The questionnaire took approximately 5-10 minutes to complete, and was collected immediately.

DATA ANALYSIS
The data was analysed using SPSS 15.0 software. Descriptive statistics were employed to analyse responses.

RESULTS
A total of 99 questionnaires were distributed, of which 94 were returned, as 5 players declined to participate (response rate: 95%). All participants answered Section A (n = 94), Section B was completed only by those previously injured playing football (n = 76), while 91 respondents filled in Section C with 3 respondents leaving it incomplete. In reporting the results here, the number of people who answered each section is taken as 100% of respondents in the three areas, i.e. for Section A: 94 respondents = 100%, Section B: 76 = 100%, and Section C: 91 = 100%.

DEMOGRAPHIC DETAILS
57% of participants were aged between 18-24, 30% were aged between 24-30, with the remaining being distributed between 3 other age categories (31-35; 36-40; 41-45). Respondents had spent a mean time of 12.66 years, including underage participation, playing football.

INJURIES AND TREATMENT
80.9% of respondents (n = 76) had received an injury playing football, with 50% of these injuries occurring on a recurring basis. 9.05 weeks (approximately 66 days) was the mean longest length of time missed due to an injury. Initially following injury, 59.2% of respondents employed physiotherapy as a treatment protocol. 61.8% applied ice, while only 7.9% utilised compression. The use of the other components of the PRICE regime is detailed in Figure 1. 92.1% of participants would avail of the same intervention that they employed initially as treatment again. Professional advice was the leading reason for choosing a particular treatment, along with participants' own knowledge and mentor advice (Table 1).

Figure 1. Treatments employed by respondents in the initial stages post acute soft tissue injury
HARM (HEAT, ALCOHOL, RUNNING/VIGOROUS EXERCISE, MASSAGE)
After injury, vigorous exercise would be avoided by 93.4% of respondents (Figure 2). 27.6% would avoid three or more of the following post injury: alcohol, heat, vigorous exercise and vigorous massage, while 82.9% of participants would not avoid both rest and compression together at this stage.

Figure 2. The percentage of respondents who would avoid each practice following injury

PRICE/RICE REGIME
Almost half of these football players (43.9%) knew four or more of the PRICE letters. 38.5% discerned one or less of the letters. Rest (67%) and Ice (64.8%) were the most well known components by respondents, while only 4.4% correctly identified Protection (Figure 3).

Figure 3. The percentage of respondents that correctly identified the letters of the PRICE regime, knew 4 or more of the letters, and knew 1 or less of the letters.

CRYOTHERAPY APPLICATION
If respondents were to use cryotherapy in the initial stages following injury, 64.8% would use an ice pack while 19.8% and 16.5% would employ a frozen gel pack and frozen pack respectively. Only 4.4% would apply chipped/crushed ice. Participants who stated that they would use cryotherapy would largely (85.7%) initiate the treatment immediately following injury, with 12.1%

Table 2. The frequency with which each respondent would apply their chosen form of cryotherapy in the initial stages after injury

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent (%)</th>
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<tbody>
<tr>
<td>Every hour</td>
<td>54.4</td>
</tr>
<tr>
<td>Every 2 hours</td>
<td>22.2</td>
</tr>
<tr>
<td>Every 4 hours</td>
<td>15.6</td>
</tr>
<tr>
<td>Every 12 hours</td>
<td>6.7</td>
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<tr>
<td>Every 24 hours</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Table 3. The duration of each cryotherapy application that respondents would utilise post acute soft tissue injury

<table>
<thead>
<tr>
<th>Duration</th>
<th>Percent (%)</th>
</tr>
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<tbody>
<tr>
<td>5 minutes</td>
<td>28.6</td>
</tr>
<tr>
<td>10 minutes</td>
<td>48.4</td>
</tr>
<tr>
<td>15 minutes</td>
<td>12.1</td>
</tr>
<tr>
<td>20 minutes</td>
<td>9.9</td>
</tr>
<tr>
<td>30+ minutes</td>
<td>1.1</td>
</tr>
</tbody>
</table>

employing it 2 hours post injury.

The frequency of cryotherapy use is displayed in Table 2, where most respondents would apply it every one (54.4%) or two (22.2%) hours. Just under half of participants (48.4%) stated that they would apply their chosen form of ice for 10 minutes. 28.6% would use ice for 5 minutes (Table 3). The majority of subjects planned to continue a routine of ice application for either one (28.9%), two (27.8%) or three (31.1%) days (Figure 4). Nearly all respondents (92.3%) would use a barrier between ice and their skin.

Figure 4. The number of days respondents would continue cryotherapy

DISCUSSION
PARTICIPANTS
A response rate of 95% was achieved. However, this sample is relatively small, as it represents only 99 of 1366 registered
players in County Clare, and this is only in one county. Over half of respondents (57%) resided in the 18-24 age category. Many players under 18 years of age play ladies Gaelic football, but were not sampled for ethical reasons. Therefore, the age profile is probably not representative of all senior ladies Gaelic football club players. Players had spent a mean of 12.66 years playing football in all codes, conveying their high level of experience in this sport.

Injuries
Overall, 80.9% of respondents were injured playing football. A recurrence rate of 50% and mean longest length of absenteeism due to injury of 66 days were reported. These figures suggest that ladies Gaelic football players are under significant risk of injury, and may not be effectively managing their injuries. A pilot study examining Gaelic football injuries reported injury recurrence and absenteeism rates of 35% and 34.6 days per year respectively. The higher recurrence and absenteeism injury rates discovered in this study could have been somewhat influenced by recall bias. It has been proposed that the longer the time frame for recollection is, the less likely injury history is to be accurate. This is due to the high injury incidence figures registered in this study. It is interesting to examine injury reporting from other Gaelic football sources. Data cannot be directly compared however, as male participants were included in the other studies and a specific time frame for injuries was indicated. A prospective study of injury in Gaelic football determined an injury rate of 2.2 injuries per player per calendar year. They also classified this as 13.5 injuries per 1,000 hours exposure to Gaelic football. The previously mentioned pilot study recounted a slightly lower rate of 1.78 injuries per player per calendar year, perhaps due to the retrospective nature of the study.

Treatment
59.2% of respondents stated that they employed physiotherapy following acute soft tissue injury, but did not elaborate on what specific treatment was provided. When examining participants' reported use of the PRICE regime, ice (61.8%) and rest (36.8%) were most frequently reported. Limited numbers of respondents employed protection (17.1%), compression (7.9%) and elevation (10.5%). Respondents asserted that professional advice (51.3%), their own knowledge (48.7%), and mentor advice (40.8%) were the most important factors influencing their treatment choice. As is evident from these figures, players indicated that more than one option influenced their therapy selection. An injury-related study reported that male Gaelic football players' treatments were based on their own knowledge in 31.3% of cases, while less than 20% of these subjects sought treatment from a health professional. This suggests a slight difference between male and female Gaelic footballers, although the reasons for this are unclear.

HARM
It is important to address those practices which may cause further harm in the initial stages following injury, i.e. Heat, Alcohol, Running (or vigorous exercise) and (Vigorous) Massage. At present, research concerning players' knowledge of such harmful systems is deficient. Moreover, only 27.6% of respondents in this study stated that they would avoid three or more of the aforementioned potentially harmful practices, although 93.4% of these players would abstain from vigorous exercise post injury. These factors have been proposed to be harmful practices after soft tissue injury, based on physiological principles. Heat increases blood flow, cellular metabolic rate and oedema. It could therefore exacerbate the inflammatory response and result in more extensive swelling. Alcohol can interfere with the healing process through the slowing of aerobic metabolism and increased dehydration. At the onset of exercise after injury, increases in epinephrine, blood flow, and cell-signalling molecules affect neutrophil margination. Therefore, vigorous exercise directly following an acute soft tissue injury is contraindicated. Lastly, vigorous massage is not recommended because of its propensity to increase blood flow to the injured area, and thus intensify the inflammatory response. It has been proposed that the longer the time frame for recollection is, the less likely injury history is to be accurate. This is due to the high injury incidence figures registered in this study. It is interesting to examine injury reporting from other Gaelic football sources. Data cannot be directly compared however, as male participants were included in the other studies and a specific time frame for injuries was indicated. A prospective study of injury in Gaelic football determined an injury rate of 2.2 injuries per player per calendar year. They also classified this as 13.5 injuries per 1,000 hours exposure to Gaelic football. The previously mentioned pilot study recounted a slightly lower rate of 1.78 injuries per player per calendar year, perhaps due to the retrospective nature of the study.

PRICE
The PRICE regime is widely advocated in the management of acute soft tissue injuries. However, less than half (43.9%) of respondents knew four or more of the components of PRICE while almost as many (38.5%) identified one or less. This displays considerable differences in the degree of knowledge of respondents. Rest (67%) and ice (64.8%) were the most well known elements, but protection was detected by just 4.4% of participants. Protection is often considered to be very closely related to rest, and indeed this regime was more often known as the RICE rather than the PRICE regime, possibly explaining the low values obtained in the study.

While the PRICE regime is recommended in the management of acute soft tissue injuries, the evidence base behind each component of the regime is quite varied. Protection is recommended for three days post injury, but complete immobilisation should be avoided. Rest is recommended for up to five days. It is stated too, that early mobilisation should avoid stress on the healing tissue, general activity should be reduced, and that isometric muscle work may be performed. The evidence behind this is however mainly sourced from animal studies, which have been extrapolated to human subjects. Compression should be applied immediately for the first 72 hours after injury, uniformly from distal to proximal, should be capable of accommodating oedema, and not impede circulation. Once again, this is based on consensus opinion, and empirical evidence is lacking. Elevation is recommended immediately following injury, and while there is a confirmed biological basis to support its use, empirical evidence is lacking. Ice / Cryotherapy was explored in particular detail in this study.
because it is the most widely accepted modality in the treatment of acute soft tissue injuries.\textsuperscript{18} Regarding mode of ice, 64.8\% of respondents favoured an ice pack and 19.8\% selected a frozen gel pack. Chipped/crushed ice appears to be the most effective application of cold, followed by ice in a plastic bag and frozen gel packs.\textsuperscript{3} Only 4.4\% of study participants chose chipped/crushed ice. A cryotherapy modality study\textsuperscript{19} identified crushed ice and ice-water immersion as the agents with the greatest cooling efficiency and ability to sustain decreased skin temperature. Convenience, ease of use and ready availability may explain the popularity of the conventional ice pack among respondents. Most participants (85.7\%) reported that they would apply ice immediately following injury, in line with the PRICE guidelines\textsuperscript{6} and other research.\textsuperscript{3} Just under one third (31.3\%) of players would continue their routine of ice application for three days, in line with the PRICE guidelines.\textsuperscript{6} Ice would be applied by subjects every one (54.4\%) or two (22.2\%) hours initially after injury, broadly in line with recommended guidelines.\textsuperscript{5,6} 48.4\% and 28.6\% of respondents would employ ice for 10 and 5 minutes respectively. However, 20-30 minutes is considered to be the most effective duration of application from biological and empirical evidence in the PRICE guidelines.\textsuperscript{6} In contrast, a review on evidence for cryotherapy\textsuperscript{20} concluded that 10 minute applications are sufficiently effective, as there is little further reduction of temperature from 10-20 minutes. A number of factors, including mode of cryotherapy and depth of subcutaneous tissue, which should be considered when selecting the optimal intervention duration, may however account for the differences in recommendations within the literature. 92.3\% of respondents would use a barrier between the ice and their skin, in line with recommendations to use a damp towel to protect against frost bite or nerve injury.\textsuperscript{6,21} Two studies\textsuperscript{2,22} which examined the difference between applying ice directly to the skin and employing a barrier found that a greater degree of cooling without adverse effects was achieved through direct ice application. However, it is unknown if this means using no barrier would be more clinically effective in reducing pain, swelling and restoring full function.

While it is reasonably positive that this population seem to have moderate knowledge of the PRICE guidelines and the proposed cryotherapy application, it must be acknowledged that these recommendations were devised from a combination of biological bases, convention and empirical proof. Similar to the "HARM" factors above, there is an absence of clinical evidence to suggest that the PRICE regime and cryotherapy reduce injury recovery time and recurrence rates.

Implications
The results of this study underline the impression that ladies Gaelic football is a sport that bears a reasonably high risk of injury. As the physiotherapist is often the health professional working in closest proximity to these athletes, it is our duty to fulfil the role of improving players' understanding of appropriate and effective injury management. This may be undertaken through education initiatives, where advice, information, and direction could be provided to promote optimal healing post injury. The study population demonstrated limited knowledge of the PRICE regime and potentially harmful post injury practices, and moderate awareness of the optimal use of cryotherapy.\textsuperscript{6} While it is important to improve players' knowledge in this area, it is also vital that the individual elements of the PRICE regime be extensively explored to produce new up-to-date guidelines based on better quality evidence. Investigation into the effects of heat, alcohol, exercise and massage following injury must also be undertaken. At present, no individual study has rigorously compared the efficacy of different modes, durations or frequencies of ice treatment, and therefore a truly optimal cryotherapy protocol cannot be created.\textsuperscript{6} Further scientific research is urgently required in this area, but until this occurs, knowledge of the most effective use of cryotherapy as indicated in the PRICE regime must be improved.

Study limitations
Many important findings regarding injury management within the ladies Gaelic football population have been highlighted through this study, but there are some issues that must be taken into account. Firstly, a sample size of 94 respondents is limited. A larger sample size would allow for greater correlations to be made with other research studies in the same field. Within the study, a more succinct injury definition could have ensured that respondents were reporting on similar experiences. A defined period of recollection, e.g. injuries during the last 12 months, may have diminished the possibility for recall bias,\textsuperscript{13} and aided the determination of annual injury incidence rates. Nonetheless, a broader perspective was gained by investigating whether participants had ever been injured throughout their entire playing career. As all injuries were required to be recalled and detailed in one questionnaire, some elements of injury history may have been omitted. The potential for bias in relation to the phrasing of questions, which is a risk with most questionnaire designs, also prevails. Furthermore, participants could not be informed that the initial stages corresponded to the first 72 hours after injury, as it may have influenced their responses. Finally, this study did not investigate the effectiveness of the PRICE regime, nor did it aim to. Further work is needed in this regard. Despite these limitations, the study may contribute to the knowledge we have regarding player awareness of injury management strategies.

CONCLUSION
It has been proposed that players may benefit from an understanding of the PRICE regime. The results of this questionnaire study indicate that physiotherapy was identified as an important treatment after injury, and the physiotherapist was an important source of advice to players. Player knowledge of both the PRICE regime and the most favourable application of cryotherapy are only moderate. In addition, the players seem to have very little understanding of the possible detrimental effects of practices such as applying heat, drinking alcohol, vigorous exercise or vigorous massage. Providing information regarding the optimal management of soft tissue injuries may improve clinical outcomes. However, greater evidence to support the recommended guidelines is first needed. Despite the fact that the use of the PRICE regime is
extensively advocated in the management of soft tissue injuries, the evidence base for this approach is mainly based on consensus, biological/physiological principles and empirical evidence.

REFERENCES