

1 **Fear-Avoidance Following Musculoskeletal Injury in Male Adolescent**  
2 **Gaelic Footballers**

### Abstract

**Context:** Gaelic football participation provides a wealth of benefits but a risk of musculoskeletal injury also exists. Injury is associated with physical consequences, including pain, discomfort, loss of function, time absent from school/sport, considerable medical expenses along with placing undue pressure on emergency services and hospital staff. Concurrent psychological consequences, such as fear-avoidance, can also occur causing psychological distress. There is a current dearth of available research examining the psychology of injury in male adolescent Gaelic footballers.

**Objective:** To examine fear-avoidance post-injury in male adolescent Gaelic footballers, the effect of pain, time-loss, injury severity and previous injury on the extent of fear-avoidance and the usefulness of a modified Athlete Fear Avoidance Questionnaire (mAFAQ) as a screening tool for predicting injury.

**Design:** Prospective cohort study.

**Setting:** Recreational clubs.

**Participants:** 97 male adolescent club Gaelic footballers (13.4±1.1 years).

**Interventions:** Musculoskeletal injuries sustained during Gaelic football participation, defined as any injury sustained during training or competition causing restricted performance or time lost from play,<sup>1</sup> were assessed and recorded weekly by a Certified Athletic and Rehabilitation Therapist. Injuries requiring time loss from participation were classed as time-loss injuries. Injury characteristics that included type, nature, location, severity and pain were recorded.

**Main Outcome Measures:** Injured players completed the Athlete Fear Avoidance Questionnaire (AFAQ), a measure of injury-related fear-avoidance following injury assessment (AFAQ1). With time-loss injuries, the AFAQ was completed again (AFAQ2) prior to return to play. mAFAQ was completed at baseline.

27 **Results:** Twenty-two injuries were recorded during the season with fear-avoidance evident  
28 post-injury that significantly decreased before returning to play. Fear-avoidance post-injury  
29 was higher in those with greater pain but time-loss, injury severity and previous injury did not  
30 significantly affect the extent of fear-avoidance. Baseline fear-avoidance did not predict injury.

31 **Conclusions:** Psychological rehabilitation is recommended for managing post-injury  
32 psychological distress in male adolescent Gaelic footballers.

33

34 **Keywords**

35 Psychological distress, Gaelic games, teenage, boys, injuries

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## Introduction

37 The Gaelic Athletic Association plays an important role in the physical activity practices of  
38 Irish society with Gaelic football recognized as the most popular club sport for adolescent  
39 males.<sup>2</sup> Gaelic football is a high-intensity, high-velocity contact game that requires large  
40 volumes of strength, endurance, flexibility and speed<sup>3</sup> where the primary aim of the game is to  
41 outscore the opposing team.<sup>4</sup> Matches last up to 60 minutes in duration in adolescents<sup>1</sup> and  
42 players may be involved with club, school and county teams simultaneously. Gaelic football  
43 participation is associated with an inherent risk of musculoskeletal injury.<sup>5</sup> Musculoskeletal  
44 injuries are defined as injuries resulting from direct trauma or overuse sustained during sports  
45 participation.<sup>6</sup> Injuries are common in male adolescent Gaelic footballers. Recent research  
46 reported one-third of all players sustain an injury over one year and almost half of injured  
47 participants suffer a subsequent injury.<sup>1</sup>

48 Musculoskeletal injury can elicit negative emotional responses that stimulate feelings of  
49 depression, anxiety, low vigor, fatigue, grief and burnout, with depression and anger also  
50 negatively affecting wound healing.<sup>7</sup> Cognitive appraisal of the injury situation and the  
51 psychological response to injury is subjective to each athlete,<sup>8-10</sup> where one athlete may  
52 perceive their injury situation to be more stressful than a teammate's perception of a similar  
53 situation. Although negative emotional post-injury responses, like frustration, mild depression  
54 and irritability may be normal,<sup>11</sup> it is estimated that 10% to 20% of athletes report extreme  
55 post-injury responses, including clinical levels of depression, low self-esteem and suicidal  
56 ideation, indicating the need for clinical referral.<sup>7</sup> Concern is warranted when the psychological  
57 responses are excessive, do not resolve, exacerbate over time, or the athlete is unable to cope.<sup>12</sup>  
58 Injured athletes report depression symptoms that are similar to levels of depression reported by  
59 patients receiving outpatient medical treatment for mental health issues,<sup>13</sup> which highlights the  
60 extent of psychological distress post-injury. Research to date has shown that elite male Gaelic

61 footballers, who have sustained one or more severe musculoskeletal injuries during their career,  
62 increase their chances of experiencing symptoms of psychological distress compared to those  
63 who had not suffered severe musculoskeletal injuries during their career.<sup>16</sup> In addition, history  
64 of injury results in an increased risk of re-injury.<sup>14-15</sup>

65 The importance of psychological rehabilitation in conjunction with physical rehabilitation is  
66 becoming increasingly recognised as a necessity for holistic recovery from injury. According  
67 to the Integrated Model of Response to Sport Injury, the psychological reaction to injury is  
68 dependent upon situational and personal factors along with differing behavioral and emotional  
69 responses to an injury situation.<sup>17</sup> Fear-avoidance, defined as the avoidance of movements or  
70 activities based on fear, is a psychological reaction to injury that can influence the experience  
71 of pain<sup>18</sup> and subsequently lead to dysfunction,<sup>19</sup> which may hinder recovery and rehabilitation  
72 following injury. Musculoskeletal injury can elicit pain-related fear-avoidance behavioural  
73 responses, which stimulate either a confrontation or avoidance approach in the injured player.<sup>18</sup>

74 With confrontation, athletes maintain engagement in physical activity through rehabilitation  
75 and involvement in the team environment where functional recovery is promoted.<sup>20</sup> In contrast,  
76 dysfunctional interpretations of pain escalate pain-related fear, forcing the athlete to adopt  
77 safety-seeking behaviours of avoidance.<sup>20</sup> These avoidance behaviours can reinforce mood  
78 disturbances, such as irritability, frustration and depression.<sup>18</sup>

79 Fear-avoidance has predominantly been measured to date in patients from the general  
80 population with chronic low back pain or those who have undergone anterior cruciate ligament  
81 reconstruction utilising the Tampa Scale for Kinesiophobia, Pain Catastrophizing Scale and the  
82 Fear-Avoidance Beliefs Questionnaire.<sup>21-23</sup> However, these questionnaires have not been  
83 developed primarily for use with athletes or have not been validated in physically active  
84 cohorts. The Athlete Fear-Avoidance Questionnaire (AFAQ) is a measure of sports injury-  
85 related fear-avoidance developed specifically for use with athletes.<sup>19</sup> Athletes are viewed as

86 having different mental traits to the general population due to their greater reliance on sport  
87 and physical activity and thus, require a unique questionnaire.<sup>19</sup> AFAQ is a valid tool for  
88 measuring fear-avoidance in athletes and can be easily administered efficiently in a short period  
89 of time.<sup>19</sup>

90 Returning a player to sport without the necessary psychological capacity can lead to fear,  
91 anxiety, re-injury, injury to other parts of the body, depression or an overall decline in  
92 performance.<sup>24</sup> The implementation of psychological interventions post-injury can moderate  
93 any dysfunctional beliefs that may hinder the rehabilitation phase<sup>8</sup> and can facilitate recovery.  
94 However, in order for sports medicine clinicians to facilitate rehabilitation using psychological  
95 interventions, an adequate understanding of the psychological processes involved with injury  
96 is essential<sup>8, 25</sup> and the extent of psychological distress experienced by male adolescent Gaelic  
97 footballers needs to be understood. No research to date has examined fear-avoidance  
98 behaviours in the Gaelic football population and the effect of associated injury characteristics  
99 on fear-avoidance. Examining the psychological effect of injury in adolescent Gaelic  
100 footballers is crucial as younger athletes under the age of 18 years are at an increased risk of  
101 experiencing injury-related psychological distress.<sup>26</sup> Managing the psychological response to  
102 injury in the adolescent years may teach the young player how to manage the psychological  
103 symptoms associated with athletic injury when they progress into adult level Gaelic football,  
104 allowing for longer and more successful sports participation. Thus, this study aimed to establish  
105 (i) the extent of fear-avoidance post-injury in male adolescent Gaelic footballers (ii) the effect  
106 of pain and days lost from Gaelic football participation on fear-avoidance experienced, (iii) if  
107 injury severity and previous injury predict fear-avoidance, and (iv) if a modified version of  
108 AFAQ completed at baseline is a useful screening tool in predicting injury.

109

## Methods

### 110 *Participants*

111 Ninety-seven male adolescent Gaelic football players ( $13.4 \pm 1.1$  years) that played at under-  
112 14 ( $n=66$ ) and under-16 ( $n=31$ ) were recruited from three local Irish Gaelic football clubs.  
113 Participants had been playing Gaelic football for  $6.2 \pm 2.1$  years. Ethical approval was granted  
114 by the institutes Research Ethics Committee and parental/guardian consent and participant  
115 assent was gained prior to the study beginning.

### 116 *Measures*

117 The validated Athlete Fear Avoidance Questionnaire (AFAQ)<sup>19</sup> is composed of ten statements  
118 detailing an athlete's post-injury fear-avoidance thoughts and feelings (Table 1). Each  
119 statement is rated on a 5-point Likert scale from 1 (not at all) to 5 (completely agree) and  
120 summed to give a total fear-avoidance score. The total score ranges from 10 to 50, with a  
121 greater overall AFAQ score indicating greater fear-avoidance. AFAQ showed significant  
122 correlations with previously validated catastrophizing and fear-avoidance assessment tools,  
123 indicating validity of the measure.<sup>19</sup> The AFAQ was modified (mAFAQ) by authors to create  
124 a screening tool for fear-avoidance (Table 2). Each of the ten statements were adapted by  
125 adding 'If I was injured' in order to measure injury-related fear-avoidance that a player expects  
126 they would experience if they became injured. The mAFAQ was ranked and scored the same  
127 as the original AFAQ. A pilot study was conducted in recreational athletes from a variety of  
128 sports ( $n=120$ ;  $20.1 \pm 3.9$  years) to examine the psychometric properties of the mAFAQ.  
129 Internal consistency was evident with Cronbach  $\alpha$  coefficient of 0.733, indicating high  
130 reliability.<sup>28</sup> Construct validity was determined by factor analysis, which identified eigenvalues  
131  $>1$  for 3 items of the mAFAQ, explaining a cumulative percentage variance of 57.2%.  
132 However, the first item accounted for 30.7% of the variance, indicating the mAFAQ is a one-  
133 dimensional scale. The original AFAQ was also identified as being a one-dimensional scale

134 and the findings suggest both questionnaires measure different traits of the fear-avoidance  
135 model, including fear-avoidance beliefs, kinesiophobia and catastrophizing.<sup>19</sup> The results  
136 identify mAFAQ as a valid and reliable measure of baseline fear-avoidance.

137 A standardized injury report form<sup>1</sup> was utilized to record injuries that occurred during the  
138 season. The characteristics of injury, including injury type, nature, location, severity and  
139 associated pain both at the time of sustaining the injury and at the time of injury assessment  
140 were documented. Pain was recorded using the Visual Analogue Scale (VAS) 0 to 10 scale,  
141 which is a valid method for measuring pain.<sup>29</sup> Injury severity was defined according to number  
142 of days missed from participation; minor (<7 days), moderate (7-21 days) or severe (>21  
143 days).<sup>1</sup>

144 [Insert Table 1]

145 [Insert Table 2]

#### 146 ***Procedure***

147 An injury history questionnaire documenting injuries sustained in the previous 12 months and  
148 their characteristics was completed at the beginning of the season. Injury history was limited  
149 to the previous 12 months to minimize recall errors associated with the collection of  
150 retrospective injury data.<sup>30</sup> Participants also completed the mAFAQ to screen for beginning of  
151 the season fear-avoidance.

152 Any participant who sustained an injury during the season ( $15.2 \pm 8.9$  weeks duration) reported  
153 to the Certified Athletic and Rehabilitation Therapist present at weekly training sessions for an  
154 injury assessment. Injuries, recorded using the standardized injury report form,<sup>1</sup> were defined  
155 as any injury sustained during training or competition resulting in restricted performance or  
156 time lost from play.<sup>1</sup> Injuries that required the participant to miss time from Gaelic football  
157 participation were classed as time-loss injuries, whereas non-time-loss injuries did not require  
158 the participant to miss participation from Gaelic football. Immediately following the injury



159 assessment, the injured participant completed the AFAQ, <sup>19</sup> which will be termed the AFAQ1  
160 for the purpose of clarity in this paper. Those who sustained a time-loss injury completed the  
161 AFAQ a second time immediately before their first training or match when returning to play,  
162 termed the AFAQ2.

### 163 *Data Analysis*

164 Data was analysed using IBM SPSS version 24 (IBM, New York, USA). Normality was  
165 examined using Shapiro-Wilks test, which identified normally distributed data with a  
166 significance value greater than 0.05. The mean and standard deviation were calculated for the  
167 score of each individual statement and overall mAFAQ, AFAQ1 and AFAQ2 scores.  
168 Independent samples T-test compared the difference between AFAQ1 scores for time-loss and  
169 non-time-loss injuries. Paired samples T-tests compared AFAQ1 and AFAQ2 scores in those  
170 who sustained a time-loss injury and mAFAQ and AFAQ1 scores in participants who sustained  
171 an injury during the season. Effect sizes for T-tests, calculated using eta squared, were  
172 determined according to Cohens' classification; small=0.01, moderate=0.06 and large=0.14.<sup>31</sup>  
173 Pearson correlations identified the relationship between (i) mAFAQ, AFAQ1, AFAQ2 and  
174 time-loss from Gaelic football participation and (ii) AFAQ1, AFAQ2 and VAS pain rating and  
175 were interpreted using the following classifications: 0.00-0.19=very weak, 0.20-0.39=weak,  
176 0.40-0.59=moderate, 0.60-0.79=strong and 0.80-1.00=very strong.<sup>32</sup> Multiple regression  
177 analysis was performed to determine if AFAQ1 scores could be predicted by injury severity  
178 and injury history in the previous 12 months. Multicollinearity of the multiple regression  
179 analysis was first examined by inspecting the correlation coefficients and variance inflation  
180 factors (VIFs), with high correlation ( $r>0.9$ ) and VIF ( $>10$ ) indicating multicollinearity. No  
181 multicollinearity was noted. Adjusted R square, which explains how much of the variance in  
182 the dependent variable is explained by the model, was utilized to explain the variance in the  
183 outcome variable. Adjusted R square was utilised for its increased accuracy over R square,

184 which tends to be an optimistic overestimation of the true value in the population.<sup>33</sup> Logistic  
185 regression was conducted to analyse if total mFAQ score predicts injury, with the odds ratio  
186 (OR) and 95% confidence interval examined. An OR value greater than one indicated an  
187 increased risk of injury. A significance level of 0.05 was set for all statistical tests ( $p \leq 0.05$ ).

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## Results

189 Twenty-two injuries were recorded over the season, four of which resulted in time-loss from  
190 play, with 18 non-time-loss injuries. The nature of injuries that required time-loss were  
191 ligament sprains (n=3) and tendinopathies (n=1). Injury history identified that 54.6% of  
192 participants sustained an injury in the previous 12 months, with 21.6% reporting two or more  
193 injuries. Hamstring (22.6%) and ankle (18.9%) were the most commonly injured body parts,  
194 with injuries predominantly occurring to muscle (39.6%), ligament (26.4%) and bone (24.5%).  
195 The average mAFAQ score for all participants at baseline was  $23.32 \pm 6.01$  (Table 3). Average  
196 AFAQ1 and AFAQ2 scores for time-loss and non-time-loss injuries are presented in Table 4.  
197 No significant differences were evident between average AFAQ1 scores for time-loss ( $26.75$   
198  $\pm 4.92$ ) and non-time-loss injuries ( $21.00 \pm 7.15$ ) ( $t(20)=1.52$ ;  $P>0.05$ ;  $\eta^2=0.10$ ). However,  
199 AFAQ1 scores ( $26.75 \pm 4.92$ ) were statistically greater than AFAQ2 scores ( $14.25 \pm 4.92$ ) in  
200 those who sustained a time-loss injury, with a large effect size ( $t(3)=5.64$ ;  $P=0.011$ ;  $\eta^2=0.91$ ).  
201 In addition, there was no significant difference between mAFAQ and AFAQ1 in those who  
202 sustained an injury during the season ( $t(21)=1.503$ ;  $P>0.05$ ;  $\eta^2=0.10$ ). No significant  
203 relationships were evident between mAFAQ, AFAQ1, AFAQ2 or days lost from Gaelic  
204 football participation ( $r= 0.014$  to  $0.595$ ;  $P>0.05$ ). Significant moderate correlations were  
205 evident between AFAQ1 and VAS at the time of injury ( $r= 0.563$ ;  $P=0.006$ ) and between  
206 AFAQ1 and VAS at the time of injury assessment ( $r= 0.596$ ;  $P=0.003$ ). No significant  
207 correlations were evident between AFAQ2 and VAS pain rating ( $r= -0.160$  to  $-0.336$ ;  $P>0.05$ ).  
208 Multiple regression analysis identified that injury severity and previous injury explain 8.1% of  
209 the variance in AFAQ1 scores in those who sustained an injury during the season, however,  
210 the model was not found to be statistically significant ( $F_{2,19} = 1.93$ ;  $P>0.05$ ;  $R^2= 0.081$ ). Injury  
211 severity ( $\beta= 0.24$ ;  $t= 1.13$ ;  $P>0.05$ ) and previous injury ( $\beta= -0.28$ ;  $t= 1.13$ ;  $P>0.05$ ) when  
212 examined individually did not contribute significantly to the model. Baseline fear-avoidance

213 was not a significant predictor of injury explaining 0.6% to 0.9% of the variance ( $P>0.05$ ).

214 However, the odds of sustaining an injury was slightly higher for those with higher baseline

215 fear-avoidance (OR=1.03; 95% CI=0.95-1.12;  $P>0.05$ ).

216 [Insert Table 3]

217 [Insert Table 4]

218

## Discussion

219 This study aimed to establish the extent of fear-avoidance post-injury in male adolescent Gaelic  
220 footballers, the effect of pain, days lost from Gaelic football participation, injury severity and  
221 previous injury on the amount of fear-avoidance reported and the usefulness of a modified  
222 AFAQ as a screening tool for predicting injury.

### 223 **Fear-avoidance post-injury**

224 The average AFAQ score reported in this study ( $22.1 \pm 7.1$ ) is similar to that of a sample of  
225 currently injured and previously injured collegiate athletes ( $n=103$ ) from a variety of sports  
226 ( $23.7 \pm 7.0$ )<sup>19</sup> and a sample of adults ( $n=102$ ;  $25 \pm 8.5$  years) with a sports-related injury ( $26.0$   
227  $\pm 8.0$ ).<sup>34</sup> Despite age differences between the adolescent, collegiate and adult participants,  
228 similar fear-avoidance is evident, outlining that adolescent Gaelic footballers experience  
229 psychological distress levels comparable to their adult counterparts. No research to date has  
230 identified fear-avoidance in Gaelic footballers, therefore, comparisons to other Gaelic football  
231 populations are unable to be completed. Nevertheless, there is a clear necessity for  
232 psychological intervention programs following injury in those that display fear-avoidance.

### 233 **Fear-avoidance and pain**

234 Fear-avoidance post-injury was higher in those with greater pain scores as measured by the  
235 VAS scale. Similar findings were found between pain and fear-avoidance in adults with a  
236 sports-related injury,<sup>34</sup> in physically active individuals with osteoarthritis<sup>35</sup> and patients with  
237 acute<sup>36</sup> and chronic low back pain.<sup>37</sup> These results support the fact that pain tolerance is a  
238 moderator of the psychological response to injury<sup>17</sup> and has significant physical and  
239 psychological effects on recovery.<sup>38</sup> In contrast, fear-avoidance has been defined as the fear of  
240 pain in chronic low back pain literature to date.<sup>23, 39</sup> The lack of a significant relationship  
241 between fear-avoidance prior to return to play and VAS pain ratings, which indicates that pain  
242 experienced when the injury was sustained does not relate to fear-avoidance prior to return to

243 play, highlights that this definition of fear-avoidance may not be appropriate in a high-  
244 functioning, physically active population. If fear-avoidance was solely to describe a fear of  
245 pain, an association between fear-avoidance and pain would be anticipated at any point  
246 following injury, particularly at a point of return to play post-injury. Fear-avoidance in injured  
247 athletes may instead be associated with the greater injury experience and the avoidance of  
248 movements or activities based on fear<sup>18</sup> and the negative emotional response to injury that  
249 stimulate feelings of depression, anxiety, low vigor, fatigue, grief and burnout.<sup>7</sup>

### 250 **Fear-avoidance, time-loss and injury severity**

251 Similar fear-avoidance was identified for participants who sustained time-loss and non-time-  
252 loss injuries, which suggests the duration of time loss from Gaelic football participation does  
253 not affect the extent of fear-avoidance. In addition, no significant relationships were noted  
254 between the duration of time-loss from Gaelic football participation and fear-avoidance at  
255 baseline, post-injury and prior to return to play. However, this finding conflicts with previous  
256 research that identified time loss duration as a moderator of the psychological response to  
257 injury.<sup>17</sup> Time loss duration may not be a moderating factor in the current study due to the low  
258 number of injuries that required missed participation from Gaelic football. Current injury  
259 severity (i.e. minor, moderate or severe based on the number of days lost from Gaelic football  
260 participation) was also not a significant predictor of fear-avoidance post-injury, despite  
261 previous research identifying that more severely injured athletes experience greater mood  
262 disturbances following injury when compared to those who suffer moderate to acute injuries.<sup>8</sup>  
263 Most injuries in the current study were minor in nature requiring less than 7 days absence from  
264 Gaelic football participation and only four time-loss injuries were noted, which may have  
265 impacted this finding. The lack of significant difference between fear-avoidance in participants  
266 who sustained time-loss and non-time-loss injuries and the lack of interaction between injury  
267 severity, days lost from Gaelic football participation and fear-avoidance could be attributed to

268 the prevalence of male adolescent Gaelic footballers who continue to play through injury.<sup>1</sup>  
269 Playing through injury results in no time-loss from Gaelic football participation, thus meaning  
270 time-loss may not affect fear-avoidance in this youth sample of the population. In addition,  
271 fear-avoidance was measured following the injury assessment where participants were aware  
272 of the nature of their injury but the extent of time loss from Gaelic football participation was  
273 not clear at that time.

#### 274 **Baseline fear-avoidance**

275 Fear-avoidance was evident at the beginning of the season, but greater fear-avoidance did not  
276 increase the likelihood of sustaining an injury over one season. Similarly, fear-avoidance  
277 following injury was not significantly greater than baseline fear-avoidance and previous injury  
278 did not predict fear-avoidance post-injury. To our knowledge, no research to date has identified  
279 fear-avoidance at baseline prior to sustaining an injury so comparisons to similar research  
280 cannot be made. The baseline mFAQ measured players' perceptions of fear-avoidance at the  
281 start of the season that may be experienced if they became injured. However, male adolescents'  
282 perceptions of their fear-avoidance may differ from their actual fear-avoidance experienced  
283 post-injury. Situational factors (level of competition, time in season, playing status,  
284 teammate/coach influences, family dynamics or social support), personal factors (player  
285 demographics, injury characteristics, injury history, pain tolerance, motivation, athletic  
286 identity, social support or mood states) or behavioural and emotional responses (risk-taking  
287 behaviours, rehabilitation adherence, tension, anger, depression, grief or emotional coping) can  
288 alter the psychological response to injury.<sup>17</sup> The stress-athletic injury model highlights that an  
289 athlete who exhibits increased amounts of stress due to their personality, history of stressors or  
290 subjective coping resources, may be at increased risk of sustaining an injury.<sup>40</sup> Therefore, fear-  
291 avoidance is highly subjective and situationally based so solely implementing baseline  
292 screening or post-injury measurement of fear-avoidance may not be useful. Instead clinicians

293 should screen for athletes who show elevated stress levels at the beginning of the season that  
294 can increase their risk of injury but also measure fear-avoidance post-injury that may  
295 overwhelmingly influence the physical and psychological response to injury that has the  
296 potential to hinder rehabilitation.

### 297 **Fear-avoidance prior to return to play**

298 Male adolescent Gaelic footballers experience fear-avoidance and psychological distress when  
299 they sustain an injury but following a period of time-loss from Gaelic football participation and  
300 rehabilitation, fear-avoidance reduces. Similar trends have been identified in previous research  
301 with negative emotions of tension, depression, anger, fatigue and confusion shown to decrease  
302 from the time of injury evaluation to the point of full recovery.<sup>24</sup> This difference could be due  
303 to the benefits of rehabilitation and the return to play process, which focuses on returning the  
304 athlete to sports participation and their pre-injury level of performance.<sup>41</sup> Meeting  
305 rehabilitation goals and successfully improving the components of performance, such as  
306 strength, flexibility and proprioception, could potentially help to reduce fear-avoidance by  
307 improving confidence in the injured body part. However, only four time-loss injuries were  
308 observed so the clinical applicability of this finding is limited. A clearer image of fear-  
309 avoidance in participants who sustain a time-loss injury may be evident with a greater number  
310 of time-loss injuries.

### 311 ***Limitations***

312 A substantially low number of time-loss injuries were observed in this study, which may be  
313 due to the short season over which data was collected. The small number of time-loss injuries  
314 may impact the ability of this study to examine time-loss and its relationship to fear-avoidance.  
315 Furthermore, injury history was only determined for injuries sustained by participants in the  
316 previous 12 months in order to reduce the effects of recall bias. However, previous injury is a  
317 risk factor for re-injury and its relationship with the extent of fear-avoidance at baseline and



318 following injury may be different when examined over a longer period. In addition, this study  
319 failed to account for the occurrence of serious traumatic injury occurring greater than 12  
320 months previous requiring surgical repair and substantial rehabilitation, despite the fact that  
321 these injuries may still insight increased levels of fear greater than 12 months post-injury.  
322 However, the incidence of sports injuries in youth participants requiring operative treatment is  
323 expected to be low with only 8.8% of sports injuries presenting to paediatric hospitals requiring  
324 surgery<sup>42</sup> and 6.7% of adolescents requiring surgery due to a Gaelic football injury.<sup>1</sup> In  
325 addition, this study solely examined fear-avoidance in male adolescent Gaelic footballers,  
326 which makes it difficult to apply the findings to collegiate and elite players or female Gaelic  
327 footballers. Future research should examine fear-avoidance and the psychological reaction to  
328 musculoskeletal injury across Gaelic football populations in a larger cohort of male adolescents  
329 and across a number of seasons.

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## Conclusions

331 Fear-avoidance is evident in male adolescent Gaelic footballers comparable to levels  
332 experienced by injured collegiate and adult athletes. Fear-avoidance post-injury was higher in  
333 those with greater pain scores. However, baseline measures of fear-avoidance did not predict  
334 the likelihood of sustaining an injury over one season, which indicated that fear-avoidance  
335 should be examined when a Gaelic footballer sustains an injury. The findings highlight the  
336 need for psychological rehabilitation in conjunction with physical rehabilitation in the  
337 management of an injured Gaelic footballer and their successful return to sport. Awareness of  
338 the extent of fear-avoidance in injured players allows clinicians to design an effective  
339 rehabilitation plan that can manage both the physical and psychological recovery required and  
340 may consequently reduce the period of time loss from participation.

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459 **Table 1** **Athlete Fear Avoidance Questionnaire Statements (Dover and Amar,**  
460 **2015)**

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<b>Question 1</b>	I will never be able to play as I did before my injury.
<b>Question 2</b>	I am worried about my role with the team changing.
<b>Question 3</b>	I am worried about what other people will think of me if I don't perform at the same level.
<b>Question 4</b>	I am not sure what my injury is.
<b>Question 5</b>	I believe that my current injury has jeopardized my future athletic abilities.
<b>Question 6</b>	I am not comfortable going back to play until I am 100%.
<b>Question 7</b>	People don't understand how serious my injury is.
<b>Question 8</b>	I don't know if I am ready to play.
<b>Question 9</b>	I worry if I go back to play too soon I will make my injury worse.
<b>Question 10</b>	When my pain is intense, I worry that my injury is a very serious one.

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**Table 2 Modified Athlete Fear Avoidance Questionnaire Statements**


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<b>Question 1</b>	If I was injured, I would never be able to play as I did before my injury.
<b>Question 2</b>	If I was injured, I would be worried about my role with the team changing.
<b>Question 3</b>	If I was injured, I would be worried about what other people will think of me if I don't perform at the same level.
<b>Question 4</b>	If I was injured, I would not be sure what my injury is.
<b>Question 5</b>	If I was injured, I would believe that my current injury has jeopardized my future athletic abilities.
<b>Question 6</b>	If I was injured, I would not be comfortable going back to play until I am 100%.
<b>Question 7</b>	If I was injured, people would not understand how serious my injury is.
<b>Question 8</b>	If I was injured, I would not know if I was ready to play.
<b>Question 9</b>	If I was injured, I would worry if I go back to play too soon I would make my injury worse.
<b>Question 10</b>	If I was injured and my pain was intense, I would worry that my injury is a very serious one.

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**Table 3** Average baseline mAFAQ scores

mAFAQ	All participants (n=97)	Injured participants (n=20)	Non-injured participants (n=77)
	Mean Score $\pm$ SD		
<b>Question 1</b>	1.57 $\pm$ 0.88	1.60 $\pm$ 0.94	1.56 $\pm$ 0.87
<b>Question 2</b>	2.03 $\pm$ 1.07	2.05 $\pm$ 1.15	2.03 $\pm$ 1.05
<b>Question 3</b>	2.06 $\pm$ 1.06	1.90 $\pm$ 0.97	2.10 $\pm$ 1.08
<b>Question 4</b>	2.23 $\pm$ 1.31	2.45 $\pm$ 1.39	2.17 $\pm$ 1.29
<b>Question 5</b>	2.01 $\pm$ 1.10	1.85 $\pm$ 1.09	2.05 $\pm$ 1.11
<b>Question 6</b>	2.24 $\pm$ 1.32	2.35 $\pm$ 1.42	2.21 $\pm$ 1.30
<b>Question 7</b>	2.51 $\pm$ 1.21	2.65 $\pm$ 1.14	2.47 $\pm$ 1.23
<b>Question 8</b>	2.54 $\pm$ 1.23	2.50 $\pm$ 1.10	2.55 $\pm$ 1.26
<b>Question 9</b>	2.81 $\pm$ 1.54	3.00 $\pm$ 1.56	2.77 $\pm$ 1.54
<b>Question 10</b>	3.33 $\pm$ 1.51	3.10 $\pm$ 1.48	3.39 $\pm$ 1.51
<b>Total</b>	23.32 $\pm$ 6.01	23.45 $\pm$ 6.13	23.29 $\pm$ 6.02

467 Notes: mAFAQ= Modified Athlete Fear Avoidance Questionnaire; SD= standard deviation

469 **Table 4** Average AFAQ1 and AFAQ2 scores for time-loss and non-time-loss  
 470 **injuries**

	AFAQ1			AFAQ2
	Time-loss injuries	Non-time-loss injuries	All participants	Time-loss injuries
Mean Score $\pm$ SD				
<b>Question 1</b>	2.75 $\pm$ 1.26	1.61 $\pm$ 0.85	1.82 $\pm$ 1.01	1.25 $\pm$ 0.50
<b>Question 2</b>	2.25 $\pm$ 1.26	2.06 $\pm$ 1.21	2.09 $\pm$ 1.19	1.25 $\pm$ 0.50
<b>Question 3</b>	2.50 $\pm$ 0.58	2.61 $\pm$ 1.42	2.59 $\pm$ 1.30	2.00 $\pm$ 1.41
<b>Question 4</b>	3.25 $\pm$ 0.96	1.56 $\pm$ 0.86	1.86 $\pm$ 1.08	1.75 $\pm$ 1.50
<b>Question 5</b>	2.25 $\pm$ 0.96	1.67 $\pm$ 0.69	1.77 $\pm$ 0.75	1.00 $\pm$ 0.00
<b>Question 6</b>	3.25 $\pm$ 0.96	2.44 $\pm$ 1.38	2.59 $\pm$ 1.33	1.50 $\pm$ 0.58
<b>Question 7</b>	1.75 $\pm$ 0.50	2.06 $\pm$ 0.87	2.00 $\pm$ 0.82	1.50 $\pm$ 1.00
<b>Question 8</b>	3.50 $\pm$ 0.58	2.17 $\pm$ 1.38	2.41 $\pm$ 1.37	1.00 $\pm$ 0.00
<b>Question 9</b>	3.00 $\pm$ 1.15	2.56 $\pm$ 1.38	2.64 $\pm$ 1.33	1.50 $\pm$ 0.58
<b>Question 10</b>	2.25 $\pm$ 1.50	2.28 $\pm$ 1.32	2.27 $\pm$ 1.32	1.50 $\pm$ 0.58
<b>Total</b>	26.75 $\pm$ 4.92	21.00 $\pm$ 7.15	22.05 $\pm$ 7.07	14.25 $\pm$ 4.92

471 Notes: AFAQ1= Athlete Fear Avoidance Questionnaire completed following injury  
 472 assessment; AFAQ2= Athlete Fear Avoidance Questionnaire completed prior to return to play;  
 473 SD= standard deviation