



## Nutrition knowledge of elite and non-elite Gaelic footballers

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### ABSTRACT

Dietary intake plays a significant role in athletic performance and is influenced by several factors, including nutrition knowledge. Gaelic footballers are amateur athletes who conduct high-intensity, intermittent activity during training and competition, and have previously demonstrated insufficient dietary intake. This study aimed to examine nutrition knowledge in elite and non-elite Gaelic footballers. An online survey was distributed to competitive Gaelic footballers, examining nutrition knowledge using the Abridged Nutrition for Sport Knowledge Questionnaire. Total, general, and sport nutrition knowledge were compared between elite and non-elite athletes, and those who had and had not previously received nutrition education, using Mann-Whitney U-tests. A total of 190 participants (15.3% women) completed the survey. No differences between elite and non-elite athletes in nutrition knowledge were identified ( $p > 0.05$ ). Athletes with previous nutrition education scored higher than those without previous nutrition education in total ( $54.0 \pm 4.9\%$  vs  $46.8 \pm 9.6\%$ ;  $p = 0.002$ ) and sport ( $51.9 \pm 12.5\%$  vs  $43.4 \pm 11.8\%$ ;  $p = 0.005$ ) nutrition knowledge. Findings suggest an importance of nutrition education at all levels of athletic competition to improve nutrition knowledge, which may empower athletes to make appropriate dietary decisions to support training and competition demands.

### ARTICLE HISTORY

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### KEYWORDS

Nutrition knowledge; athlete; sport; education

### Background

Nutrition plays a significant role in athletic performance, achieved through the dietary influence on body composition, training adaptation, and recovery (Garthe et al. 2013; Beck et al. 2015). However, team sport athletes regularly fail to meet recommended dietary intakes; although protein and fat requirements are typically met, energy and carbohydrate intake are often below recommendations (Jenner et al. 2019). An inadequacy of energy and carbohydrate intake in a team sport context may limit substrate availability during training and matches as well as impair recovery (Williams and Rollo 2015). Ongoing insufficient dietary intake may therefore compromise athletic performance and success.

Dietary intake is influenced by factors including taste, cost, and convenience (Spronk et al. 2014). The nutrition knowledge of an individual has also been associated with dietary intake, albeit weakly (Heaney et al. 2011; Spronk et al. 2014, 2015). For this reason, dietary education has increasingly been included in team sport athlete preparation, with sports nutrition professionals highly valued in such settings. These dietary education programs aim to improve both general and sport nutrition knowledge, the latter of which to specifically address food choices in order to maximise the dietary influence on athlete performance (Tam et al. 2019).

Gaelic football is a high intensity, intermittent-style team sport, widely played throughout Ireland (Reilly and Doran 2001). The physiological demands of the sport have been shown to be similar to that of Australian football and soccer (Brewer et al., 2010; Osgnach et al. 2010; Malone et al. 2016), thus dictating similar dietary requirements. The dietary intake

of elite Gaelic footballers during a pre-season period was recently assessed, showing that energy intake did not meet energy expenditure, particularly on training days (O'Brien et al. 2019). Such shortfalls in energy intake may reflect inadequate nutrition knowledge of athletes. However, to date there has been limited examination of the nutrition knowledge of Gaelic footballers, with the only recent study showing poor nutrition knowledge in a small cohort of Gaelic footballers (McCrink et al. 2020). Previous studies have shown that, despite access to qualified nutrition professionals and ongoing dietary education, elite, sub-elite, and non-elite Australian football and soccer players have poor to average general and sport nutrition knowledge (Devlin and Belski 2015; Devlin et al. 2017; Trakman et al. 2018a, 2018b). In comparison with Australian football and soccer though, Gaelic football is unique in that even at the elite All-Ireland national (inter-county) level, players remain strictly amateur. As such, due to budget and time restrictions, access to sports dietitians may be limited to one-off group education sessions at the elite level, while non-elite teams likely lack the capacity to offer any professional dietary education. Given these limitations, the nutrition knowledge of Gaelic football players may be insufficient, potentially leading to dietary inadequacies which may impair performance.

The aim of the present study was to assess the nutrition knowledge of elite and non-elite Gaelic footballers. A secondary aim was to compare nutrition knowledge of Gaelic footballers who had and had not previously received nutrition education. We hypothesised that elite athletes, and athletes who had previously received nutrition education, would have greater nutrition knowledge relative to non-elite

athletes and those without previous nutrition education, respectively.

## Materials and methods

An online survey was used in this observational study to assess nutrition knowledge in Gaelic footballers. Men and women  $\geq 18$  years old, currently playing in a competitive Gaelic football team, and living in the Republic of Ireland were eligible for inclusion. Participants were recruited through snowball sampling. Although snowball sampling involves non-random selection of participants, it provides reach to participants with similar characteristics and is based on networks and relationships which may lend credibility to research (Valerio et al. 2016). Initially, the survey link was distributed to elite and non-elite football players and managers known to the research group via social media, who were then asked to further distribute the link to their contact base of players, managers, and clubs. Informed consent was provided upon entering the survey, which was open for data collection between 19<sup>th</sup> January and 31 March 2020. Ethics approval for the study was provided by the University College Dublin Human Research Ethics Committee. The survey was delivered online using Google Forms (docs.google.com/forms). This program is compliant with data protection policies, with access to submitted data only available to the research group.

A pilot of the survey was conducted on a mixture of footballers and other researchers in the department ( $n = 24$ ), providing feedback regarding clarity and usability. The final survey contained 49 items, across two sections. Section 1 gathered basic demographic information about participants, including age, anthropometrics (weight, height), Gaelic football experience, playing calibre, training frequency, and level of education. Section 2 examined nutrition knowledge using the Abridged Nutrition for Sport Knowledge Questionnaire (ANSKQ) (Trakman et al. 2018a, 2019). The ANSKQ is a validated 35-item questionnaire assessing both general (11 items) and sport nutrition knowledge (24 items). The questionnaire contains multiple choice and agree/disagree items. To prevent guessing, participants were instructed to select 'not sure' when appropriate. Construct validity of the ANSKQ has been previously demonstrated (Trakman et al. 2018a). The ANSKQ has good test-retest reliability ( $r = 0.7$ – $0.8$ ) and participant scores correlate strongly with the complete Nutrition for Sport Knowledge Questionnaire ( $r = 0.9$ ) (Trakman et al. 2018a). Correct items were summed to give total, general, and sport nutrition knowledge scores. Scores were categorised as poor (0–49%), average (50–64%), good (65–74%), and excellent ( $\geq 75\%$ ) (Trakman et al. 2017, 2018b). Participants were asked to rate their confidence in nutrition knowledge (no, slight, moderate, or high confidence), perceived understanding of athlete nutrition needs (no, slight, moderate, or high understanding), and perceived quality of their eating habits (poor, fair, good, very good quality). Participants were also asked if they had previously received formal nutrition education.

Means and standard deviations were calculated for all continuous variables. Normality of data was checked using the Shapiro-Wilk test. Participant characteristics were compared using independent samples t-tests and Pearson Chi squared

tests. Due to non-normal distribution of data, Mann-Whitney U-tests were used to assess differences in nutrition knowledge scores based on sex, age (younger,  $< 23$  years; older,  $\geq 23$  years), athlete calibre, level of education, and previous nutrition education. Athlete calibre was classed as elite (inter-county competition) and non-elite. Pearson's Chi squared test was used to assess differences in distribution of confidence in nutrition knowledge, perceived understanding of athlete nutrition needs, and perceived quality of eating habits based on athlete calibre and previous nutrition education. Spearman's correlation coefficient was used to test the association between nutrition knowledge and confidence in nutrition knowledge, perceived understanding of athlete nutrition needs, and perceived quality of eating habits. Significance was set at  $p < 0.05$ . All analyses were conducted using SPSS (version 24.0).

## Results

A total of 192 individuals entered the survey. Two individuals failed to meet inclusion criteria (not currently playing Gaelic football). The remaining 190 participants (15.3% women) completed the survey in full and were included in analysis. Completion time of the survey was typically 12–15 minutes. Participant characteristics are presented in Table 1. Participating men were significantly older, taller, and heavier, and had played Gaelic football for more years than women. A greater proportion of women played at the elite level at the time of sampling compared to men. A greater proportion of participants whose highest playing calibre was elite had previously received nutrition education ( $p = 0.019$ ).

Total nutrition knowledge score for the entire cohort was  $47.8 \pm 9.9\%$ , classified as poor knowledge. Mean general and sport nutrition knowledge were  $55.2 \pm 13.2\%$  (average knowledge) and  $44.6 \pm 12.3\%$  (poor knowledge), respectively.

**Table 1.** Characteristics of Gaelic football athletes participating in the nutrition knowledge study.

	Total ( $n = 190$ )	Women ( $n = 29$ )	Men ( $n = 161$ )
Age (years)	$23.6 \pm 5.3$	$21.4 \pm 2.7$	$24.0 \pm 5.5^a$
Stature (cm)	$170.6 \pm 8.4$	$167.8 \pm 7.2$	$181.8 \pm 6.6^a$
Weight (kg)	$78.6 \pm 10.6$	$64.9 \pm 7.5$	$81.1 \pm 9.0^a$
BMI ( $\text{kg}/\text{m}^2$ )	$24.3 \pm 2.5$	$23.1 \pm 2.6$	$24.5 \pm 2.4^a$
Level of education			
Secondary school or less	49 (25.8%)	8 (27.6%)	41 (25.5%)
Tertiary education	141 (74.2%)	21 (72.4%)	120 (74.5%)
Playing experience (years)	$15.5 \pm 5.6$	$11.7 \pm 5.3$	$16.2 \pm 5.4^a$
Current playing calibre			
Elite	29 (15.3%)	10 (34.5%)	19 (11.8%) <sup>b</sup>
Non-elite	161 (84.7%)	19 (65.5%)	142 (88.2%)
Highest playing calibre			
Elite	94 (50.5%)	18 (62.1%)	76 (47.2%)
Non-elite	96 (49.5%)	11 (37.9%)	85 (52.8%)
Training frequency (sessions/week)			
1–2	15 (7.9%)	1 (3.4%)	14 (8.7%)
3–5	149 (78.4%)	23 (79.3%)	126 (78.3%)
>6	26 (13.7%)	5 (17.2%)	21 (13.0%)
Previous nutrition education			
Yes	27 (14.2%)	5 (17.2%)	22 (13.7%)
No	163 (85.8%)	24 (82.8%)	139 (86.3%)

Results presented as mean  $\pm$  standard deviation, unless otherwise indicated. <sup>a</sup>, difference between men and women based on independent samples t-test ( $p < 0.05$ ); <sup>b</sup>, difference in distribution between men and women based on Pearson's Chi squared test ( $p < 0.05$ ). BMI, body mass index.

**Table 2.** Differences in nutrition knowledge based on participant characteristics in Gaelic footballers measured using the abridged nutrition for sport knowledge questionnaire.

	Total nutrition knowledge (%)	General nutrition knowledge (%)	Sport nutrition knowledge (%)
Sex			
Women (n = 29)	45.4 ± 13.1	55.5 ± 12.0	41.1 ± 16.9
Men (n = 161)	48.2 ± 9.2	55.1 ± 13.5	45.2 ± 11.2
Age			
Younger (n = 104)	45.5 ± 9.4	53.1 ± 14.4	42.3 ± 11.6
Older (n = 86)	50.6 ± 9.9 <sup>b</sup>	57.6 ± 11.3 <sup>a</sup>	47.4 ± 12.4 <sup>b</sup>
Current playing calibre			
Elite (n = 29)	46.5 ± 9.5	53.9 ± 12.6	43.4 ± 11.7
Non-elite (n = 161)	48.0 ± 10.0	55.4 ± 13.4	44.8 ± 12.4
Highest playing calibre			
Elite (n = 94)	47.0 ± 10.7	54.4 ± 14.2	44.0 ± 12.8
Non-elite (n = 96)	48.5 ± 9.1	56.0 ± 12.3	45.1 ± 11.8
Level of education			
Secondary school or less (n = 49)	43.7 ± 9.4	50.3 ± 13.0	40.8 ± 11.8
Tertiary education (n = 141)	49.2 ± 9.7 <sup>b</sup>	56.9 ± 12.9 <sup>b</sup>	45.9 ± 12.2 <sup>a</sup>
Previous nutrition education			
Yes (n = 27)	54.0 ± 9.9 <sup>b</sup>	58.6 ± 14.3	51.9 ± 12.5 <sup>b</sup>
No (n = 163)	46.8 ± 9.6	54.6 ± 13.0	43.4 ± 11.8

Results presented as mean ± standard deviation. <sup>a</sup>,  $p < 0.05$ ; <sup>b</sup>,  $p < 0.01$ ; Younger, < 23 years; Older, ≥ 23 years.

Differences in knowledge based on sex, age, playing calibre, level of education, and previous nutrition education are presented in Table 2.

No differences in total, general, or sport nutrition knowledge were observed based on sex or athlete calibre ( $p > 0.05$ ). Older participants scored higher than younger participants on total ( $p < 0.001$ ), general ( $p = 0.024$ ), and sport nutrition knowledge ( $p = 0.005$ ). Participants with tertiary-level education scored higher than those with secondary school or lower level education on total ( $p = 0.003$ ), general ( $p = 0.006$ ), and sport nutrition knowledge ( $p = 0.038$ ). Participants who had previously received nutrition education scored higher in total ( $p = 0.002$ ) and sport nutrition knowledge ( $p = 0.005$ ), while no difference was seen in general nutrition knowledge ( $p = 0.062$ ).

Nearly half of participants (48.4%) were slightly confident in their nutrition knowledge, while a third (37.9%) were moderately confident. Similarly, 47.9% and 41.6% of participants perceived their understanding of athlete nutrition needs as slight and moderate, respectively. Participants perceived the quality of their eating habits as fair (43.7%), good (42.1%), and very good (9.5%). There were no differences in the distribution of nutrition knowledge confidence, perceived understanding of athlete nutrition needs, and perceived quality of eating habits between participants based on current or highest playing calibre ( $p > 0.05$ ). A higher proportion of participants who had previously received nutrition education reported moderate to high confidence in their nutrition knowledge ( $p = 0.003$ ), and perceived their eating habits as good to very good ( $p = 0.038$ ), than those who had no previous nutrition education. Total and sport nutrition knowledge scores were positively associated with nutrition knowledge confidence ( $\rho = 0.415\text{--}0.498$ ,  $p < 0.001$ ), perceived understanding of athlete nutrition needs ( $\rho = 0.307\text{--}0.358$ ,  $p < 0.001$ ), and perceived quality of eating habits ( $\rho = 0.227\text{--}0.234$ ,  $p \leq 0.002$ ).

## Discussion

The aim of this study was to assess the nutrition knowledge of elite and non-elite Gaelic footballers, and to compare nutrition knowledge in participants who had and had not previously received nutrition education. Results demonstrated that the nutrition knowledge of included participants was poor, reflected in the poor sport specific nutrition knowledge of participants. No differences were observed in nutrition knowledge between elite and non-elite athletes, while those who had previously received nutrition education scored greater in total and sport nutrition knowledge. These results highlight the importance of nutrition education at all levels of athletic competition.

The current cohort of Gaelic footballers demonstrated poor overall nutrition knowledge, scoring less than 50% in both total and sport nutrition knowledge. A slightly improved outcome was found for the general nutrition knowledge section, where participants were classified as average (mean general nutrition knowledge:  $55.2 \pm 13.2\%$ ). These results are similar to a recent report of a small cohort of Gaelic footballers, who scored 40% and 30% for total and sport nutrition knowledge, respectively (McCrink et al. 2020). Similarly, professional male Australian footballers scored 46% and 47% for total and sport nutrition knowledge, respectively (Jenner et al. 2018). Given that dietary intake is influenced by nutrition knowledge, the participants in the current study are likely unaware of sports nutrition recommendations surrounding energy and nutrient intake provided by international sporting committees (for example the International Olympic Committee, American College of Sports Medicine) (International Olympic Committee 2011; Thomas et al. 2016) and therefore may follow an insufficient diet for training and performance. The general nutrition knowledge score also suggests that the present cohort of Gaelic footballers may have a limited understanding of general healthy eating recommendations, which may result in a limited capacity to translate these recommendations into dietary practice (Spronk et al. 2014).

No differences were observed in total, general, or sport nutrition knowledge between elite and non-elite participants. This finding runs counter to our initial hypothesis, instead conforming with results from Devlin, Leveritt (Devlin et al. 2017), which showed no difference in total, general or sport nutrition knowledge between male elite and sub-elite Australian footballers and elite soccer players. However, our results contrast research in a separate sample of Australian footballers which found non-elite athletes demonstrated greater total nutrition knowledge compared to elite athletes (Trakman et al. 2018b). The nutrition knowledge of the elite Australian footballers was classified as poor ( $45.5 \pm 14.7\%$ ), while the non-elite was classified as average ( $50.9 \pm 11.0\%$ ). It was suggested that this difference may be attributed to the slightly higher prevalence of university educated participants in the non-elite group (Trakman et al. 2018b). Another proposed explanation was the reliance of elite participants on the team dietitian for support, not requiring these athletes to synthesise, recall, and apply essential nutrition facts related to optimal nutrition practice (Trakman et al. 2018b).

The proposed reliance of elite players on the team dietitian for support in the previously mentioned study (Trakman et al. 2018b) may partly explain the lack of difference in scores based on player calibre in the present study. Elite Gaelic footballers remain amateur and therefore clubs may not have the capacity to provide a team dietitian full time or at all for players to depend on, thus these elite athletes must apply their own nutrition knowledge to meet dietary recommendations. Conversely, the amateur nature of elite Gaelic football may also explain why these participants did not score greater than non-elite participants in the present study. Budget, time constraints, and competing pressures may limit the opportunity for elite clubs to provide nutrition support to athletes. The small sample size of current elite-level participants in the present study may also contribute to the non-significant findings. Although, the trend of no difference remained present for athletes whose highest career calibre was elite. Future research recruiting a larger sample of current elite athletes may demonstrate if any difference in nutrition knowledge exists between elite and non-elite Gaelic footballers. Inclusion of a dietary intake measure in addition to a questionnaire-based knowledge assessment may assist in investigations of knowledge between playing calibres, particularly through highlighting the ability of athletes to apply nutrition knowledge.

Previous formal nutrition education was shown to influence nutrition knowledge in the current study. Participants who reported having previously received formal nutrition education demonstrated average total, general, and sport nutrition knowledge, which was significantly greater than participants who had not previously received nutrition education. Only a small percentage of participants in the present study reported previous nutrition education (14.2%), of which the larger proportion were elite athletes. The type of nutrition education participants reported having received varied, including formal tertiary education courses and education received from nutrition professionals through their football club. These findings suggest providing nutrition education to athletes can benefit their nutrition knowledge. However, this finding contrasts a recent assessment of Australian footballers. Trakman, Forsyth (Trakman et al. 2018b) showed no difference in total and sport nutrition knowledge between participants who had and had not previously undertaken nutrition study. Furthermore, participants who had access to nutrition information with or without a dietitian at their club did not differ significantly in nutrition knowledge from participants who had no nutrition support at their club (Trakman et al. 2018b).

Despite the lack of difference in nutrition knowledge based on access to nutrition information in Australian footballers (Trakman et al. 2018b), a recent systematic review supports the use of nutrition education for improving nutrition knowledge (Tam et al. 2019). The majority of included studies reported a significant increase in nutrition knowledge following nutrition education, with a mean increase of 17.1% (Tam et al. 2019). Given this, nutrition education is likely an important tool which Gaelic football clubs could employ to improve the nutrition knowledge of athletes, with the goal of eliciting an improvement in dietary intake and athletic performance. Given the amateur nature of this sport, cost effective education methods may be warranted, such as fact sheets, group

presentations, and videos. The Gaelic Athletic Association (the governing body of Gaelic football in Ireland) could also promote general and sport nutrition education to athletes through provision of such evidence-based education material. As younger participants demonstrated lower levels of nutrition knowledge in the present study, providing education resources to developing players may be particularly pertinent.

Total nutrition knowledge score was positively associated with nutrition knowledge confidence, perceived understanding of athlete nutrition needs, and perceived quality of eating habits. This suggests that those with increased nutrition knowledge are more confident with their nutrition knowledge and their ability to make appropriate dietary decisions for health and performance. This is reflected in the athletes who had previously received dietary education. A higher percentage of participants with previous dietary education reported moderate to high confidence in their nutrition knowledge and perceived their eating habits as good or very good quality compared to those who had no previous nutrition education. This further suggests the benefit of nutrition education for athletes, suggesting such programs will not only improve athlete nutrition knowledge, but also confidence in applying their knowledge into practice.

Several limitations should be considered when interpreting the findings of the present study. Despite an extremely high completion rate, elite and women athletes were under-represented. This non-response bias must be considered when interpreting the non-significant differences in nutrition knowledge based on athlete calibre and sex. In addition, differences were present in playing calibre and experience between men and women. The sampling strategy and online nature of the study may also influence subgroup comparisons. Selection bias may be introduced by the sampling strategy, whereby individuals with greater or lesser nutrition knowledge may be more or less likely to participate. Given the survey was conducted online, independent completion by participants cannot be guaranteed. The assessment of previous education did not distinguish between those who had received education through their club and those who had undertaken tertiary level nutrition education. The ANSKQ was utilised rather than the full Nutrition for Sport Knowledge Questionnaire to promote a greater completion rate (Trakman et al. 2018a). This abridged questionnaire assesses declarative (e.g. food sources of nutrients) but not procedural (e.g. how to prepare a high carbohydrate meal) knowledge, an important component of nutrition knowledge (Spendlove et al. 2012). The use of an extended questionnaire which includes procedural knowledge items, such as the full Nutrition for Sport Knowledge Questionnaire (Trakman et al. 2017), may provide an insight into athletes' ability to translate knowledge into practice. Including a formal dietary intake assessment such as a validated food frequency questionnaire in conjunction with nutrition knowledge assessment may also be of value in examining procedural knowledge.

## Conclusion

Gaelic footballers in the present study demonstrated poor to average nutrition knowledge as demonstrated by the ANSKQ.



Poor sport nutrition knowledge may result in limitations in dietary intake related to sport performance. No differences between elite and non-elite athletes were observed, while differences in nutrition knowledge between individuals who had and had not previously received nutrition education highlight the benefit of education programs in team sports. As such, provision of nutrition education to both elite and non-elite athletes is warranted to ensure athletes are empowered with an understanding of appropriate dietary choices which can support training and match demands. Given the amateur nature of Gaelic football, clubs and the Gaelic Athletic Association should explore cost effective education material, such as group education and online learning resources. Ensuring education resources are made available to developing athletes will assist in addressing the limitations of younger athletes identified in the current study. Future research should aim to explore nutrition knowledge in a larger cohort of elite Gaelic footballers, and employ a control cohort, such as a community sample, for comparison.

### Disclosure of interest

LM consults as a performance dietitian to a club affiliated with the Gaelic Athletic Association.

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### Data availability

Data may be obtained from the lead author upon reasonable request.

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