# Off-Season Changes in Body Composition of Elite Gaelic Footballers: Starters vs Non-Starters

**Eoghan Boyle** [1], **Shane Mangan** [1, 2], **Cian O'Neill** [2], **Gavin Rackard** [3], **Joe Warne** [1, 4], **Arthur Dunne** [5], **SarahJane Cullen** [5], **Giles Warrington** [6, 7], **Kieran Collins** [1]

[1]Gaelic Sports Research Centre, Technological University Dublin - Tallaght Campus, Dublin, Ireland,[2]Department of Sport, Leisure & Childhood Studies, Cork Institute of Technology, Cork, Ireland,[3]Connacht Rugby, The Sportsground, College Road, Galway, Ireland,[4]Setanta College, Thurles, Tipperary, Ireland,[5]Department of Sport & Exercise Science, Waterford Institute of Technology, Waterford, Ireland,[6]Department of Physical Education and Sport Science, University of Limerick, Limerick, Ireland, and [7]Sport and Human Performance Research Centre, Health Research Institute, University of Limerick, Limerick, Ireland

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## Headline

Analysis of body composition is commonly conducted as a performance-profiling marker of Gaelic football players [4]. Excess body fat is deemed unsatisfactory in athletic performance as it may hinder performance where body mass (BM) must be accelerated during running, or lifted against gravity in aerial contests [5, 17]. Due to this negative impact of excess adipose tissue, a body composition difference between starters and non-starters may be one of several factors to consider during the team selection process.

Body composition of elite (inter-county) adult Gaelic footballers (n = 39, across 2 teams), when reported as a body fat percentage (BF %) from a sum of seven skinfold equation [17], were observed to be 10.9 - 11.3% [7, 16]. Research involving sub-elite collegiate footballers reported higher BF % values when compared to elite players (15.7 ± 3.8%) [4]. The application of Dual Energy X-ray Absorptiometry (DXA) scans are now commonly used to report the body composition of Gaelic footballers [2-4]. The mean DXA BF % for elite adult Gaelic footballers, recorded from five teams (n = 46) is reported to be 14.9 % [2], with sub-elite players (n = 20) reporting a mean value of 15.7 % [4].

Time of season is reported to have a significant effect on body composition within elite Gaelic football [9, 18]. Elite hurling research examining the seasonal DXA-measured body composition changes of three adult teams observed a concurrent increase in lean tissue mass (LTM) and loss of fat tissue mass from end of a competitive season to the start of the following pre-season [3]. Elite Australian football literature, a field sport with similar characteristics to Gaelic football [10], examined seasonal DXA-measured body composition changes of one team (n = 45), discovering that fat-free mass (FFM) increased during the pre-season, while fat tissue mass decreased [1]. An examination of the training load across a season for a single elite Gaelic football team (n = 30) discovered that variation in training load across the seasonal blocks was evident [11]. During the off-season period of a Gaelic football season, training load is reduced, followed by a period of increased training load during the competitive season, before once again being reduced during the latter stages of competition while game load is increased [9].

To date, DXA-derived research in Gaelic football has primarily examined body composition values at a single time point [2, 4], and variations across playing position [2]. However, changes in DXA-derived body composition values across player role (starter vs non-starter) or time of season is yet to be investigated in Gaelic football. Research in elite Australian football of one team reported no significant differences between starters and non-starters for height, BM and sum of seven skinfolds [20]. Additionally, literature in elite youth soccer has shown no significant differences in skinfold thickness when comparing starters, non-starters and substitutes not used [15]. To the authors' knowledge, there is currently no extant literature assessing body composition differences between starters and non-starters in elite Gaelic football. Further, off-season changes in body composition comparing player role has also yet to be investigated.

## Aim

The aim of this study was to investigate the off-season changes in body composition of elite, adult male Gaelic football players with specific reference to player role (starter vs non-starter). It is hypothesised that at the second time point, non-starters will have a significantly higher body fat % and lower lean tissue mass when compared to starters.

## Methods

### Athletes

Fifty-seven elite inter-county adult male Gaelic football players (age: 26 ± 3 years, body mass: 85.6 ± 6.7 kg and stature: 184 ± 6 cm, respectively) from two teams participated in the study. Ethical approval was given by local board of ethics for this study and conformed to the Code of Ethics of the World Medical Association (Declaration of Helsinki).

### Design

Data were collected across the 2019 Gaelic football season. For the comparison of player role, participants were classified into one of two groups; starter (n = 34) and non-starter (n = 23). A player was considered a starter if they started in one or more All-Ireland Championship fixtures during the 2019 season. The All-Ireland Championship is the annual national tournament that is contested by all the elite Gaelic football teams in the country. Participants consented to body composition analysis via DXA at two time points: mid-season (MID); prior to the commencement of the All-Ireland Championship (April), and off-season (OFF); prior to the commencement of the following pre-season (December).

### Methodology

Stature and body mass were measured using a Seca Stadiometer and a weighing scales (Seca Instruments Ltd, Germany), respectively. Dual Energy X-ray Absorptiometry (DXA) (Lunar iDXATM) (GE Healthcare) was used to quantify body composition, and scans were analysed using enCORETM v.14.1 software. Participants were instructed to follow a standardised protocol consistent with the official position statement of the International Society of Clinical Densitometry [6, 14, 19]. Participants avoided strenuous exercise for 12 hours prior to analyses, arrived fasted (minimum 4 hours), consumed 500 ml of water 1 hour before the scan and emptied the bladder immediately prior to measurement. All scanning and analyses was performed by the same operator to ensure consistency and in accordance with standardised testing protocols.

## Data Analysis

A mixed between-within ANOVA was conducted to determine whether factors of player role (starter and non-starter) and time of season were associated with differences in body mass (kg), fat-free mass (kg), lean tissue mass (kg) and body fat % across the two time points. Significance was accepted where $p \leq 0.05$. Statistical analyses were performed within the statistical package of the social sciences (21.0, SPSS Inc. Chicago, IL).

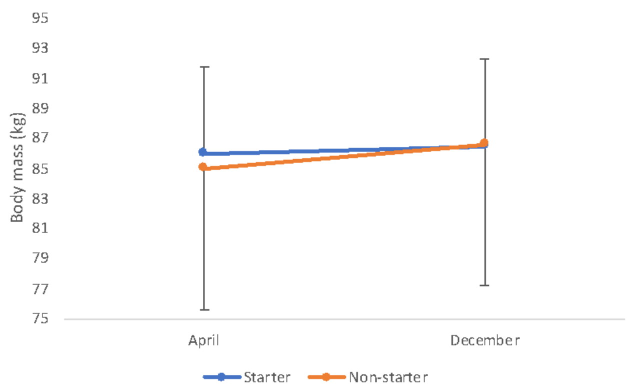


**Fig. 1.** Off-season changes in body mass (kg) with respect to role. Error bars represent SD.

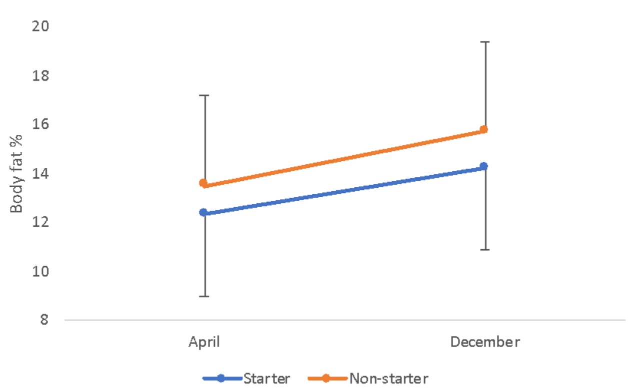


**Fig. 2.** Off-season changes in body fat % with respect to role. Error bars represent SD.

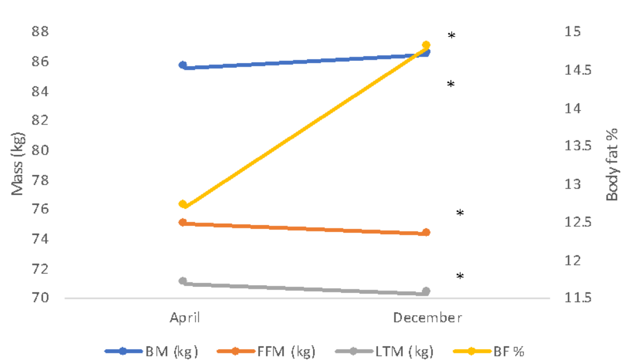


**Fig. 3.** Off-season body composition changes; independent of player role.

## Results

Mean scores (±SD) of the descriptive statistics for all variables are presented in Table 1. Pairwise comparisons of body composition across player role and time of season are presented in Table 2.

There was no significant interaction for any variable between player role * time of season (BM, $p = 0.190$; FFM, $p = 0.347$; LTM, $p = 0.419$; BF %, $p = 0.473$). There was no main effect for differences between player role for any variable, independent of time (BM, $p = 0.828$; FFM, $p = 0.273$; LTM, $p = 0.304$; BF %, $p = 0.140$). However, independent of player role, all variables observed a significant change over time (BM, $p = 0.006$, mean diff = 1.045 kg, 95 % CI [0.31 – 1.78]; FFM, $p = 0.018$, mean diff = -0.694 kg, 95 % CI [-1.27 – -0.12]; LTM, $p = 0.012$, mean diff = -0.733 kg, 95 % CI [-1.30 – -0.17]; BF %, $p \leq 0.001$, mean diff = 2.097 %, 95 % CI [1.58 – 2.61]).

## Discussion

The purpose of this study was to examine the off-season changes in body composition comparing player role. The main findings of the investigation were that there were no significant differences in BM, FFM, LTM or BF % when comparing starters and non-starters across the two time points, thus rejecting the research hypothesis. However, independent of player role, all four body composition variables observed a significant change over time.

Starters and non-starters both experienced a non-significant BM increase from MID to OFF. However, independent of player role, BM significantly increased from MID to OFF. Elite hurling literature similarly reported a significant increase in BM from mid-season to off-season [3]. A reduction in work load during the off-season period is most likely responsible for these BM increases.

Starters and non-starters both experienced non-significant decreases in FFM from MID to OFF. However, similar to BM, when player role was not considered a significant decrease was observed. Elite soccer research examining the effects of training and competition on body fat content and sprint performance reported no significant change in FFM (JP equation) [8] across four time points from the start of one season to the beginning of the next season [13]. Furthermore, elite Australian football research examining the development and variation in body composition of footballers over three consecutive seasons similarly found non-significant seasonal changes in FFM [1]. Longitudinal changes in FFM appear minimal in elite sports, with further investigations within Gaelic football required to gain a greater insight. Starters and non-starters both exhibited non-significant decreases in LTM from MID to OFF, with a significant reduction independent of player role observed. Davies et al. (2017) observed a non-significant increase in LTM from mid-season to off-season, with LTM then maintained during in-season.

A non-significant increase in BF % from MID to OFF was reported for both starters and non-starters. However, similar to all other body composition values, a significant difference was observed when player role was not considered. In support of these findings, significant increases in BF % from MID to OFF have been previously reported in elite hurling [3] and elite soccer [13]. To conclude, the detraining, off-season period does not significantly impact non-starters more than starters, or vice versa, with respect to body composition. BM and BF % increased, while FFM and LTM decreased, although homogenous profiles were discovered when player role was compared.

**Table 1.** Independent-measures analysis of body composition: starters vs non-starters. Mean ± SD (95% confidence intervals).

| Role | Independent of Time | | | | | | April 2019 | | | | December 2019 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Age (years) | Height (cm) | BM (kg) | FFM (kg) | LTM (kg) | BF % | BM (kg) | FFM (kg) | LTM (kg) | BF % | BM (kg) | FFM (kg) | LTM (kg) | BF % |
| **Starter (n = 34)** | 27 ± 3 | 185 ± 5 | 86.2 ± 7.1 [83.8 –88.6] | 75.7 ± 5.8 [73.4 –77.4] | 71.3 ± 5.4 [69.4 –73.1] | 13.2 ± 3.4 [12.0 –14.4] | 86.0 ± 5.8 [83.6 – 88.3] | 75.9 ± 5.3 [73.8 – 77.9] | 71.7 ± 5.0 [69.8 – 73.7] | 12.3 ± 3.0 [11.1 – 13.4] | 86.5 ± 6.0 [83.9 – 89.1] | 74.9 ± 4.8 [72.9 – 76.9] | 70.8 ± 4.5 [68.9 – 72.6] | 14.2 ± 3.3 [12.8 – 17.5] |
| **Non-Starter (n = 23)** | 24 ± 4 | 183 ± 7 | 85.8 ± 7.0 [82.9 –88.7] | 73.6 ± 5.8 [71.2 –76.1] | 69.8 ± 5.4 [67.5 –72.0] | 14.6 ± 3.4 [13.2 –16.0] | 85.0 ± 8.0 [82.2 – 87.9] | 73.9 ± 6.8 [71.4 – 76.3] | 70.0 ± 6.4 [67.7 – 72.3] | 13.5 ± 3.7 [12.0 – 14.8] | 86.6 ± 9.4 [83.4 – 89.7] | 73.4 ± 7.0 [71.0 – 75.9] | 69.5 ± 6.5 [67.3 – 71.7] | 15.7 ± 4.5 [14.1 – 17.3] |
| **Total (n = 57)** | | | | | | | 85.6 ± 6.7 [83.7 – 87.3] | 75.0 ± 6.0 [73.2 – 76.5] | 71.0 ± 6.0 [69.4 – 72.4] | 12.7 ± 3.3 [12.0 – 13.7] | 86.5 ± 7.5 [84.5 – 88.6]* | 74.3 ± 5.8 [72.6 – 75.7]* | 70.3 ± 5.4 [68.7 – 71.6]* | 14.8 ± 3.9 [13.9 – 16.0]* |

Abbreviation: BM; body mass. FFM; fat-free mass. LTM; lean tissue mass. BF; body fat
Significantly different from April ($P < 0.05$) = *

**Table 2.** Pairwise comparisons of body composition across time and player role.

| Variable | Comparison | Mean difference | 95% CI | P-value | Cohen's D [size] |
|---|---|---|---|---|---|
| **BM (kg)** | Change over time | 1.045 | [0.31 – 1.78] | 0.006* | 0.14 [small] |
| **BM (kg)** | Role | 0.414 | [-3.38 – 4.21] | 0.828 | 0.05 [small] |
| **FFM (kg)** | Change over time | -0.694 | [-1.27 – -0.12] | 0.018* | 0.12 [small] |
| **FFM (kg)** | Role | 1.722 | [-1.40 – 4.84] | 0.273 | 0.36 [small] |
| **LTM (kg)** | Change over time | -0.733 | [-1.30 – -0.17] | 0.012* | 0.12 [small] |
| **LTM (kg)** | Role | -1.507 | [-4.41 – 1.40] | 0.304 | 0.28 [small] |
| **BF %** | Change over time | 2.097 | [1.58 – 2.61] | ≤0.001* | 0.58 [medium] |
| **BF%** | Role | 1.386 | [-.0.47 – 3.24] | 0.140 | 0.41 [small] |

Abbreviation: BM; body mass. FFM; fat-free mass. LTM; lean tissue mass. BF; body fat, CI; confidence interval
Significantly different ($P < 0.05$) = *

## Practical Applications

- Players may require further education on the impact of reduced work load and off-season lifestyle choices on their body composition.
- This study is the first of its kind within elite Gaelic football to assess the off-season changes in body composition when comparing player role.

## Limitations

- This investigation did not consider years of playing experience and exposure to physical conditioning when examining body composition.
- Due to the small sample size, the results are not intended to be interpreted as normative for all elite Gaelic football players.
- DXA-derived estimates of fat-free mass and lean tissue mass were not normalised for stature.

## Dataset

Dataset available on SportPerfSci.com.

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