The Work-Rate of Substitutes in Elite Gaelic Football Match-Play

Eoghan Boyle 1, Joe Warne 1 2, Alan Nevill 3 Kieran Collins 1

1 Gaelic Sports Research Centre, Technological University Dublin - Tallaght Campus, Dublin, Ireland; 2 Setanta College, Thurles, Tipperary, Ireland, and 3 Faculty of Education, Health and Wellbeing, University of Wolverhampton, UK

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Headline
According to a study assessing changes in match running performance in elite Gaelic football players, there is a significant reduction in relative high-speed distance (RHSD) in the second, third and fourth quarters when compared to the first quarter [1]. Subbed on players in elite soccer were reported to cover greater RHSD (19.8 – 25.1 km·h⁻¹) compared to full game players [2]. In elite Rugby union, subbed on players generally demonstrated improved running performance in comparison to full game and subbed off players. Subbed on players also reported a better running performance over their first 10 minutes of play compared to the final 10 minutes of play of whom they replaced [3]. Existing substitute work-rate studies across field sports appear to indicate the positive impact of a substitute in terms of physical performance. However, there is currently limited information on the impact of playing time on Gaelic football match running performance. The relative match-play distances across position comparing full game players, substituted players and substitutes is yet to be investigated in Gaelic football.

Aim
The aim of this study was to investigate the work rate profile of elite male Gaelic football match-play when comparing substitute status and playing position. It is hypothesised that subbed on players will have a greater work rate profile than both full game and subbed off players.

Methods
Athletes
Fifty-two inter-county, elite senior male Gaelic football players from a single panel (age: 25 ± 4 years, body mass: 85.6 ± 6.3 kg and stature: 182 ± 6 cm, respectively) participated in the study. Informed consent was given by local board of ethics for this study and conforming to the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Design
Data were collected across the 2017 and 2018 Gaelic football seasons. For the comparison of playing time, players were classified into one or more of three groups; full game (n=37), subbed off (n=38) and subbed on (n=47). A subbed on player was excluded from the analysis if their game time was less than 5-minutes. For the comparison of position, players were classified into one or more of the five playing positions; full back (n=14), half back (n=19), midfield (n=11), half forward (n=19) and full forward (n=18).

Methodology
During competitive match-play over two seasons, running performance was measured via a global positioning system (GPS) sampling at 10-Hz (VX Sport, New Zealand) in a total of 23 games. Dependent variables consisted of relative total distance (RTD; m·min⁻¹), relative high-speed distance (m·min⁻¹; ≥17km·h⁻¹), peak speed (km·h⁻¹), peak metabolic power and sprints per minute (accel·min⁻¹). Relative total distance was calculated as the total distance (metres) from a single match divided by match-play duration in minutes. Relative high-speed distance was calculated as the total high-speed distance (metres; ≥17km·h⁻¹) from a single match divided by match-play duration in minutes. Peak speed was calculated as the maximum speed (km·h⁻¹) achieved from a single game. Peak metabolic power was calculated as the maximum metabolic output achieved from a single game. Sprints per minute was calculated as the total number of sprints performed from a single game divided by match-play duration in minutes.
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Table 1. Match Performance of Subbed on Players Versus Full Game or Subbed off Players, Independent of Position.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Full game (n = 37)</th>
<th>Subbed off (n = 38)</th>
<th>Subbed on (n = 47)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTD (m·min⁻¹)</td>
<td>123 ± 20</td>
<td>126 ± 16</td>
<td>155 ± 25*</td>
</tr>
<tr>
<td>RHSD (m·min⁻¹; ≥17km·h⁻¹)</td>
<td>22 ± 5</td>
<td>23 ± 5</td>
<td>26 ± 6*</td>
</tr>
<tr>
<td>Peak Speed (km·h⁻¹)</td>
<td>30.1 ± 1.3</td>
<td>29.4 ± 1.2</td>
<td>29.0 ± 1.7*</td>
</tr>
<tr>
<td>Peak Met Power</td>
<td>280 ± 82</td>
<td>274 ± 67</td>
<td>257 ± 89</td>
</tr>
<tr>
<td>Sprints-min (accel·min⁻¹)</td>
<td>2.76 ± 0.65</td>
<td>2.76 ± 0.42</td>
<td>3.63 ± 1.17*</td>
</tr>
</tbody>
</table>

Significantly different from full game and subbed off players (P ≤ 0.05) = *
Significantly different from full game players (P ≤ 0.05) = #

Table 2. Independent-Measures Analysis of Match Performance of Subbed on Players Versus Full Game or Subbed off Players.

Data Analysis

A three-way ANOVA was conducted to determine if the factors of playing position (full back, half back, midfield, half forward and full forward) or substitute status (full game, subbed off and subbed on) were associated with differences in relative total distance (m·min⁻¹), high-speed distance (m·min⁻¹; ≥17km·h⁻¹), peak speed (km·h⁻¹), peak metabolic power and sprints per minute (accel·min⁻¹), where participants were allowed to vary between substitution status as a random effect in the ANOVA. Where main effects were observed, post hoc analysis was conducted under a Bonferroni adjustment to control for multiple comparisons (SPSS adjusted P values reported). Significance was accepted where $\alpha \leq 0.05$.

Results

Mean (±SD) of the descriptive statistics for all variables is presented in Table 1 and 2.

There was a significant interaction between playing position and substitute status for RTD covered (p = 0.048, $\eta^2_p = 0.936$). Results of this interaction can be observed in Figure 1. Simple main effects identified that the interaction was due to full backs substitution status being different than all other positions. We identified that for full backs, the full game players did significantly less RTD than both the subbed off (p = 0.024, mean diff = -18 m·min⁻¹, 95% CI [-35 to -2 m·min⁻¹]) and subbed on players (p = 0.004, mean diff = -26 m·min⁻¹, 95% CI [-55 to -3 m·min⁻¹]), and there was no difference between subbed on and subbed off (p = 1.00, mean diff = -8 m·min⁻¹, 95% CI [-30 to 14 m·min⁻¹]). We also noted that for full game and subbed on players, the middle positions (half back, midfield, and half forward) did significantly more RTD than the full backs and full forwards (as outlined in figure 1).

However, as a result of full backs that were subbed off doing more RTD than other groups, the full backs were not significantly different than these central positions in this subbed off category (all p > 0.95).

Discussion

The purpose of the current study was to examine the work-rate profile of elite Gaelic football match-play with specific reference to substitute status. The key findings of the investigation were that subbed on reported a significantly higher relative total distance, relative high-speed distance and sprints per minute compared to full game and subbed off players. Therefore, the hypothesis is accepted that subbed on players will have a greater work rate profile compared to those who played the entire match, and whom they replaced.
Increased relative total, and high-speed running by subbed on players may be explained by a reduced match-play duration. In support of the current findings, rugby sevens research reported that late subbed on players (last quarter) had a greater relative total and high-speed running distance compared to full game players [4],[5]. Furthermore, literature in elite soccer reported that relative high-intensity running was greater in subbed on players compared with full game players or subbed off players [2].

Interestingly, in the current investigation, subbed on players also reported a significantly lower peak speed compared to both full game and subbed off players. Research in elite soccer similarly reported that subbed on players had a significantly lower peak speed when compared to those who played the full game and were subbed off [6]. The reduced peak speed by subbed on players may be explained by full game and subbed off players spending a longer duration on the field of play, thus giving them a greater opportunity to reach their peak speed. Literature in elite rugby similarly reported match-play duration as an explanation for reduced peak acceleration by subbed on players [4]. Subbed on players performed more sprints per minute compared to both full game and subbed off players. Similar to total and high-speed distance, match-play duration is most likely a contributing factor.

A hierarchy in positional work-rate was observed with the three middle positional lines covering the greatest relative total, and relative high-speed running distance, with this positional trend in line with existing elite Gaelic football literature [1,7,8]. These “central” positions are often referred to as the transitional lines; the link between attack and defence. The multi-disciplinary role of these middle positional lines means they can be consistently involved in both attacking and defending periods, thus increasing match-play work rate [1,7]. As a result, full backs and full forwards had a significantly lower relative total, and relative high-speed distance compared to all other positional lines. Similarly, previous research found full backs had a significantly lower relative high-speed distance compared to all other positions except full forwards [1]. Therefore, the findings of the current study conform with the existing knowledge that the three central positional lines have a greater work rate when compared to both full back and full forwards.

No significant difference was reported for peak speed across playing position. This finding is in line with previous Gaelic football research which found no main effects for peak speed with respect of playing position across quarters [1]. More recent literature also discovered no significant variation in sprint time across positions in elite Gaelic football players [10]. The current study reported no significant differences for peak metabolic power across position and substitute status. Contrastingly, other elite Gaelic football literature reported midfielders having a significantly greater average metabolic power compared to full backs, full forwards and half forwards. Positional differences in average metabolic power have also been reported in other field sports, including elite soccer [11]. The non-significant positional variation in the current study may be players’ metabolic power being performed in comparison to average. Half backs and midfielders performed significantly more sprints per minute compared to full-backs and full-forwards. This is in line with existing elite Gaelic football literature, which reported half backs and midfielders to perform a higher number of accelerations compared to all other positions (7). Similar to total and high-speed running, this finding may be explained by the variation in positional role. Half backs and midfielders (central positions) are naturally more involved in match-play action due to their literal position on the pitch, allowing them the opportunity to be exposed to more sprints than those positioned closer to the goals.

**Practical Applications**

- Coaches need to be cognizant of the game impact which a subbed-on player can make based on situational, technical, and positional factors.
- Players should be physically prepared based on their positional requirements.

**Limitations**

- The current profile fails to consider the technical considerations placed on subbed on players. It is of limited value to the team if the work rate of a subbed on player is high whilst not impacting on the game.
- Match dynamics (winning and losing; ranking of opponent; playing at home or away) were not taken into consideration.

**Dataset**

Dataset available on SportPerfSci.com.

**References**


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<dataset available on SportPerfSci.com>