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Changes in Player Activity Profiles following the 2015 FIH Rule Changes in Elite Women's Hockey

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Running Head: Elite Women's Hockey Activity Profiles with 2015 Rule Changes

Abstract

The aim of this study was to compare the player activity profiles of elite international women hockey players pre (2014) and post (2015) the 2015 FIH match rule changes at team and positional levels. The match activity profiles (*n*=400) of 19 female hockey players (Age 23±4 years, mass 63.6±5.5 kg, VO_{2max} 57±6 ml·kg^{-1}·min^{-1} in 2014, 58±6 ml·kg^{-1}·min^{-1} in 2015) were recorded during competitive international matches in 2014 (match *n*=12) and 2015 (match *n*=13) using 10Hz GPS units. The practical utility of an effect was only classified as substantial when there was a >75% likelihood that the ±90% CI of the ES was equal to or greater than the small (ES ± 0.2) reference value. Mean match time decreased by over two minutes from 71.72±1.38 to 69.40±4.72mins. There were increases at the team level in relative substitutions (SUB), relative distance (RD), High Speed Running (HSR - 3.08-5.27m·s^{-1}) and surges (S), with a fall in Low Speed Running (LSR- 0-3.05m·s^{-1}) between 2014 and 2015. There were no changes in the between-position differences observed from 2014 to 2015. Within-positions, there were relative increases in RD for all positions, HSR and S for midfield, and in SUB and S in forwards. The 2015 FIH rule changes appear to have increased the general intensity of international women's hockey. However the different facets of physical performance did not change uniformly across team positions. Therefore specific modifications to conditioning practises for each position may be warranted to more accurately reflect match demands.

Key Words: Female, GPS, Hockey, Rules

INTRODUCTION:

In order to develop effective and efficient physical preparation training programs, the coach or sports science practitioner must understand the physical activity profile of competition demands. Once this has been established, a training program encompassing development of the profile capacities can be tailored to the individual needs of each playing position to reflect competition demand. In terms of the physiological and physical activity profiles, hockey is classed as a high intensity, intermittent sport (14, 23, 26). For example**,** international male hockey may elicit greater on-pitch relative distances (130 $m \cdot min^{-1}$ - a function of distance covered per minute); than soccer (110 $m \cdot min^{-1}$), rugby union (72 $m \cdot min^{-1}$), rugby league (95 $m \cdot min^{-1}$) and approaching levels of AFL (139 $m \cdot min^{-1}$) (1, 6, 7, 10, 20). It should be noted here that these are generalised relative distances for each team sport as discrete positions within each sport may elicit slightly different relative distances. However, with regards women's international hockey performance, there is currently only one study in the literature providing an insight into match activity profiles. Macutkiewicz and Sunderland (19) reported match activity profiles of 25 international players during 13 international matches in 2007, collecting Global-positioning system (GPS) data using a 1Hz system. This study found that the average total distance covered by players across the whole team was 5541±1144m, with an average of 1653m, 3006m and 852m distance covered at low (0-0.6 $km \cdot h^{-1}$), moderate (6.1-15.0 $km \cdot h^{-1}$) and high intensities (15.-29.5 $km \cdot h^{-1}$) respectively. This equated to ~55.5 %, 38.1% and 6.4% of total match time spent at low, moderate and high intensities respectively. GPS technology has been shown to be valid and reliable in analysing team sport activity profiles (4, 5, 11, 18) and has been used to assess match and training demands in hockey (9, 14, 16, 18, 25, 26). 10Hz GPS systems have been found to be more valid than 1Hz and 5Hz systems for reporting GPS-based metrics (21, 22, 24). Using 1Hz GPS units, MacLeod et al. (18), demonstrated that using GPS to assess hockey movement patterns that

there was a mean difference ± limits of agreement of 0.0 ± 0.9 km·h^{-1} for four shuttle speeds with a Pearson correlation of *r*=>0.99. Therefore, with improved sampling rates of 10Hz currently available, more accurate and valid measures of female international performance can be made.

In 2015, the International Hockey Federation (FIH) introduced rule changes (8) to the existing game format. Prior to 2015, international hockey was played in a 2-halve, 35-minute continuous play fashion, separated by a 10 minute half-time interval. The game clock would continue to run when penalty corners or goals were awarded. Following rule changes, the format now incorporates four 15-minute quarters, with quarters 1 and 2, and 3 and 4 being separated by 2-minute intervals, and a 10-minute half-time interval between quarters 2 and 3. Therefore, total available playing time has been reduced from 70 minutes to 60 minutes. However, further rule changes include where there is a goal or penalty corner awarded, the game clock is stopped and an independent 40-second period to the game clock is given for these events. As an example, if 3 goals have been scored during a single 15-minute quarter, the three 40-second additional periods for each goal, mean than in real-time the quarter will have lasted 17 minutes, even though the game-clock will always read 15 minutes. Such rule changes have the potential to impact the physiological and activity profiles of the competitive demands of international hockey. The introduction of brief recovery periods between quarters could facilitate aerobic recovery and a shorter total game time (or volume of work) could potentially lead to players being able to perform at a higher intensities. The introduction of unlimited substitutions into the sport was hypothesised to bring about a similar phenomenon. This therefore has the potential to affect how training programs are designed to replicate and prepare athletes for these demands, due to these above factors. Furthermore, the only other study employing GPS technology to describe match demands in women's international field hockey have outlined position-specific differences in player activity profiles (19).

For example, in this study, forwards were found to have spent significantly more time performing moderate and high-intensity running than defenders and midfielders. Therefore positional comparisons following the 2015 FIH rule change are also warranted in order to provide the practitioner with this data to inform training and match preparation practices.

The aims of the current study are to 1) report contemporary match activity profiles in elite international women's hockey using a 10Hz GPS system data, 2) compare the activity profiles in women's elite hockey pre and post the 2015 FIH rule changes at both the team and position-specific levels, and 3) describe the possible implications for training prescription.

METHODS:

Experimental Approach to the Problem

The player activity profiles of elite international women hockey players were recorded using GPS and tri-axial accelerometers during 12 international games in 2014, and 13 international games in 2015. The absolute and relative data was then compared between these two data sets at the team and positional levels.

Subjects

19 female elite international women hockey players (Age 23±4 years, mass 63.6±5.5 kg, VO_{2max} estimated from a multi-stage fitness test 57±6 $ml \cdot kg^{-1} \cdot min^{-1}$ in 2014, and 58±6 $ml \cdot kg^{-1} \cdot min^{-1}$ in 2015) participated in the study. Profiles of all 16 outfield players were analysed in every match, comprised of 5 defenders, 5 midfielders and 6 forwards. At any one time, there were 4 defenders, 4 midfielders and 3 forwards active on the field of play.

Players were members of the Irish national team in the competition-phase of the annual plan, and therefore in relative peak condition and free from injury during data collection. Each participant gave written and informed consent, with ethics approved by the ethics committee at the Ulster University, and follows the principles of the Declaration of Helsinki. Data collected was part of the routine squad performance profiling and monitoring.

Procedures

Match Data

12 international matches were analysed pre-2015 changes (3 Nations, 2x4 Nations and 3-test series) against teams ranked 4-22, with 13 post-2015 changes matches analysed (World League 2, 3x3-test series) against teams ranked 5-31. Therefore a total of 400 match analyses were performed. Apart from very minor changes to squad members in 2014 matches, the squad members analysed were identical for the majority of 2014 and all of the 2015 matches.

GPS equipment

The Catapult Sports OptimEye S5 10Hz GPS system (Catapult Innovations, Melbourne, Australia) was used for all match data collection. The validity and reliability of this system has not been published in a peer-reviewed journal thus far, however these are the next generation GPS units from Catapult Minimax 10Hz GPS units, whose validity and reliability has been verified previously (15, 24). Each GPS unit was turned on and left idle for 10 minutes pitch-side to allow location of satellites as per manufacturer's recommendations. Following confirmation of satellite connection, each unit was placed in the manufacturer's specific bib with a neoprene pouch for minimising extraneous unit movement, held approximately between the players' scapulas.

Players had been wearing the bibs and units routinely for several months before data collection and were fully familiarised with the equipment. GPS data was sampled at 10Hz.

GPS analyses

All GPS data was downloaded using a Catapult Sports multi-unit docking station and was analysed using Catapult Sprint version 5.1.7 software (Catapult Innovations, Melbourne, Australia). The start and stop times of each quarter beginning and end were for each match were performed live, in real-time by the same observer, with game substitutions also being performed live. Match time (MT) is the time of the sum of each of the four quarters, whilst total time (TT) is the total amount of time each player spent on the pitch. SUB is the substitution between an active player on the pitch with an inactive player from the bench. Before generation of raw data reports, verification of substitution accuracy was done by interrogation of the raw velocity trace of each individual player against pitch mapping in the software. Simultaneously, horizontal dilution of precision (HDOP) and satellite number was analysed to ensure GPS data quality. The average HDOP and satellite number respectively for the pre-2015 rule change games was 0.71±0.3 and 15±1, and post 2015 rule change games was 0.66±0.8 and 16±1. Therefore GPS quality was deemed as excellent according to manufacturer's guidelines. Player load (PL) was calculated within the software using the formula outlined previously (3).Velocity bands were standardised between the two periods of data collection and are as described in Macutkiewicz and Sunderland (19). Bands were identified as Low Speed Running (LSR 0-3.05m$\cdot s^{-1}$) and High Speed Running (HSR 3.08->5.27 m$\cdot s^{-1}$). Surges (S) are defined as the number of HSR efforts (i.e. efforts >3.08 m$\cdot s^{-1}$). Relative Distance (RD) is defined as the number of metres ran (distance covered) as a function of time (per minute).

In order to allow practitioners to evaluate both total volume of distances covered, and the rate at which they are performed, match performance variables are described in absolute terms (for total distances/ efforts) and relative terms (rate of distance covered: $m \cdot min^{-1}$) in the results section.

Environmental Conditions

Environmental temperatures were recorded live at each game using a handheld environmental meter (Kestrel 5200, Nielson-Kellerman, USA) by the same observer as GPS. Temperature readings were taken at the beginning, half-time and end of each match, with the average of the 3 readings used as the match temperature. Pre-2015 games were played in Italy and Ireland, with post-2015 games played in Ireland, Spain and USA in the seasons of spring and summer 2014 and 2015. There was no significant difference between average match temperatures between 2014 (19±4 °C, range 12-27 °C) and 2015 (20±3 °C, range 14-27 °C) games (p=0.877, independent t-test).

Statistical Analyses

Descriptive data are presented as mean ± SD. All other variables were log-transformed to reduce bias due to non-uniformity of error and analysed using Cohen's effect size (ES) statistic with ±90% confidence intervals (CI) and percent change to determine the magnitude of any difference displayed, using a customized Microsoft Excel® spreadsheet (12). The following magnitude thresholds were used for the standardized differences in means: <0.2 = trivial, <0.6 = small, <1.2 = moderate, <2.0 = large and >2.0 = very large. The percentage likelihood of a difference between groups being positive, trivial or negative was calculated and the qualitative probabilistic terms were assigned using the following scale: <1%, almost

certainly not; 1-5%, very unlikely; 5-25%, unlikely; 25-75%, possibly; 75-95%, likely; 95-99%, very likely; >99 %, almost certainly. The practical utility of an effect was only classified as substantial when there was a >75% likelihood that the ±90% CI of the ES was equal to or greater than the small (ES ± 0.2) reference value. Effects with less certainty were classified as trivial, and where the ±90% CI of the ES spanned both small ES boundaries, then the effects were reported as unclear (2, 13).

Results:

Absolute Differences

All Players

A substantial decrease in match time (MT) and increase in total number of substitutions (SUB) were observed from 2014 to 2015 (Table 1).

(Table 1 about here)

Forward vs. Defenders

The direction of the positional differences between forwards (FWD) and defenders (DEF) remained unaltered from 2014 to 2015 for those variables categorised as substantial on both occasions (Table 2). The magnitude of the ES between FWD and DEF for total distance (TD) and low speed running (LSR) changed from moderate to small due to a substantial increase in LSR from 2014 to 2015 by FWD (Tables 2 & 3). The practical utility between FWD and DEF of player load (PL) and surges (S) changed from substantial to trivial and unclear, respectively (Table 1). These changes occurred due to unclear changes in PL for both positional groups and trivial changes in S for both positional groups (Table 3).

Forwards vs. Midfielders

The direction of the positional differences between FWD and midfielders (MID) remained unaltered from 2014 to 2015 for those variables categorised as substantial on both occasions (Table 2). The magnitude of the ES for these variables changed from moderate to small due to a substantial increase in SUB by MID, substantial increases in TD and LSR by FWD, trivial decreases in total time (TT) and PL by MID and a trivial increase in S by FWD from 2014 to 2015 (Tables 2 & 3). The practical utility of HSR and maximum velocity (MV) between FWD and MID changed from trivial to substantial due to a trivial increase in HSR by MID and MV by FWD, respectively (Tables 2 & 3).

Midfielders vs. Defenders

The direction of the positional differences between MID and DEF remained unaltered from 2014 to 2015 for those variables categorised as substantial on both occasions (Table 2). The practical utility of TT and PL between MID and DEF changed from substantial to trivial due to a trivial decrease in TT by DEF and a trivial decrease in PL by MID (Tables 2 & 3).

Other

SUB also changed from 2014 to 2015 for DEF and FWD (ES= -0.52 and 0.52, respectively) but didn't alter any positional comparisons.

(Table 2 about here)

(Table 3 about here)

Relative Differences

All Players

Substantial increases in SUB, RD, HSR and S were observed from 2014 to 2015. A substantial decrease in LSR was also observed (Table 1).

Forwards vs. Defenders

The direction of the positional differences between FWD and DEF remained unaltered from 2014 to 2015 for all variables on both occasions (Table 4). The magnitude of the ES between FWD and DEF for PL and HSR changed from moderate to small due to a trivial increase in PL and a substantial increase in HSR by DEF from 2014 to 2015 (Table 4 & 5).

Forwards vs. Midfielders

No substantial positional differences existed between FWD and MID in 2014, except for SUB and LSR (Table 4). These differences were not observed in 2015 due to a substantial increase in SUB by MID and substantial decrease in LSR by FWD (Table 4 & 5).

Midfielders vs. Defenders

The direction of the positional differences between MID and DEF remained unaltered from 2014 to 2015 for all variables on both occasions (Table 3). The magnitude of the ES between MID and DEF for PL and LSR changed from moderate to small and vice-versa, respectively, due to a trivial changes by DEF from 2014 to 2015 (Table 4 & 5).

Other

RD increased substantially from 2014 to 2015 for all positional groups (ES=0.57-0.64) but didn't change alter any positional comparisons. The substantial increases in S by MID and FWD, SUB by FWD and HSR by MID also didn't alter any positional comparison.

(Table 4 about here)

(Table 5 about here)

Discussion

The current study aimed to 1) report contemporary match activity profiles in elite international women's hockey using a 10Hz GPS system data, 2) compare the activity profiles in women's elite hockey pre and post the 2015 FIH rule changes at both the team and position-specific levels, and 3) describe the possible implications for training prescription. The major findings of the current study are that the 2015 FIH Rule changes appears to 1) have resulted in an increase in relative distance (RD) across players in each position, 2) have only reduced real-time match length by ~2mins on average. The current data suggest that as a result of the rule changes, matches have become more intense and physical conditioning may require some position and capacity-specific modification of current training methodologies to reflect current match demands.

The results have described match activity profiles in absolute and relative terms. This allows two related but discrete factors in the physical preparation of elite women hockey players to be evaluated. Firstly, absolute terms provide the practitioner with information on the total volume of distance covered in a hockey match, which therefore facilitates the prescription of training around the total aerobic/ anaerobic capacities necessary to perform at this level. Secondly, the relative data serves to normalise data to playing time, allowing the practitioner

to accurately prescribe training exercise/ drills on an intensity basis (i.e. $m \cdot min^{-1}$) for a specific amount of time to reflect match demands.

In terms of the physiological and physical activity profiles, hockey is classed as a high intensity, intermittent sport (14, 23, 26). Currently, there is a lack of contemporary data reflecting the match activity profiles in international women's hockey. To date, there is only one study that has attempted to characterise the playing profiles of international level women hockey players (19). The average total distance (TD) at the team level in Macutkiewicz and Sunderland (19) (5541±1144m), is 13.5% greater than that of the current study in 2014, and 7.2% than in 2015. This may be due to factors such as total playing time, which is heavily related to absolute distance covered during games. The rules during the collection of data in Macutkiewicz and Sunderland (19) were similar to that of 2014 in terms of match length, but different to those of 2015. Other possible factors related to this could be differing individual physiological profiles of the players between two different squads (not described in the previous study), or differences in technology. The current study included GPS sampling rates at 10Hz versus 1Hz employed in (19). 10Hz GPS systems have been found to be more valid than 1Hz and 5Hz systems for reporting GPS-based metrics (21, 22, 24). Overall at the team level, the absolute trends in 2015 were increases in most parameters, although many were trivial. However relativistically speaking in 2015, there were substantial increases in RD, HSR and S at the team level. This suggests that there has been a change in match demands, with a shift towards a more intense activity profile.

At face value, the expected most striking apparent change in the rules would be the match time moving from a two 35 minute per halve continuous match fashion, to a 15 minute four-quarter intermittent fashion. Despite the apparent 10 minute change in total match time, in real-time when stoppages (e.g. 40secs for penalty corners and goals) were included, the actual average difference was actually just over 2 minutes i.e. a 3.4% decrease.

Despite this much smaller decrease in real-time between match length in 2014 and 2015 than expected, it was still deemed substantial statistically. Although this is still a possible reason to explain the lack of substantial differences across many profile variables between 2014 and 2015.

At the team level, the rule changes did not have a substantial impact on most aspects of the absolute activity profiles, with apart from the aforementioned change in total match time, the only other substantial change being in number of substitutions. This reflects substantial increases in substitutions in midfielders and forwards in 2015. Lythe and Kilding (17) demonstrated in male international hockey, that the physical outputs in terms of TD or distance in each velocity zone was not significantly different following 15, 8 or 0 substitutions amongst a group of strikers. Therefore the authors concluded that substitution frequency had no effects on improving physical outputs, but rather can offset decrements in outputs. In the current study, only forwards had a substantial increase in both absolute substitution frequency as well as absolute physical output (in terms of TD). Forwards also seen substantial increases in relative measures in RD and surges in 2015. However defenders also experienced a substantial increase in RD and HSR despite no relative changes in substitution frequency, which was actually a substantial decrease in absolute terms. Midfielders experienced substantial increases in RD, and surges per minute along with substitution frequency changes in 2015. It is therefore unclear between positions, if substitution frequency impacted on the players' physical outputs in absolute and relative terms. Lythe and Kilding (17) also demonstrated significantly better technical outputs in the forwards of whom were more frequently rotated. Therefore, although improvements in match-related outcomes were not found in the physical domain, they can still be achieved by other facets relating to total hockey performance.

When identifying general position-specific differences in activity profiles, the current data suggests that in absolute terms, defenders spend more time on the pitch, cover more total distance, engage in less HSR and achieve lower maximal velocities than both midfielders and forwards. Similar findings were also reported in Macutkiewicz and Sunderland (19), such as defenders experiencing greater pitch time, completing a smaller proportion of total time and distances engaged in running, fast running and sprinting than either of the other two positions. These positional observations are also similar to that identified in elite men's hockey using 1Hz GPS (16). From the current data, the 2015 rule changes do not seem to have altered the between position characteristics that existed in 2014, which is reflected in the fact that the direction of absolute or relative substantial differences between positions remained unaltered following the rule changes.

Further positional considerations following the rule changes occur with the rate at which variables accumulate (i.e. the relative changes). For defenders and midfielders, substantial increases in HSR were observed, along with no. of S in midfielders and forwards. The 2015 rule changes were brought about with the intention of creating a more high-intensity match format. Taking the aforementioned changes to HSR, S and RD altogether it appears that each positional group in the team has experienced a shift toward working at either higher velocities on average, or completing more distance at high intensity. This would suggest improvements in aerobic capacity and/ or power are needed. There are also subtle differences to be noted in each position that may require specific attention when designing conditioning. For example, forwards have seen a substantial increase in surges per minute, but not in HSR distance per minute, suggesting shorter duration efforts. Previous research in hockey has suggested strong consideration of ATP-PCr kinetics for optimising exercise prescription for forwards due to their profile or ratio of high intensity activity on a predominant background of low intensity activity(9, 19).

The current data suggests that although the total amount of high intensity work has not changed post rule changes, the number of efforts has increased inferring on average a decrease in surge distance. Midfielders however experienced substantial increases in both HSR per minute and no. of surges per minute, which suggest that this positional group will require an all-round improvement in aerobic conditioning to support the greater overall physical demand of the role.

Practical Applications:

The current data is of use to coaches and sports science practitioners to allow a general comparison of a squad to international standards in elite women's hockey. The data is presented in absolute terms, allowing capacity specific development of elite women hockey players, and also in relative terms, allowing practitioners to prescribe conditioning at the appropriate intensities. The data can be then used to refine and optimise current training and conditioning practises to reflect contemporary match demands of specific positions following the FIH 2015 rule changes.

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Tables

Table 1. Team/group changes from 2014-2015.

	2014	2015	% Diff	ES (±90% CI)	Qualitative Descriptor
Absolute					
MT (mins)	71.72 ± 1.38	69.40 ± 4.72	-3.4	-0.66 ± 0.65	substantial ↓
TT (mins)	44.98 ± 9.54	44.66 ± 11.04	-2.1	-0.08 ± 0.16	trivial ↓
SUB (#)	70 ± 4	74 ± 4	5.7	0.87 ± 0.63	substantial ↑
TD (m)	4879.9 ± 935.6	5167.4 ± 1029.8	5.1	0.21 ± 0.16	trivial ↑
PL (AU)	503.3 ± 114.2	489.7 ± 102.1	-2.9	-0.12 ± 0.17	trivial ↓
LSR (m)	3948.7 ± 864.1	4188.9 ± 894.5	5.5	0.21 ± 0.16	trivial ↑
HSR (m)	912.9 ± 270.1	959.5 ± 294.3	4.5	0.13 ± 0.17	trivial ↑
MV ($m \cdot s^{-1}$)	23.9 ± 1.5	24.1 ± 1.5	0.8	0.12 ± 0.17	trivial ↑
S (#)	187.7 ± 37.6	192.3 ± 40.8	2.9	0.12 ± 0.17	trivial ↑
Relative					
SUB ($\#\cdot min^{-1}$)	0.98 ± 0.07	1.07 ± 0.08	9.4	1.07 ± 0.58	substantial ↑
WR ($m \cdot min^{-1}$)	109.12 ± 12.6	113.30 ± 13.51	7.5	0.57 ± 0.16	substantial ↑
PL ($AU \cdot min^{-1}$)	11.32 ± 2.09	11.24 ± 2.12	-0.8	-0.05 ± 0.17	trivial ↓
LSR ($m \cdot min^{-1}$)	120.5 ± 7.2	117.7 ± 6.5	-2.2	-0.38 ± 0.16	substantial ↓
HSR ($m \cdot min^{-1}$)	296.3 ± 7.1	298.2 ± 6.6	0.6	0.28 ± 0.17	substantial ↑
S ($\#\cdot min^{-1}$)	4.2 ± 0.7	4.4 ± 0.8	5.2	0.27 ± 0.16	substantial ↑

MT = match time; TT = total time; SUB = substitutions; WR = work rate; PL = player load; LSR = low speed running; HSR: high speed running; S = surges

Table 2. Absolute positional comparisons.

	Forwards vs. Defenders			*Forwards vs. Midfielders*			*Midfielders vs. Defenders*		
	% Diff	ES (±90% CI)	Qualitative Descriptor	% Diff	ES (±90% CI)	Qualitative Descriptor	% Diff	ES (±90% CI)	Qualitative Descriptor
2014									
SUB (#)	216.1	1.88 ± 0.20	substantial ↑	8.3	0.75 ± 0.66	substantial ↑	191.9	1.87 ± 0.20	substantial ↑
TT (mins)	-24.3	-1.19 ± 0.29	substantial ↓	-17.0	-1.05 ± 0.23	substantial ↓	-8.8	-0.46 ± 0.34	substantial ↓
TD (m)	-16.3	-0.80 ± 0.31	substantial ↓	-17.4	-0.98 ± 0.24	substantial ↓	1.4	0.08 ± 0.34	unclear
PL (AU)	-10.1	-0.44 ± 0.32	substantial ↓	-17.0	-0.80 ± 0.26	substantial ↓	8.3	0.36 ± 0.33	substantial ↑
LSR (m)	-23.2	-1.06 ± 0.29	substantial ↓	-19.8	-1.05 ± 0.23	substantial ↓	-4.3	-0.21 ± 0.34	trivial ↓
HSR (m)	27.8	0.71 ± 0.30	substantial ↑	-7.9	-0.27 ± 0.28	trivial ↓	38.8	1.02 ± 0.28	substantial ↑
MV ($m \cdot s^{-1}$)	3.8	0.63 ± 0.29	substantial ↑	1.0	0.16 ± 0.27	trivial ↑	2.8	0.45 ± 0.29	substantial ↑
S (#)	-11.4	-0.51 ± 0.29	substantial ↓	-17.7	-0.82 ± 0.26	substantial ↓	7.7	0.39 ± 0.31	substantial ↑
2015									
SUB (#)	266.0	1.93 ± 0.11	substantial ↑	4.7	0.56 ± 0.66	substantial ↑	249.6	1.93 ± 0.12	substantial ↑
TT (mins)	-17.1	-0.62 ± 0.31	substantial ↓	-14.0	-0.48 ± 0.26	substantial ↓	-5.5	-0.20 ± 0.31	trivial ↓
TD (m)	-8.5	-0.33 ± 0.31	substantial ↓	-14.0	-0.50 ± 0.26	substantial ↓	4.3	0.17 ± 0.30	trivial ↑
PL (AU)	-7.4	-0.28 ± 0.30	trivial ↓	-13.8	-0.47 ± 0.27	substantial ↓	5.4	0.21 ± 0.29	trivial ↑
LSR (m)	-14.3	-0.55 ± 0.30	substantial ↓	-13.7	-0.47 ± 0.27	substantial ↓	-2.6	-0.10 ± 0.30	unclear
HSR (m)	28.9	0.77 ± 0.28	substantial ↑	-13.8	-0.39 ± 0.26	substantial ↓	46.6	1.06 ± 0.25	substantial ↑
MV ($m \cdot s^{-1}$)	5.6	0.80 ± 0.28	substantial ↑	2.6	0.42 ± 0.27	substantial ↑	2.9	0.49 ± 0.29	substantial ↑
S (#)	-0.7	-0.03 ± 0.30	unclear	-14.5	-0.49 ± 0.26	substantial ↓	13.7	0.51 ± 0.28	substantial ↑

SUB = substitutions; TT = total time; TD = total distance; PL = player load; LSR = low speed running; HSR: high speed running; MV = maximum velocity; S = surges.

Table 3. Absolute changes from 2014-2015.

	2014	2015	% Diff	ES (±90% CI)	Qualitative Descriptor
Defender					
SUB (#)	10 ± 2	9 ± 1	-9.5	-0.52 ± 0.69	substantial ↓
TT (mins)	51.91 ± 11.89	49.14 ± 13.47	-6.9	-0.25 ± 0.34	trivial ↓
TD (m)	5182.2 ± 1051.9	5228.4 ± 1087.7	0.4	0.02 ± 0.34	unclear
PL (AU)	506.6 ± 117.0	489.0 ± 98.2	-0.3	-0.13 ± 0.34	unclear
LSR (m)	4429.3 ± 999.5	4467.3 ± 999.1	0.5	0.02 ± 0.34	unclear
HSR (m)	728.8 ± 214.1	737.0 ± 196.4	1.9	0.06 ± 0.35	unclear
MV ($m \cdot s^{-1}$)	23.3 ± 1.2	23.4 ± 1.3	0.2	0.04 ± 0.34	unclear
S (#)	186.9 ± 35.8	181.2 ± 36.0	-3.5	-0.17 ± 0.34	trivial ↓
Midfielder					
SUB (#)	30 ± 3	32 ± 3	8.3	0.80 ± 0.64	substantial ↑
TT (mins)	46.57 ± 7.28	45.72 ± 10.05	-3.5	-0.16 ± 0.25	trivial ↓
TD (m)	5195.5 ± 747.3	5431.3 ± 961.4	3.3	0.16 ± 0.25	trivial ↑
PL (AU)	543.3 ± 105.2	515.3 ± 92.2	-5.7	-0.25 ± 0.25	trivial ↓
LSR (m)	4179.8 ± 672.4	4323.8 ± 814.8	2.2	0.10 ± 0.25	trivial ↑
HSR (m)	998.2 ± 241.6	1089.1 ± 294.0	7.7	0.25 ± 0.25	trivial ↑
MV ($m \cdot s^{-1}$)	24.0 ± 1.5	24.1 ± 1.4	0.3	0.05 ± 0.26	unclear
S (#)	201.0 ± 34.1	207.2 ± 41.5	1.9	0.08 ± 0.25	trivial ↑
Forward					
SUB (#)	32 ± 3	34 ± 2	4.7	0.52 ± 0.69	substantial ↑
TT (mins)	38.55 ± 5.27	40.08 ± 8.50	1.9	0.09 ± 0.29	unclear
TD (m)	4313.4 ± 783.8	4789.6 ± 969.7	9.8	0.40 ± 0.28	substantial ↑
PL (AU)	454.6 ± 104.8	457.7 ± 108.9	-0.2	-0.01 ± 0.28	unclear
LSR (m)	3362.2 ± 615.6	3817.8 ± 797.1	12.1	0.48 ± 0.28	substantial ↑
HSR (m)	935.6 ± 279.3	955.7 ± 257.1	2.7	0.08 ± 0.28	unclear
MV ($m \cdot s^{-1}$)	24.2 ± 1.5	24.7 ± 1.6	1.9	0.30 ± 0.28	trivial ↑
S (#)	167.3 ± 35.8	181.5 ± 37.6	8.2	0.29 ± 0.28	trivial ↑

SUB = substitutions; TT = total time; TD = total distance; PL = player load; LSR = low speed running; HSR: high speed running; MV = maximum velocity; S = surges.

Table 4. Relative positional comparisons.

	Forwards vs. Defenders			*Forwards vs. Midfielders*			*Midfielders vs. Defenders*		
	%	ES (±90%	Qualitative	%	ES (±90%	Qualitative	%	ES (±90%	Qualitative
2014									
SUB	216.1	1.88 ±	substantial ↑	8.3	0.75 ±	substantial ↑	191.9	1.88 ±	substantial ↑
WR	9.9	0.67 ±	substantial ↑	-1.2	-0.10 ±	trivial ↓	11.2	0.99 ±	substantial ↑
PL	18.8	0.93 ±	substantial ↑	0.0	0.00 ±	unclear	18.8	0.99 ±	substantial ↑
LSR	6.2	0.87 ±	substantial ↑	3.0	0.56 ±	substantial ↑	3.1	0.54 ±	substantial ↑
HSR	2.5	0.94 ±	substantial ↑	0.7	0.31 ±	trivial ↑	1.8	0.79 ±	substantial ↑
S ($\#\cdot min^{-1}$)	17.1	0.75 ±	substantial ↑	-0.9	-0.06 ±	unclear	18.2	1.04 ±	substantial ↑
2015									
SUB	266.0	1.93 ±	substantial ↑	4.7	0.44 ±	unclear	249.6	1.92 ±	substantial ↑
WR	10.4	0.83 ±	substantial ↑	0.2	0.02 ±	unclear	10.2	0.72 ±	substantial ↑
PL	11.7	0.54 ±	substantial ↑	0.2	0.01 ±	unclear	11.6	0.56 ±	substantial ↑
LSR	5.0	0.75 ±	substantial ↑	0.4	0.09 ±	trivial ↑	4.6	0.77 ±	substantial ↑
HSR	1.4	0.56 ±	substantial ↑	0.1	0.03 ±	unclear	1.3	0.64 ±	substantial ↑
S ($\#\cdot min^{-1}$)	19.9	0.97 ±	substantial ↑	-0.4	-0.03 ±	unclear	20.4	0.93 ±	substantial ↑

SUB = substitutions; WR = work rate; PL = player load; LSR = low speed running; HSR: high speed running; S = surges.

Table 5. Relative changes from 2014-2015.

	2014	2015	% Diff	ES (±90% CI)	Qualitative Descriptor
Defender					
SUB (#·min^{-1})	0.15 ± 0.03	0.13 ± 0.02	-6.3	-0.36 ± 0.71	unclear
WR (m·min^{-1})	100.97 ± 11.92	109.09 ± 14.93	7.8	0.57 ± 0.33	substantial ↑
PL (AU·min^{-1})	9.83 ± 1.20	10.44 ± 14.93	4.1	0.22 ± 0.34	trivial ↑
LSR (m·min^{-1})	116.5 ± 8.1	113.8 ± 8.8	-2.4	-0.33 ± 0.34	trivial ↓
HSR (m·min^{-1})	291.6 ± 6.0	295.2 ± 6.6	1.2	0.54 ± 0.33	substantial ↑
S (#·min^{-1})	3.7 ± 0.6	3.8 ± 0.7	3.6	0.19 ± 0.34	trivial ↑
Midfielder					
SUB (#·min^{-1})	0.42 ± 0.04	0.47 ± 0.06	12.2	0.94 ± 0.61	substantial ↑
WR (m·min^{-1})	111.87 ± 8.68	119.89 ± 12.57	6.8	0.61 ± 0.24	substantial ↑
PL (AU·min^{-1})	11.76 ± 1.98	11.47 ± 1.72	-2.3	-0.14 ± 0.26	trivial ↓
LSR (m·min^{-1})	119.9 ± 5.4	118.8 ± 4.4	-0.9	-0.23 ± 0.26	trivial ↓
HSR (m·min^{-1})	296.8 ± 6.2	299.0 ± 5.3	0.8	0.39 ± 0.26	substantial ↑
S (#·min^{-1})	4.3 ± 0.5	4.6 ± 0.7	5.5	0.37 ± 0.25	substantial ↑
Forward					
SUB (#·min^{-1})	0.45 ± 0.05	0.49 ± 0.04	8.5	0.81 ± 0.65	substantial ↑
WR (m·min^{-1})	111.31 ± 14.60	119.80 ± 9.95	8.3	0.64 ± 0.27	substantial ↑
PL (AU·min^{-1})	11.80 ± 2.24	11.53 ± 2.03	-2.1	-0.12 ± 0.28	trivial ↓
LSR (m·min^{-1})	123.7 ± 7.0	119.3 ± 5.7	-3.5	-0.63 ± 0.27	substantial ↓
HSR (m·min^{-1})	298.9 ± 7.4	299.3 ± 7.4	0.1	0.06 ± 0.29	unclear
S (#·min^{-1})	4.3 ± 0.8	4.6 ± 0.6	6.1	0.34 ± 0.28	substantial ↑

SUB = substitutions; WR = work rate; PL = player load; LSR = low speed running; HSR: high speed running; S = surges.