

GPS Analysis of an International Field Hockey Tournament

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Purpose: The purpose of this study was to investigate the influence of multiple games on exercise intensity during a world-class hockey tournament. **Methods:** 15 players (mean \pm SD age 27 ± 4 y, stature 179 ± 5 cm, body mass 77 ± 5 kg, and estimated VO_2 64.2 ± 3.1 mL \cdot kg⁻¹ \cdot min⁻¹) competing in the Champions Trophy (CT). Global-positioning systems assessed total distance (TD), low-speed activity (LSA; 0.10–4.17 m/s), and high-speed running (HSR; >4.17 m/s) distance. Differences in movement demands (TD, LSA, HSR) between positions and matches were assessed using the effect size and percent difference \pm 90% confidence intervals. Two levels of comparison were made. First, data from subsequent matches were compared with match 1, and, second, data from each match compared with a tournament average (TA). **Results:** In all matches, compared with game 1, midfielders performed less HSR distance. However, the amount of HSR did not decrease as the tournament progressed. When compared with the TA, defenders showed more variation in each match. All positions showed lower movement outputs when the team won by a large margin. **Conclusions:** It was possible for elite team-sport athletes to maintain exercise intensity when playing 6 matches in a period of 9 days, contrary to the only other investigation of this in elite male field hockey.

Keywords: time–motion analysis, high-intensity running, performance analysis

Field hockey is an international sport played at many standards, ranging from amateur to elite level. The 3 major international competitions at the elite level are the Olympic Games, World Cup, and Champions Trophy (CT). The CT consists of the top-6-ranked countries playing a round-robin-style tournament over a period of 9 days. This schedule may involve intense periods where teams are required to play up to 3 matches in 4 days. With limited time to recover before the next match and an increased importance of match outcomes as the tournament progresses, the ability to maintain exercise intensity across a tournament could be important, as it is possible players will experience accumulated fatigue.

International male field hockey players spend most of a match exercising at low intensity (ie, standing, walking, jogging), with a small proportion of time (~5.6%) spent at higher intensities (striding and sprinting) and an occasional bout of repeated-sprint exercise.^{1,2} Several studies have shown a decrement in physical performance during soccer matches.^{3–5} In particular, some studies have shown that high-speed running (HSR) and sprinting decrease from the first to the second half. This decline in physical activity has been linked to match-related fatigue.^{3,5,6} Similar findings have been observed in elite female field

hockey players, with a decline in high-intensity exercise in the second half of matches.⁷ However, other studies from elite men's hockey have shown that the distance covered in HSR or time spent in HSR zones did not decrease as the halves progressed.^{1,2} Differences in the results may be due to the data-collection methods used in these time–motion-analysis studies (ie, global-positioning vs video-based system). In addition, these time–motion-analysis methods may not have been sensitive enough to detect HSR. The use of subjective techniques^{1,7} and, more recently, data collection using 1-Hz global-positioning-system (GPS) units² to describe player activity may not be sensitive enough to accurately categorize high-intensity running distances.⁸ Several studies have shown that HSR is important to performance in team sports.^{3,4,9} Indeed, in soccer it has been shown to differentiate between the tactical roles of players,¹⁰ as well as being linked to a team's success. Furthermore, higher-ranked soccer teams have been shown to perform less HSR than lower-ranked teams.⁹ The extent to which playing position and team ranking influence high-intensity running performance in elite field hockey across a tournament is currently unknown.

Only 1 study has examined changes in activity profiles over a tournament in elite hockey players using video-based time–motion analysis.¹¹ During the tournament investigated, players increased their time spent standing and reduced their time spent jogging from match 1 to match 3, indicative of fatigue. In that study, residual fatigue was evident in subsequent matches when players competed in 3 field hockey matches within a 4-day time period. However, during major international tournaments,

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more than 3 matches are played. For example, the CT consists of 6 matches played over a period of 9 days. Thus, the fatigue experienced by players competing in the CT may be even greater than previously reported,¹¹ although this is yet to be investigated.

Information on the movement demands of a single match may provide valuable information on positional profiles in field hockey. However, a detailed analysis throughout a tournament could provide a greater insight into the requirements over the duration of such competitions. Previous studies examining match demands in a tournament have compared subsequent matches with the first match played in the tournament.^{11–13} While this approach provides a comparison with a theoretically fatigue-free baseline (ie, match 1), results may be heavily influenced by tactics, opposition, and environmental and other factors related to the first match. This was especially the case in quasi-experimental studies that analyzed match demands of teams participating in international competitions. Therefore, this method of analysis may be limited. A potential method of analysis to ameliorate some of the limitations of this approach may be to compare activity profiles of each match within a tournament with the typical or average match requirements of that team participating in the tournament. Although each method of comparison has limitations, performing both levels of analysis may provide a more complete understanding of the changes in exercise intensity in an international tournament.

Therefore, the purpose of this study was to investigate the influence of multiple matches on exercise intensity during a world-class hockey tournament. Our specific aims were to determine if the mean match intensity changed throughout a tournament, specifically, HSR, and if playing position influenced movement output across the tournament.

Methods

Fifteen male field hockey players (mean \pm SD age 27 \pm 4 y, stature 179 \pm 5 cm, body mass 77 \pm 5 kg, and estimated VO_2 64.2 \pm 3.1 mL \cdot kg⁻¹ \cdot min⁻¹) from the Australian field hockey team were investigated while they competed in the 2009 CT. Goalkeepers were excluded from this study, which conformed to the National Health and Medical Research Council's Statement on Human Experimentation. All athletes gave informed consent after full disclosure of procedures.

Experimental Design

Time–motion analyses were conducted during the CT, which consisted of 5 round matches and a final. The matches were played in a stable ambient temperature (22–26°C). The 6 matches were played over 9 days, with a rest day separating matches 2 and 3, 3 and 4, and 4 and 5. Each match consisted of two 35-minute halves and was played under International Hockey Federation rules, which allow for the use of unlimited substitutions.

During each match, 15 players each wore a GPS unit (MinimaxX, Team 2.5, Catapult Innovations, Scoresby, Australia) in a custom pocket in his uniform, located between the scapulas. The antennas of each unit were exposed to allow clear satellite reception. The number of satellites and the mean horizontal dilution of precision during data collection were 8.3 \pm 0.6 and 1.25 \pm 0.2, respectively. A sample rate of 5 Hz was used for data collection. To limit error, each player wore the same unit for the duration of the competition.¹⁴

The distances from each field position, not the individual players, were used to describe the positional activity patterns.^{1,2,11} For example, when several players played in one position, the activity patterns were recreated by combining data from each substitute playing in that position. The match data were then divided into activity patterns for 3 distinct positional groups: strikers, midfielders (attacking and defensive), and defenders. The following parameters were assessed during the matches: total distance (TD), HSR (running speed >4.17 m/s) distance, and low-speed activity (LSA; 0.10–4.17 m/s). These measures are more reliable for assessing team-sport activity patterns than using narrow speed bands (especially at higher speeds) when using GPS.⁸ Data for each player across the tournament were averaged to calculate the tournament average (TA). This information was divided into positional groups for the cited parameters. Each of the round matches and the final were then compared with the TA to determine changes in exercise intensity.

Statistical Analyses

Descriptive data are presented as mean \pm SD. All other variables were log-transformed to reduce bias due to nonuniformity of error and analyzed using the effect size with 90% confidence intervals and percent difference to determine the magnitude of effects using a custom spreadsheet.¹⁵ Mean differences in movement demands (TD, HSR, LSA) between positions and matches were assessed using a customized spreadsheet.¹⁵ Likely differences between means of less than 75% were considered not practically important.¹⁶ The likelihood of a >75% difference in means was accepted as representing a practically meaningful difference. Differences >95% and >99% were classified as very likely and almost certainly, respectively.¹⁵

Results

Table 1 illustrates the match score against each of the opponents during the CT tournament. The mean (\pm SD) numbers of substitutions per playing position per match were 18 \pm 0.4, 31 \pm 0.8, and 17 \pm 1.5 for strikers, midfielders, and defenders, respectively. The same substitution strategy was used across each positional group in each match. Defenders averaged the highest match playing time (57.20 min), while the strikers and midfielders averaged 44.34 and 49.25 minutes, respectively. Individual

match running performance and tournament average for TD, LSA, and HSR are shown in Table 2.

Comparison With Match 1

Differences in TD, LSA, and HSR distance for different playing positions compared with match 1 are shown in Table 3. The overall physical output (TD, LSA, and HSR) of the strikers was lower in matches 3 and 5 than in match 1. The HSR of strikers decreased in matches 3, 5, and 6, but no variation was found in matches 2 and 4.

Compared with match 1, variations in TD covered by the midfielders were only demonstrated in matches 5 and 6, with less distance covered in these matches. The greatest variation was observed in HSR distance. In all matches, compared with match 1, less HSR distance was performed. However, the amount of HSR did not decrease as the tournament progressed.

With the exception of match 4 (a loss to Germany), there was relatively little variation in the movement

characteristics of the defenders during the tournament. In match 4, the defenders had higher TD and LSA. In matches with a definitive winning score line (more than 2 goals), defenders performed less HSR.

All positions showed the lowest physical output in match 5, where the team won by a large margin (10–2 vs Spain). Only the defenders' LSA did not conform to this pattern, with no clear difference observed.

Comparison With TA

Comparisons between individual matches and the TA characteristics for strikers, midfielders, and defenders are shown in Table 4. There were no practically important differences between the variables in TD for strikers, except between matches 1 and 4. In those matches, strikers covered a greater distance than the TA. In addition, the strikers' LSA increased in match 4, which coincided with a defeat against Germany.

Midfielders and defenders showed far more variation in each match when compared with the TA. Midfielders covered less distance in matches 5 and 6. Matches 1 and 6 provided the greatest variation in HSR, with midfielders performing more HSR in match 1 but less in match 6. Increases in LSA were evident in matches 1 and 4; however, less distance was covered in match 2 than the TA.

Defenders showed the largest variations in distance in each movement category of all positions. Matches 3 and 4 produced increases in all 3 variables compared with the TA. When compared with the TA, more HSR was completed in matches 1, 3, and 4. In match 5, where the team won by the largest margin (10–3), defenders showed a decrease in all variables. However, in the other match with a large winning score line (match 2: 7–2) no clear difference was observed.

Table 1 Opponent and Result for Each Round of the Australian Men's Field Hockey Team in the 2009 Champions Trophy

Round	Opponent	Result
1	Korea	4–0
2	Holland	7–2
3	England	2–1
4	Germany	1–3
5	Spain	10–3
6	Germany	5–3

Table 2 Mean Match Running Performance (m) During an International Field Hockey Tournament

	Opponent						Tournament average, mean ± SD
	Korea	Holland	England	Germany	Spain	Germany	
Striker							
total distance	10,787	9791	8956	10,530	9211	9638	9819 ± 720
low-speed-activity distance	8013	7354	6944	7651	6975	7192	7405 ± 472
high-speed-running distance	2706	2382	1975	2497	2160	1418	2189 ± 456
Midfield							
total distance	10,336	10,342	10,185	10,310	9900	9883	10,160 ± 215
low-speed-activity distance	7642	6889	7387	7677	7223	7357	7363 ± 290
high-speed-running distance	2787	2536	2597	2545	2399	2459	2554 ± 134
Defender							
total distance	9514	9433	9871	10,251	8638	9010	9453 ± 579
low-speed-activity distance	7600	7706	7936	8310	7200	7363	7686 ± 400
high-speed-running distance	1887	1675	1837	1868	1418	1716	1734 ± 177

Table 3 Differences in Distance by Playing Position Compared With Match 1 of an International Field Hockey Tournament

	Total Distance			Low-Speed-Activity Distance			High-Speed-Running Distance		
	%Diff	Qual	ES	%Diff	Qual	ES	%Diff	Qual	ES
Striker									
M1 v M2	10.1 ± 33.9	unclear	0.3 ± 0.8	8.9 ± 39.3	+ ve likely, probable	0.6 ± 2.4	14.1 ± 107.8	unclear	0.4 ± 2.1
M1 v M3	20.6 ± 58.2	+ ve likely, probable	1.4 ± 3.4	15.5 ± 68.2	+ ve likely, probable	0.9 ± 3.2	36.9 ± 36.6	+ ve likely, probable	1.2 ± 1.2
M1 v M4	2.4 ± 38.1	unclear	0.2 ± 2.6	0.7 ± 36.3	unclear	0.0 ± 1.2	8.5 ± 63.6	unclear	0.6 ± 3.4
M1 v M5	17.1 ± 46.9	+ ve likely, probable	1.5 ± 3.6	14.8 ± 43.8	+ ve likely, probable	1.2 ± 3.3	25.5 ± 72.4	+ ve likely, probable	1.3 ± 3.1
M1 v M6	11.8 ± 33.0	unclear	0.2 ± 0.4	11.3 ± 34.5	unclear	0.0 ± 0.0	12.7 ± 37.3	+ ve likely, probable	0.6 ± 1.6
Midfield									
M1 v M2	0.1 ± 7.6	unclear	0.1 ± 1.1	11.4 ± 11.6	+ ve likely, probable	1.1 ± 1.1	11.4 ± 20.7	+ ve likely, probable	0.6 ± 1.1
M1 v M3	1.4 ± 4.4	unclear	0.4 ± 1.1	3.4 ± 4.7	+ ve likely, probable	0.8 ± 1.1	7.3 ± 8.9	+ ve likely, probable	0.9 ± 1.1
M1 v M4	0.2 ± 5.0	unclear	0.1 ± 1.1	-0.5 ± 4.7	unclear	-0.1 ± 1.1	10.2 ± 15.5	+ ve likely, probable	0.7 ± 1.1
M1 v M5	4.4 ± 4.7	+ ve likely, probable	1.0 ± 1.1	5.9 ± 4.7	+ ve likely	1.3 ± 1.1	7.4 ± 9.2	+ ve likely, probable	0.9 ± 1.1
M1 v M6	4.6 ± 4.9	+ ve likely, probable	1.0 ± 1.1	3.9 ± 6.1	+ ve likely, probable	0.7 ± 1.1	13.2 ± 8.0	+ ve likely	1.8 ± 1.1
Defender									
M1 v M2	0.6 ± 15.4	unclear	-0.1 ± 1.4	-1.7 ± 23.8	unclear	-0.1 ± 1.7	12.9 ± 13.9	+ ve likely, probable	1.6 ± 1.7
M1 v M3	-3.4 ± 17.4	unclear	-0.4 ± 1.4	-4.6 ± 21.3	unclear	-0.3 ± 1.4	2.8-9.2	unclear	0.5 ± 1.4
M1 v M4	-7.5 ± 17.1	- ve likely, probable	-0.7 ± 1.4	-8.9 ± 21.2	- ve likely, probable	-0.7 ± 1.4	1.0 ± 7.5	unclear	0.2 ± 1.5
M1 v M5	9.9 ± 18.1	+ ve likely, probable	0.9 ± 1.6	5.1 ± 21.6	unclear	0.4 ± 1.5	33.3 ± 15.2	+ ve likely	3.3 ± 1.6
M1 v M6	5.6 ± 19.3	unclear	0.5 ± 1.5	3.1 ± 22.4	unclear	0.2 ± 1.5	10.9 ± 31.6	unclear	0.5 ± 1.4

Abbreviations: %Diff, percentage difference; Qual, qualitative outcome; ES, effect size; M1, match 1 M6, match 6; ve, very.

Table 4 Differences in Distance by Playing Position Compared With the Tournament Average (TA) During an International Field Hockey Tournament

	Total Distance			Low-Speed-Activity Distance			High-Speed-Running Distance		
	%Diff	Qual	ES	%Diff	Qual	ES	%Diff	Qual	ES
Striker									
M1 v TA	-8.6 ± 35.0	- ve likely, probable	-0.5 ± 1.5	-7.1 ± 34.9	unclear	-0.1 ± 0.4	-1.1 ± 103.9	unclear	0.0 ± 1.7
M2 v TA	0.6 ± 12.6	unclear	0.2 ± 3.2	1.3 ± 16.8	unclear	0.1 ± 1.2	-1.1 ± 101.6	unclear	0.0 ± 1.7
M3 v TA	10.2 ± 45.6	unclear	0.3 ± 1.0	7.5 ± 53.7	unclear	0.0 ± 0.2	18.6 ± 30.1	+ ve likely, probable	1.1 ± 1.6
M4 v TA	-6.4 ± 19.9	- ve likely, probable	-1.1 ± 3.1	-6.3 ± 10.6	- ve likely, probable	-1.6 ± 2.5	-6.1 ± 58.9	unclear	-0.4 ± 3.0
M5 v TA	7.1 ± 32.2	unclear	0.4 ± 1.7	6.8 ± 24.1	unclear	0.2 ± 0.7	8.7 ± 68.0	unclear	0.4 ± 2.7
M6 v TA	2.2 ± 11.4	unclear	0.5 ± 2.2	3.5 ± 4.7	unclear	0.2 ± 0.2	-2.3 ± 31.0	unclear	-0.2 ± 2.0
Midfield									
M1 v TA	-1.1 ± 4.4	unclear	-0.3 ± 1.1	-3.6 ± 4.8	+ ve likely, probable	-0.9 ± 1.1	-6.4 ± 10.3	- ve likely, probable	-7.2 ± 1.1
M2 v TA	-1.0 ± 7.6	unclear	-0.2 ± 1.1	7.4 ± 11.8	+ ve likely, probable	0.7 ± 1.1	4.3 ± 21.6	unclear	0.2 ± 1.1
M3 v TA	0.3 ± 2.4	unclear	0.1 ± 1.1	-0.3 ± 3.7	unclear	-0.1 ± 1.1	0.4 ± 10.4	unclear	0.1 ± 1.1
M4 v TA	-0.9 ± 4.1	unclear	-0.3 ± 1.1	-4.1 ± 3.6	- ve likely, probable	-1.3 ± 1.1	3.1-16.0	unclear	0.2 ± 1.1
M5 v TA	3.2 ± 3.5	+ ve likely, probable	1.0 ± 1.1	1.9 ± 3.7	unclear	0.6 ± 1.1	0.5 ± 10.6	unclear	0.1 ± 1.1
M6 v TA	3.4 ± 3.8	+ ve likely, probable	1.0 ± 1.1	0.2 ± 5.5	unclear	0.0 ± 1.1	6.0 ± 9.9	+ ve likely, probable	0.7 ± 1.1
Defender									
M1 v TA	0.5 ± 18.5	unclear	-0.5 ± 1.6	2.4 ± 22.3	unclear	0.2 ± 1.6	-8.0 ± 6.2	- ve ve likely	-2.2 ± 1.5
M2 v TA	1.2 ± 8.7	unclear	0.2 ± 1.5	0.6 ± 9.8	unclear	0.1 ± 1.5	-3.9 ± 13.8	unclear	0.4 ± 1.7
M3 v TA	-3.4 ± 7.3	- ve likely, probable	-0.8 ± 1.7	-2.4 ± 7.2	- ve likely, probable	-0.6 ± 1.6	-5.3 ± 9.1	- ve likely, probable	-0.9 ± 1.4
M4 v TA	-7.0 ± 6.7	- ve likely, probable	-0.6 ± 1.4	-6.8 ± 6.9	- ve likely, probable	-1.6 ± 1.4	-0.7 ± 7.3	- ve likely, probable	-1.5 ± 1.5
M5 v TA	10.4 ± 7.2	+ ve ve likely	2.3 ± 1.5	7.6 ± 6.5	+ ve ve likely	1.7 ± 1.5	22.7 ± 15.1	+ ve ve likely	2.4 ± 1.6
M6 v TA	6.1 ± 17.9	unclear	0.6 ± 1.7	5.5 ± 19.2	unclear	0.5 ± 1.6	2.1 ± 31.4	unclear	-0.2 ± 2.0

Abbreviations: %Diff, percentage difference; Qual, qualitative outcome; ES, effect size; M1, match 1 . . . M6, match 6; ve, very.

Discussion

This is the first study to investigate the activity profiles in elite field hockey during the CT. Results indicate that this elite team was able to maintain exercise intensity when playing 6 matches in a period of 9 days. These results are in contrast to previous investigations of tournament play in field hockey.

Only 1 study has examined fatigue over a tournament in elite hockey players.¹¹ In that study, players increased their time spent standing and reduced their time spent jogging from match 1 to match 3, suggestive of fatigue. In contrast, when assessing LSA across all positions in the current study, this was not evident, with only strikers following a similar pattern. This was only apparent when each match was compared with the first match. No distinct pattern was observed when comparing with the TA. However, direct comparison with the previous study is difficult due to the different match-analysis methods used (eg, GPS and manual video-based analysis). Furthermore, it is possible that match movement patterns have changed in the 5 to 6 years since the earlier study was completed.²

In general, research in soccer has investigated fatigue over the course of a match or different phases of a season.^{3,10,17,18} A recent study that examined the effects of 3 matches in 5 days in professional soccer suggested that the activity profiles were not influenced by the short recovery between matches.¹⁹ Similar results were observed when comparing the same top-class soccer players over 2 consecutive matches,²⁰ suggesting that activity profiles were not statistically influenced by the short recovery periods between matches. Collectively, these findings support the current results, suggesting that short periods of recovery do not necessarily affect activity profiles of elite-level field hockey players.

One of the most significant rule changes in field hockey (in 1995) was to allow unlimited interchange of players during matches. This change may have markedly altered the tactical and apparent physiological requirements of the match.¹¹ Unfortunately, the number of substitutions has not been described in previous field hockey research. Similar to other team sports (basketball, ice hockey, Australian Rules football), coaches in elite field hockey use a high number of interchanges in an attempt to maintain the team's exercise intensity. This tactic allows attacking and defensive pressure to be applied to the opposition throughout a match.²¹ In the current study, a high number of substitutions was used to rotate players throughout each match, and the same substitution strategy was used for each match. This tactical approach may have permitted the maintenance of positional intensity by allowing players time to recover on the bench. This interchange strategy may have influenced players' ability to cope with the requirements of the tournament, given the short recovery periods between matches. However, this strategy relies on an even distribution of talent (technical-skill efficiency and tactical knowledge) throughout the team and may not suit teams with a lack of depth. In this study, technical-skill efficiency was not analyzed or

controlled for. Therefore, future studies should examine the importance of these abilities in different rotational strategies in team sports such as field hockey.

In addition to significant rule changes, recent studies have shown higher fitness levels in modern-day elite field hockey players.² Indeed, research from soccer has demonstrated in both referees and players that increases in fitness translate to enhanced physical outputs during matches.^{22,23} Players who can sustain a high work rate throughout a match gain an advantage over equally skilled players whose activity levels decrease toward the end of a match or after a series of high-intensity efforts, resulting in reduced performance.²⁴ The elite Australian field hockey players had similarly high aerobic capacities to their New Zealand counterparts² but higher than other previously reported elite players.¹ The higher fitness of these elite players, coupled with a high rotational strategy during each match, may partly explain the ability to maintain high exercise intensity during the tournament.

Evidence suggests that the situational variables of match location, match status (ie, whether the team was winning, losing, or drawing),²⁵ and the quality of the opposition (strong or weak) are important factors for soccer performance. In a recent study of elite Spanish soccer players investigating the effect of score line on performance, players performed less high-intensity activity when winning than when they were losing. In that study, the midfielders and defenders performed less HSR than in match 1 in matches with large positive score lines. However, when comparisons were made with the TA, only defenders reduced their amount of HSR when the team was winning. In the most significant victory, comparing with the TA results suggested that the score line did not influence the amount of HSR performed for strikers and midfielders. Conversely, the opposite was shown for defenders. In the most significant victory, (ie, the 10–3 victory against Spain), defenders decreased their amount of HSR by 22.7% ± 15.1% compared with the TA. Although this is speculative because of the low number of matches analyzed, this may have been due to the lack of defensive play required during the match, with the ball therefore spending most of the time in the attacking half of the field.

In a previous study of soccer, players also performed less low-intensity activity when losing than when winning.²⁵ In the only loss of the tournament (match 4 vs Germany), compared with the TA, players' LSA across the 3 positions increased. However, only the defenders increased the amount of LSA compared with the first match of the tournament. Given that winning is a comfortable status for a team,²⁶ it is possible that opposition players assumed a ball-contention strategy, keeping the match slower. This is typical of European field hockey teams in a winning position, playing the ball around defensive personnel to maintain possession and denying the opposition use of the ball. Defenders also showed an increase in HSR (compared with TA) during this match, as well as in the close 2–1 victory against England. This may be explained by the defensive players' being under

greater sustained periods of pressure with the ball in the defensive half of the field for a greater period of time. In addition, the requirement to cover attacking leads from defenders might lead to an increase in HSR.

Two styles of analysis were used in this investigation that often provide different results. By comparing subsequent matches with the first match of a tournament, the assumption made is that match 1 is free of fatigue and not influenced by contextual factors. However, when comparing these results with analysis against the TA, no distinct trends emerged. This may suggest that both methods have limitations and that these limitations need to be considered when interpreting results in tournament-based time–motion-analysis studies. By performing both methods of analysis, however, a more complete understanding of the tournament may be achieved.

Practical Application

While each method of comparison used in this study has limitations, performing both analyses together provides a greater understanding of the activity profiles of team-sport players competing in tournaments. These findings can be applied in practice to inform coaches of the positional movement requirements in international men's field hockey and to inform scientists that care should be applied when interpreting fatigue from match data from tournaments. We suggest that time–motion data from sports such as hockey be interpreted in the context of match result and tactical strategies used.

Conclusion

In summary, the activity profiles of players from an elite field hockey team competing in an international tournament were analyzed. Overall, results demonstrated that it was possible for elite team-sport athletes to maintain exercise intensity when playing 6 matches in a period of 9 days. A potential limitation of this study was the relatively low number of matches and players examined. Therefore, the patterns observed might only be specific to this particular team. Accordingly, care should be taken when generalizing these findings to other field hockey teams or other sports.

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