

## **MATCH-TO-MATCH VARIABILITY OF HIGH INTENSITY ACTIONS FOR THE WOMEN'S NATIONAL FIELD HOCKEY TEAM DURING THREE 2014 WORLD CUP MATCHES: A CASE STUDY**

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**INTRODUCTION:** Coaches and sport scientists often quantify player load during matches using external variables such as total distance covered, and distance covered during high intensity actions (HIA) produced by integrated accelerometers and global positioning system (GPS) units (Aughey, 2011; Gabbett, 2010; Gabbett, Wiig, & Spencer, 2013; Lythe & Kilding, 2011; Macutkiewicz & Sunderland, 2011). It has been proposed that high between match-to-match variability exists when examining external variables recorded by GPS technology (Gregson, Drust, Atkinson, & Salvo, 2010). However, when examining variability, studies often include multiple teams, across multiple seasons, and under various environmental conditions. Compounding variables can lead to an assumed increased instability of data (Bradley & Noakes, 2013; Gregson et al., 2010; MacLeod, Bussell, & Sunderland, 2007).

HIA derived from GPS are often used when determining strategies for training prescription which can lead to circumstances in which training loads are misrepresented. Subsequently, incorrect loads are often prescribed. When coaches document a team's specific variations in external loading, training processes can be modified to efficiently allow for the correct administration of volume and intensity. Therefore, the aim of this case study was to quantify the match-to-match variability of distances covered during HIA by the US Women's national team during three 2014 World Cup field hockey matches.

**METHODS:** Eighteen members of the US Women's National Field Hockey Team participated in this study. However, the two goalies were removed from GPS analysis due to lack of data resulting in the analysis of the sixteen field players. Changes to the roster were not made during the tournament, data from the same sixteen field players is represented across all three matches. GPS recordings were collected during three games of the 2014 World Cup. The team finished the international tournament with a 4<sup>th</sup> place ranking, including four wins, one tie, and two losses (Table 1). The East Tennessee State University Institutional Review Board approved this study and each athlete read and signed a written informed consent document.

All GPS data collection was performed on the same outdoor water based turf during the 2014 Rabobank Hockey World Cup in The Hague, Netherlands. All GPS data was collected using Catapult MinimaxX (Catapult Innovations, Melbourne, Australia), which samples at 10 Hz. This device had previously been shown to be valid for distance, and velocity during linear and sport specific movements (Johnston, Watsford, Kelly, Pine, & Spurrs, 2014; Johnston et al., 2012; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009; Varley, Gabbett, & Aughey, 2014). The GPS units were worn in a specifically designed bib with a neoprene pouch. The bibs hold the units between the shoulder blades of the athlete. Each player wore the same device across all three matches. All players were acclimated to wearing the GPS units as a result of previous practice and game monitoring.

The GPS data was downloaded using the manufacturer-supplied software (Logan Plus, version 5.1.7). The downloaded data was edited to only include time spent on the field of play, during the regulation game time (Table 2). Warm up, rest periods, and time on the substitution bench was not analyzed or included in any calculations of rest or low-intensity exercise, allowing

for an accurate representation on time on pitch (sec), and total distance covered (m). The mean  $\pm$  SD for the HIA of running, sprinting, and fast running was determined. The HIA velocity zones were chosen from previously published international field hockey research (run 3.06-4.16 m/s, fast run 4.17-5.27 m/s, and sprint >5.27 m/s) (Lythe & Kilding, 2011; Macutkiewicz & Sunderland, 2011). Time on pitch (sec), total distance covered (m) and HIA during running, fast running, and sprinting match to match variability was quantified using coefficient of variation (CV).

**RESULTS:** Time on pitch (sec), total distance covered (m), HIA during running, fast running, and sprinting are presented as mean  $\pm$  SD within the three matches (Table 3). The mean  $\pm$  SD, between matches, and the variability, quantified using coefficient of variation (CV) was calculated (Table 4). Across three matches during the 2014 World Cup the US Women's national team experience little match-to-match variation between time on field (CV = 0.6%), for total distance covered (CV = 1.76%), distance covered running (CV = 2.98%), and distance covered fast running (CV = 3.68%). Distances covered during sprinting experienced the highest variability (CV = 15.96%).

**DISCUSSION:** This case study provides a unique observation of elite field hockey players' high speed load variations produced during the 2014 World Cup. The small variation in the time on field (CV = 0.6%) is indicative of the similar tactics, and substitution strategies employed during the three games. The relatively large variation (CV = 15.96%) produced by distance covered while sprinting is indicative of the critical nature of the highest of the HIA. Field-based team sports such as field hockey, and soccer are often characterized by repeated periods of high intensity activity, and sprinting efforts in match-play cannot be over-emphasized. It has been suggested that sprinting efforts might be the most appropriate means of evaluating and interpreting physical performance (Krustrup, Zebis, Jensen, & Mohr, 2010).

The limited variability for total distance covered (CV = 1.76%), distance covered running (CV = 2.98%), and fast running (CV = 3.68%) produced over the three matches challenges the manner in which we consider the value of match-to-match variation reported by previous studies. This elite population clearly showed less variability, possibly due to the high level of the players, the consistent high level of the opposition, the stable tactical and tactical play, the standardized substitution strategy, and the ability of the athletes and medical personal to control the impacts of fatigue between matches. It would seem that unless coaches are evaluating the variability of total distance, running, and fast running produced by their own players, the data would provide little benefit especially as a performance measure. Large diverse sample sizes, and longitudinal data collection methods undoubtedly produce the most precise estimate of variation, however the usefulness of such studies for individual teams is questionable.

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