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Characterizing the peak kinematic and mechanical most demanding periods in elite football: composition analysis of each half and match demands

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## INTRODUCTION:

A comprehensive understanding of the most intense periods (MIP) of elite football activity is critical to informing training design to ensure optimal preparation of athletes. The characterization and reporting of MIP demands in current studies [1,2] are limited in their application in performance monitoring and designing of training sessions. Therefore, the aim of this study was to characterize the 5-min peak kinematic (5'MIPk; running distance) and mechanical (5'MIPm; acceleration/deceleration) periods in elite football through describing the composition of the respective MIP in terms of the percentage magnitude, percentage duration, and number of efforts of the constituent performance variables.

## METHODS:

Global positioning system (GPS) data was collected during 45 matches of two teams in the Swedish first division (n=329 observations) across two seasons. The 5'MIPk periods were identified based on the maximal total distance covered concurrently at 15-19.8 km·h<sup>-1</sup> (high-intensity running; HIR), 19.8-25.2 km·h<sup>-1</sup> (high-speed running; HSR), and 25.2 km·h<sup>-1</sup> (sprinting; SPR). The 5'MIPm were identified as the maximal average magnitude of concurrent high-intensity acceleration (ACC3; 3 m·s<sup>-2</sup>) and deceleration (DEC3; -3m·s<sup>-2</sup>) demands. The percentage of the total distance (MIPk) and average acceleration/deceleration (MIPm), percentage duration of the 5-min period, and the number of efforts for the performance variables and their respective constituent variables were analyzed between each half and the full match.

## RESULTS:

Linear mixed-effects models revealed small to moderate significant (p 0.05) decreases of 5-9% and 9-11% between halves for the magnitude, number of efforts, and duration of both 5'MIPk and 5'MIPm, respectively. Similarly, small to moderate significant (p 0.05) differences of 11-12%, 7-10%, and 5-10% between halves were observed for the magnitude, number of efforts, and duration of HIR, HSR, and DEC3, respectively. The percentage distance, percentage duration, and number of efforts composition of MIPk and constituent kinematic performance variables were small to very large significantly (p 0.05) greater in the match 5'MIPk compared to 5'MIPm. Similarly, the high intensity mechanical constituent variables and MIPm were significantly (p 0.05) greater in the match 5'MIPm compared to 5'MIPk.

## CONCLUSION:

Results of this study provide greater insight into the composition of peak kinematic and mechanical demands in elite football and demonstrate that MIPk and MIPm represent distinct periods of peak demands in each half and the full match. The detailed characterization of the respective MIP allows coaches to design bespoke training sessions targeting specific locomotor activities, and the design of MIP in standardized settings to assess individualized physiological response and fatigue development to the respective MIP based on match demands.

[1] Casamichana et al., (2019), Biol. Sport, 36(3), 233-240.

[2] Martín-García et al., (2018), J. Sports Sci. Med., 17(4), 563

Topic: Statistics and Analyses

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