VALIDITY OF SPEED AND ACCELERATION FOR GAME SPORTS DERIVED FROM A NEW LOCAL POSITIONING SYSTEM

Philip X. Fuchs[1,2], Yi-Cheng Chou[1], Wei-Han Chen[1,3], Tzyy-Yuang Shiang[1]

[1] National Taiwan Normal University, Taiwan; [2] University of Salzburg, Austria; [3] University of Taipei, Taiwan

Tracking player positions has increasingly become popular in game sports for tactical analyses and training load regulations. Although local positioning systems (LPS) were reported to be superior to GPS and video-based systems [1], data differentiated in the time-domain (i.e., speed and acceleration) were reviewed critically [2]. The objective was to assess the accuracy of a new LPS for speed and acceleration in dynamic movements, common to game sports.

Time-series and peak speed, acceleration, and deceleration were compared between concurrently collected data via LPS (50 Hz) and Vicon (100 Hz) data during 10 repetitions of linear, curved, triangle, and shuttle running in low and high intensity (n=80). Data processing followed the developer guidelines, filtering after residual analyses, and synchronization via time-shift until the minimum error was reached [3]. Concordance correlation coefficients (CCC), percentage root mean square errors (RMSE), Bland-Altman plots, and analyses of variances were provided.

CCC were 0.893 (time-series speed), 0.816 (time-series acceleration), 0.923 (peak speed), 0.486 (peak acceleration), and 0.731 (peak deceleration). RMSE were larger in time-series acceleration (14.4±3.8%) than speed (12.0±5.8%) (η^2=0.472, p<0.001) and larger in peak acceleration (28.0±14.3%) and deceleration (25.1±14.9%) than in speed (7.3±6.1%) (η^2=0.091, p<0.01). RMSE were also larger in high intensity compared with low intensity for time-series speed and acceleration as well as peak acceleration and deceleration ($0.064 \leq \eta^2 \leq 0.475$, p<0.05), but not significantly for peak speed (η^2=0.029, p=0.149). Bland-Altman plots including 95% limits of agreement and Spearman correlation results for trendlines were depicted in Figure 1.

Strong concordance and smaller errors in time-series speed and acceleration as well as peak speed suggested that the tested LPS can be used for applications when entire time-series data are required (e.g., for energy expenditure estimation via acceleration) [4] and when peak speed serves as a performance identifier (e.g., for determination of intensity zones) [5]. In consideration of previous studies [2], the current accuracy of both time-differentiated time-series was very promising. However, serious deficits were found in peak acceleration and deceleration, comparable with previous findings [6]. The data suggested a lacking ability of the LPS to detect these peaks accurately with increasing magnitude of the true values. Acceleration data should be used with caution if peak values play a crucial role in the intended analyses (e.g., determining performance via peak values). Corroborated by others [7], this should be considered especially for very dynamic movements as errors increased in high intensity.

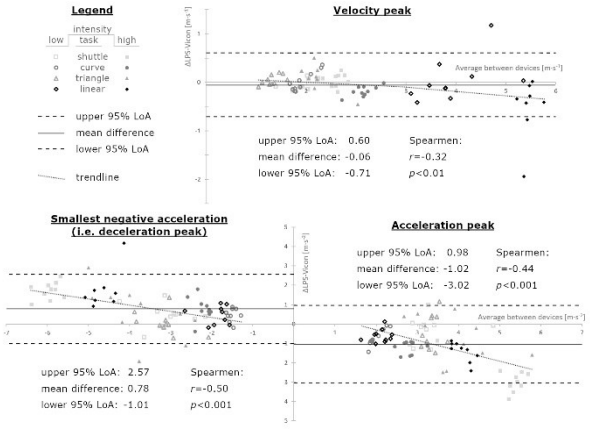

Figure 1: Bland-Altman plots of differences in peak speed, acceleration, and deceleration between LPS and Vicon including 95% limits of agreement (95% LoA) and Spearman correlation (r) for trendlines; derived from [8].

References

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