

## ANALYSIS OF THE SPRINTS FEATURES DURING FUTSAL MATCHES

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The purpose of this study was to analyse the repeated-sprint sequences (RSS) and to characterise the sprints performed during futsal matches. Automatic tracking system was used to obtain the player's trajectories (n=97) during five official matches. The sprints were analysed during the both halves and RSS were categorised according to the number of sprints and the time between them. The results showed a decrease in the number of sprints per minute in the second half. However, the duration of the sprints was greater in the second half. For the RSS analysis, the results showed that the most frequent RSS consisted of two sprints interspersed with a maximum of 15 s of recovery. The study characterised the features of sprinting of futsal players, which can help coaches to plan physical training and assessments according to the sport requirements.

**KEY WORDS:** high-intensity running, repeated-sprint, videogrammetry.

**INTRODUCTION:** The advances in image processing make possible the registration of the trajectory of the players during official matches using videogrammetry (Figueroa, Leite, & Barros, 2006). This tracking method has been widely used to analyze matches in official competitions in various sports with the purpose of quantifying the physical, technical, and tactical demands (Bueno et al., 2014).

The studies conducted about the physical demand during futsal matches characterised players' total distance covered and distance covered in different speed ranges (Barbero-Alvarez, Soto, Barbero-Alvarez, & Granda-Vera, 2008; Bueno et al., 2014). The distance covered in sprint represents up to 7.6 % of the displacement in a futsal match (Bueno et al., 2014). According to (Dogramaci, Watsford, & Murphy, 2011) the futsal players perform intermittent high-intensity efforts. A previous study (Makaje, Ruangthai, Arkarapanthu, & Yoopat, 2012) reported that the time spent in sprint may differ according to the level of the players, comparing professionals and amateurs. In addition, the ability to perform repeated high-intensity running is very relevant to the performance during matches (Oliveira, Leicht, Bishop, Barbero-Alvarez, & Nakamura, 2013).

Despite the existence of some scientific evidence on the physical demands of futsal match, there is a lack of information about the profile of repeated-sprints sequences (RSS) and sprints that players perform during official matches. Data about the most frequent sequences of sprints, as the number of sprints performed in each sequence or the recovery time between consecutive sprints, and sprint features may help coaches to plan players' physical training, according with the match demands. Thus, the purpose of this study was to analyse the repeated-sprints sequences and characterize the sprints performed by professional athletes during official matches.

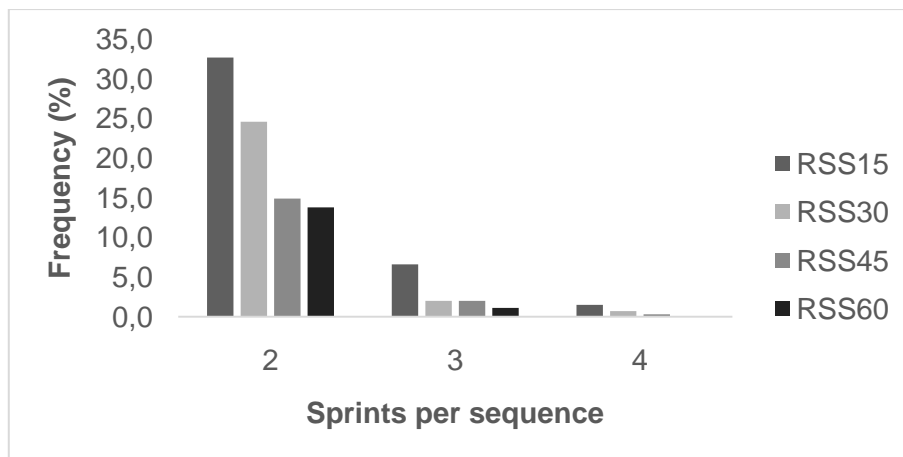
**METHODS:** Two digital cameras (30 Hz) were used to record five futsal official matches. The cameras were fixed at elevated positions in the gymnasium. Each camera covered three-quarters of the court with an overlapping region between them. A common event in this overlapped region was used for synchronize the images. Finally, an automatic tracking system was used for record the player's positions as a function of time. Trajectories of 97

professional futsal players were obtained by automatic tracking system of DVideo software (Figueroa et al., 2006). The Ethics Committee at the State University of Londrina approved the study.

A Butterworth third-order low-pass digital filter was used to filter the player trajectories with a cut-off frequency of 0.4 Hz, according to procedures previously performed by (Moura, Martins, Anido, Barros, & Cunha, 2012). The cumulative sum of displacement between two consecutive frames defined the distance covered by each player. Time-velocity curve was numerically derived from the time-position curve, and the displacements performed at a velocity greater than 5.08 m/s were considered a sprint, as previously proposed by (Marche et al., 2009). The beginning of sprint was defined as the local minimum prior the peak velocity and the end when the player velocity was lower than 5.08 m/s. Finally, we calculated the distance covered, duration, initial velocity, and peak velocity of each sprint, as well as the number of sprints per minute and recovery time between them for the first and second halves. As previously proposed by (Varley, Gabbett, & Aughey, 2013) the RSS was considered as two or more consecutive sprints performed with intervals of 15 (RSS15), 30 (RSS30), 45 (RSS45) or 60 s (RSS60).

A frequency of occurrence in each RSS was presented by relative frequencies and evaluated by the Fisher's Exact Probability Test. The features of sprints were compared between halves with Wilcoxon rank-sum test because the Kolmogorov-Smirnov test showed a non-standard distribution in all variables. The effect size (ES) was calculated and differences were evaluated according to Cohen (1988). A significance level of  $p < 0.05$  was used for all statistical analyses. All statistical procedures were performed using MATLAB® software (MathWorks Inc., USA).

**RESULTS:** The relative frequencies of the occurrence of the sprint sequences are shown in Figure 1. The results showed that the relative frequencies of the recovery categories were significantly different ( $p < 0.001$ ) among the number of sprints per sequence categories.



**Figure 1: Relative frequencies of the sprint sequences.**

Values of the sprint features performed by the players during the halves are expressed by median and interquartile range in the Table 1. The number of sprint per minute decreased from the first to second half ( $p = 0.039$ ;  $ES = 0.230$ ). On the other hand, sprint duration was significantly greater for the second half, compared to the first half ( $p = 0.022$ ;  $ES = 0.114$ ). No differences between the first and second halves were found for the other variables.

**Table 1**  
**Median and interquartile range of the variables related to sprint features performed by professional players during official matches.**

	First Half	Second Half	<i>p</i>
<b>Distance covered (m)</b>	12.13 (7.19)	12.27 (8.16)	0.089
<b>Duration (s)</b>	2.90 (1.60)	3,03 (1.80) *	0.022
<b>Peak velocity (m/s)</b>	5.70 (0.91)	5.74 (0.90)	0.299
<b>Initial velocity (m/s)</b>	1.07 (1.64)	0.98 (1.73)	0.059
<b>Recovery time between sprints (s)</b>	36.47 (63.57)	39.90 (79.68)	0.238
<b>Sprint per minute</b>	0.84 (0.51)	0.74 (0.35) *	0.039

Note. \* significant different from the first half.

**DISCUSSION:** The purpose of this study was to analyse the sprints sequences that occurred during the matches. Furthermore, we characterised the sprints performed by futsal players and compare the variables between the halves. The main results showed greater sprint duration in the second half. Moreover, the number of sprints per minute decreased in the second half compared to the first half. However, low effect sizes were observed in both comparisons. In addition, differences were found in the relative frequencies of the recovery categories among the number of sprints per sequence categories.

When compared the features of sprints during futsal matches with the literature, our results are greater than values of 10.5 m for distance and 1.95 s for the sprint duration presented by (Castagna, D'Ottavio, Granda Vera, & Barbero Alvarez, 2009). In other study (Dogramaci et al., 2011), the values of 13 m for distance covered and 1.9 s for sprint duration were presented, which is slightly higher and lower than our results, respectively. However, in these previous studies the sprint analysis begins only when the athlete overcomes the velocity threshold. In our study, the analysis of the sprint considered the time at which the athlete starts to increase its velocity. We believe that analyses based only on the velocity threshold may underestimate the intensity of effort because they disregard the physical demand required by the athlete before the sprint velocity threshold (Marche et al., 2009). The results presented no differences between the halves or showed a low ES, suggesting that the physical performance of athletes is maintained during the match. A possible explanation for this fact is due to the unlimited substitutions allowed by futsal rules, which may avoid a state of fatigue on the athletes.

The high-intensity efforts during several sports are considered important (Gregson, Drust, Atkinson, & Salvo, 2010). Furthermore, the ability of to perform consecutive high-intensity actions with a short interval between them has been crucial for athlete performance (Spencer et al., 2004). By analysing the values of the RSS it was possible to visualise that the sequences with smaller interval (RSS15) and only two sprints are the most frequent than others, which corroborates partially with the previous study applied to football matches (Buchheit, Mendez-villanueva, Simpson, & Bourdon, 2010). The authors also reported RSS with small interval as the most frequent ones, but with a greater number of sprints per sequence. However, we must consider that the RSS with few sprints in futsal may not to be related to the physical condition of the athletes. A possible explanation is that the futsal playing area is smaller compared to other sports. Thus, the athletes may not have space enough to reach the velocity threshold adopted for rating some efforts as a sprint.

**CONCLUSION:** The results presented in this study characterised the sprinting features performed by players during official futsal matches. Our findings can help improve planning and development of physical training for professional futsal players according to match demands and suggest that coaches may consider a greater number of substitutions during the match to prevent physical performance decrease.

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