Mechanical sprinting profiles and their relationship to soccer drill performance in female athletes.

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Summary

This study examined the link between mechanical sprinting profiles and soccer-specific drill performance in ten female players. In-line sprinting velocity, power, and force-velocity balance were key for drill performance, while absolute force was less impactful, highlighting the importance of force-velocity balance in soccer**.**

Introduction

Force-velocity and power-velocity (i.e. mechanical) sprinting profiles offer a detailed evaluation of an athlete's sprinting mechanics, highlighting the relationship between the force they can produce and the velocity they can reach during acceleration [1]. However, straight-line sprinting differs significantly from the multifaceted actions required in soccer, and evidence is limited on whether these profiles directly contribute to soccer-specific performance improvements. Identifying the key factors influencing specific performance is crucial, as it would allow to train these specific components more efficiently based on the athlete's profile [2]. The purpose of this study was to evaluate the link between mechanical sprinting profiles and soccer drill performance.

Methods

Ten female soccer players participated in this study and performed two maximal intensity sprints of 60 meters and two drills: a back-and-forth slalom dribble with the ball with six posts placed in a line and spaced 0.91m apart, and a 5-cones cutting drill (square of 3.6 m with a center cone) involving 90° and 135° cuts without the ball. During the sprints, continuous speed data was recorded using a Vector S7 GPS unit [3], and the average of the two sprints' mechanical profiles were created using Samozino et al's equations [1]. The maximal force (F0), maximal theoretical velocity (V0), maximal power (Pmax), and the regression slope between F0 and V0 (slope) were quantified. For the drills, completion time was measured using timing gates, averaging the best three of nine trials. Simple linear regression between the mechanical sprinting profiles and the performance were performed.

Table 1: Descriptive values of participants' anthropometrics, sprinting mechanical profiles, and drill performance.

	Mean	SD	Min	Max
Age (years)	24.3	3.7	18.0	35.0
Height (cm)	167.1	2.4	160.0	171.0
Mass (kg)	63.8	3.1	59.0	68.5
F0 ($N \cdot kg^{-1}$)	5.3	0.5	4.5	6.1
V0 ($m \cdot s^{-1}$)	7.5	0.6	6.7	8.4
Pmax ($W \cdot kg^{-1}$)	9.9	1.5	7.9	12.6
Slope ($(N \cdot kg^{-1})/(m \cdot s^{-1})$)	.70	.05	.63	.80
5-Cones Performance (s)	7.9	0.4	7.4	8.4
Slalom Performance (s)	10.4	0.5	9.7	11.4

Results and Discussion

The 5-cones drill was significantly faster for athletes with a high V0 (p=0.013) and Pmax (p=0.058), indicating that powerful and fast athletes performed better. Interestingly, F0 did not correlate with performance (p=0.24). Given the distance between the cones (3.6 meters), it is possible that F0 may play a larger role in performance over even shorter distances or in drills with steeper changes of direction. Slalom performance showed a tendency to improve for athletes with a shallower slope (p=0.068), suggesting that those who can generate force at higher velocities tend to excel in movements requiring sustained high speed and frequent changes of direction. Despite the inclusion of a technical component (dribbling with a ball), it is surprising that F0 (p=0.91), Pmax (p=0.51), and V0 (p=0.13) were not significantly correlated with slalom performance. These drills also demand strong braking forces, highlighting the potential value of assessing braking (i.e., eccentric) capacities in future studies to better understand their role in soccer performance [4].

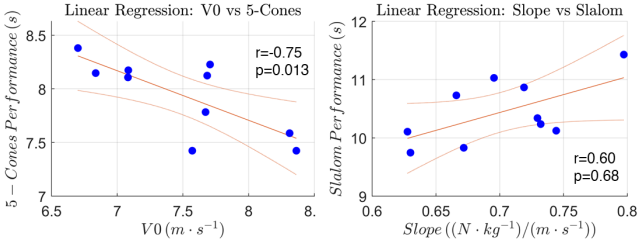

Figure 1. Linear regressions between V0 and 5-cones performance (left), and between the slope and slalom performance (right).

Conclusions

Metrics derived from mechanical sprinting profiles, such as V0, Pmax, and the slope, serve as valuable indicators of drill performance. Conducting sprint tests with soccer players could help refine training programs to enhance soccer-specific drills and in-game performance. Braking performance was not quantified in this study, though it may be a strong indicator of an athlete's ability to decelerate effectively before making cuts. Additionally, movements involving steeper turns are fundamental in soccer, highlighting the need for further research to explore the relationship between mechanical profiles, braking performance, and specific soccer drills.

References

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