Comparing Hurdling Techniques among Different Heights Hurdles for Beginner Hurdlers

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Introduction

Techniques for sprint hurdling have been extensively studied, with key performance factors identified, such as maintaining a longer take-off distance and clearing hurdles at the lowest possible trajectory [1]. However, these findings were derived from studies conducted on elite hurdlers, leaving a gap in knowledge regarding effective training strategies for beginners. In hurdle training, adjustments to specific variables, such as hurdle heights and interval distances, can be implemented to create different training conditions. However, the effects of these variables on hurdling techniques have not been clarified yet. Therefore, the present study aimed to examine hurdling techniques under different hurdle height conditions to provide practical insights into training strategies for novice hurdlers.

Methods

Thirty physical education students participated in the present study (20 males and 10 females, age: 20.9±2.1, height: 1.69±0.09 m, body mass: 64.8±14.0 kg). Notably, none of the participants had experience as competitive hurdlers. They performed 40-m hurdles running under three different hurdle height conditions: high (0.83 m), middle (0.76 m), and low (0.68 m). Three hurdles were set at 13.0, 20.5, and 28.0 m from the start line. Hurdling kinematics of 2nd hurdle were captured using a motion capture system (Vicon v2.2/V5) at 250 Hz. One-way ANOVA was used to test the main effect of hurdle height. Pearson's correlation coefficient was used to test the relationship between kinematics and hurdling speed.

Results and Discussion

There were significant differences in hurdling speed across the three conditions ($p < 0.001$). The hurdling speed was fastest in the low condition and slowest in the high condition. Similarly, the maximum height of body's center of mass differed significantly among conditions ($p < 0.001$), with the highest value observed in the high condition and the lowest in the low condition. The take-off angle also varied significantly between conditions ($p < 0.001$), being smallest in the low condition and largest in the high condition. In contrast, the take-off distance ($p = 0.705$), hurdling distance ($p = 0.555$), and the horizontal position at maximum height of the center of mass ($p = 0.180$) did not show significant differences across the three conditions. However, the take-off distance was positively and significantly correlated with hurdling speed (high: $r = 0.632$, $p < 0.001$; middle: $r = 0.614$, $p < 0.001$; low: $r = 0.523$, $p = 0.003$; Figure 1). Conversely, the take-off angle was negatively and significantly correlated with hurdling speed (high: $r = -0.911$, $p < 0.001$; middle: $r = -0.916$, $p < 0.001$; low: $r = -0.919$, $p < 0.001$).

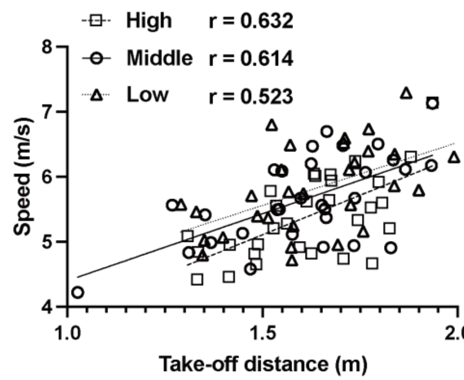

Figure 1: Relationships between the take-off distance and hurdling speed.

In the high condition, the trajectory of the body's center of mass was higher compared to the other conditions, while in the low condition, it was the lowest. When clearing a higher hurdle, participants increased their take-off angle but simultaneously decreased their hurdling speed, as demonstrated in a previous study [2]. The take-off distance did not differ among the conditions, whereas it is assumed that the take-off distance would be longer in the high condition because the longer take-off distance might not need a steeper take-off angle for a higher hurdle. However, this lack of difference may also be attributed to the fact that the interval distance between the hurdles was kept constant. This constant interval may have constrained the participants' approach, preventing substantial differences in the take-off distance across conditions. On the other hand, positive correlations between the take-off distance and hurdling speed suggest that faster running speed are associated with longer take-off distance. Therefore, achieving a higher running speed appears to be critical for increasing the take-off distance.

Conclusions

The trajectory of the body's center of mass and take-off angle during hurdling were higher in conditions with greater hurdle heights, while the take-off distance remained unchanged across all conditions. This finding suggests that take-off distance is more dependent on running speed rather than hurdle height.

References

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