Effects of tailwind and headwind on approach position and approach velocity in the long jump

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Summary

This study examines the effect of wind on take-off position and approach velocity in the long jump. The long jump was performed in three conditions: tailwind, headwind, and no wind, and the distance and velocity of the approach to the long jump were observed.

Introduction

In track and field, the long jump is an event where athletes take a running approach, take off, and compete based on the distance covered until landing in a sandpit. To achieve a longer jump, it is crucial to increase approach speed, minimize the deceleration of horizontal velocity at takeoff, and generate greater vertical velocity[1,2].

However, in long jump, if an athlete steps beyond the takeoff board, the jump is considered a foul, and the attempt is not recorded. Therefore, in addition to the ability to jump far, athletes must develop skills and strategies to avoid fouls. One possible factor contributing to fouls is the influence of tailwinds and headwinds, which can either assist or resist the athlete's motion, affecting sprinting speed and altering the takeoff position.

This study aims to examine the effects of wind on takeoff position and approach speed in the long jump.

Methods

Participants were 18 male students (Long Jump PR: 6.82 ± 0.43 m) who belonged to a university track and field club. The experiment was conducted on a 120m indoor running track field lined with urethane rubber, and participants were asked to perform a 60m run. Measurements were conducted three conditions: Non (no wind, 0.00 m/s), Assist (tailwind, 2.00-4.00 m/s), and Resist (headwind, 2.00-4.00 m/s). A wind was generated by 30 industrial fans installed on both sides at 4m intervals from the start to the finish. For data collection, a laser speed measuring machine and a high-speed camera were synchronized to capture the sprint. Laser measurement system (LDM301S; 100Hz) was placed behind the start, collected distance-time data. Velocity was calculated by differentiating the distance data. The takeoff point was photographed by a high-speed camera (TS-5,200 Hz). The statistical analysis was conducted using repeated measures analysis of variance (ANOVA), followed by post hoc testing with the Holm method ($p<0.05$).

Results and Discussion

The results showed significant differences in approach distance across conditions ($p < 0.05$). Compared to the Non condition, the approach distance increased by 0.36 m under the Assist condition and decreased by 0.56 m under the Resist condition. Significant differences in maximum velocity were observed only between the Non and Resist conditions. Although similar changes in aiding distance and maximum velocity could be expected from similar wind speeds in headwinds and tailwinds, they were different in this study. Moinat[3] found that headwinds have a greater impact on performance than tailwinds in the long jump under conditions of 2 m/s wind speed. These may be due to differences in the rate of change of aerodynamic drag between tailwind and headwind.

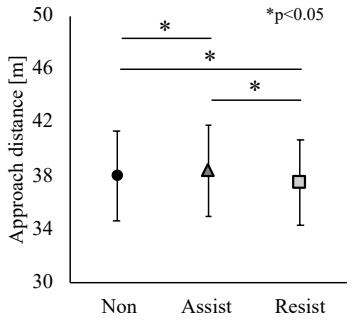

Figure 1: Approach distance for each condition.

Conclusions

In the long jump, tailwind and headwind change the approach distance by more than 0.3 m, so it is necessary to develop strategies according to the wind.

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References

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