OPTIMUM TAKE-OFF RANGE IN VERTICAL JUMPING

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INTRODUCTION

A standing vertical jump is a common test of lower body muscle power. However, the start position of the squat or the depth of countermovement is often not specified, and so the subject's performance will be underestimated if they do not select their optimum take-off range. The aim of this study was to identify the optimum take-off range that maximizes performance in a standing vertical jump.

METHOD

A male track and field athlete performed squat jumps and countermovement jumps (without arm movement) on a force platform. The vertical position of the subject's centre of mass during the propulsion and flight phases was calculated by numerical integration of the force-time record.

RESULTS AND DISCUSSION

For the countermovement jumps, the subject had an optimum take-off range at which the knees were flexed to about 90°, but for the squat jumps there was no clear optimum take-off range (Figure 1). The relation between flight height and vertical take-off range appears to be a complicated function of the force-length, force-velocity, and moment arm relations of the many muscles in the lower body. In the jumps from the deepest squat positions, the subject had a "two-phase" vertical force profile, possibly because of the sharp decrease in knee extensor strength in a deep squat (Figure 2).

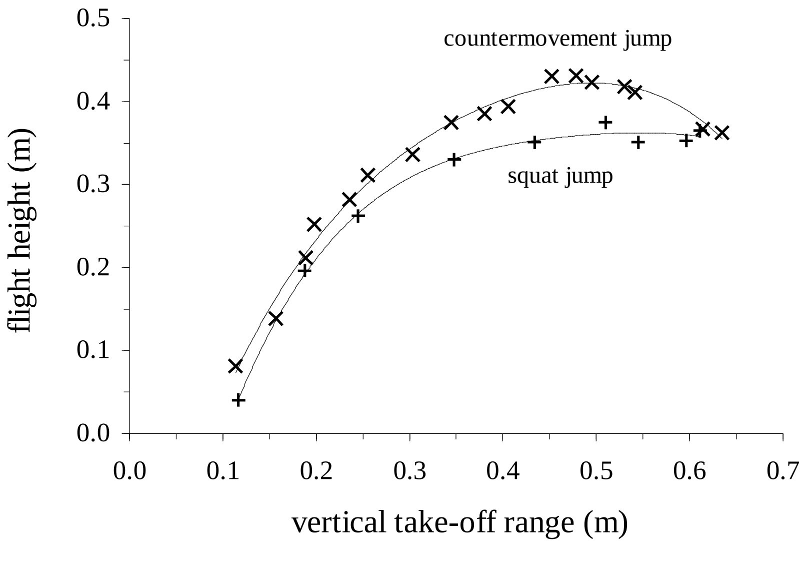

Figure 1. Dependence of flight height on vertical take-off range.

In a countermovement jump, a ground reaction force larger than body weight is required to slow and eventually reverse the initial downward movement. The subject therefore has a greater force at the start of the concentric phase than in a squat jump (Figure 3). A countermovement eliminates the vertical take-off range that is "wasted" in a squat jump while the muscles build up to maximum force, and so the subject performs more work during the concentric phase (Bobbert *et al.*, 1996).

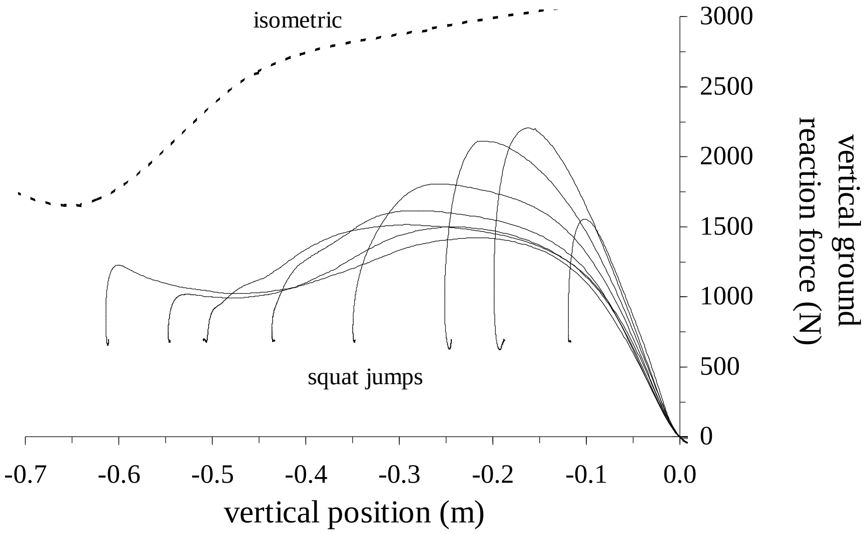

Figure 2. Force-position curves for squat jumps using different take-off ranges. The zero position is the point of take-off, where the subject's legs are close to full extension. Also shown is the subject's maximum isometric squat strength.

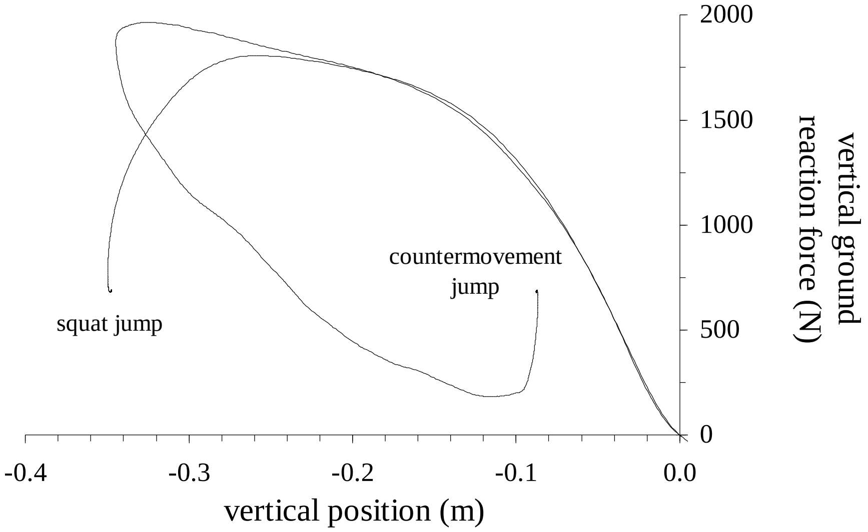

Figure 3. Force-position traces for a squat jump and a countermovement jump with the same vertical take-off range.

CONCLUSION

Precise selection of the maximum squat position in a vertical jump is not critical. Similar flight heights are achieved over a wide selection of vertical take-off range.

REFERENCE

1. Bobbert *et al*. (1996). *Medicine and Science in Sports and Exercise*, **28**, 1402-1412.

SPEAKER INFORMATION

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