THE COUNTERMOVEMENT JUMP IS MORE FUNCTIONAL THAN THE SQUAT JUMP IN MEASURING ELITE BASKETBALL PLAYER PERFORMANCE

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INTRODUCTION

Predicting athletic performance from quantitative tests is of the utmost interest to strength and conditioning professionals, biomechanics, and coaches. For example, sports like basketball host combine events with the goal of highlighting future player performance. However, due to the basketball’s multifaceted nature no single test predicts an athlete’s abilities [1]. Nevertheless, the force from a player’s vertical jump has been linked to increased playing time [2]. The two most commonly tested vertical jump conditions are the countermovement jump and the squat jump [2, 3]. It is argued that the countermovement jump is more sport-specific, allowing for greater vertical height [4] whereas the squat jump is a better measure of lower body power [5]. The various forms of the vertical jump, including squat and countermovement with no arm involvement, one-, or two-arm swings, may be why no one jumping form has been recommender for player testing to date [2, 3, 6, 7].

The purpose of this study is to evaluate the force profiles of the countermovement and the squat vertical jumps in elite basketball players to determine if one jump is superior to the other as a measure of performance.

METHODS

All fifteen players from an elite men’s basketball team were recruited to perform six jumps on a portable BERTEC force plate (BERTEC Corporation, Columbus, OH, USA). Three countermovement jumps and three squat jumps were performed, each with an arm swing. A Vertec vertical jump tester (Power Systems Incorporated, Knoxville, TN, USA) was placed 0.25 meters forward of the force plate at a base height 2.90 meters of to give the players a target. Seven identical data collections took place across the playing season during scheduled practice times, averaging one collection every three weeks. Due to injuries accrued during the season the incomplete data of two players were ignored.

A custom script using MATLAB (The Mathworks Inc., Natick, MA, USA) determined the maximum vertical force, rate of force development, maximum velocity, and maximum power from the ground reaction force.

The data was analyzed using SPSS Statistics (IBM, Corporation, Armonk, NY, USA). The mean values across the season of the maximum vertical force, rate of force development, maximum velocity, and maximum power were calculated for each player by jump type. A bivariate correlation compared the types of jump while a paired sample t-test evaluated the absolute differences of the measured values.

RESULTS AND DISCUSSION

The high correlations of the maximum vertical force, maximum velocity, and maximum power between the jumps demonstrate that the countermovement and squat jump are similar (Table 1). However, the correlation of the rate of force development between the jumps was low \( r = 0.504 \). The mean value of the rate of force development of the countermovement jump \( (M = 1932 \text{ N/s}, SD = 636 \text{ N/s}) \) was larger than that of the squat jump \( (M = 1769 \text{ N/s}, SD = 732 \text{ N/s}) \). This difference may be explained by the initial countermovement before jumping which has been linked to increase force production and muscle activity [4].
In the case of the maximum vertical force (Figure 1), rate of force development, and maximum power, the absolute difference values of the measures did not demonstrate significant differences ($p<0.01$) between jump types. However, the maximum velocity was higher in the countermovement jump. This difference is due to the increased work produced in the countermovement by the leg muscles [4].

**Figure 1**: Comparison of maximal vertical forces of the countermovement and squat jumps.

The squat jump is a more direct measure of lower limb strength, as it does not require generating the countermovement with the upper body. Nevertheless, in basketball the squat jump is not common. Players are required to manipulate their upper bodies to achieve a transfer of energy allowing them to successful shoot or to gain possession of a rebound.

Given the high correlations between the squat and countermovement jump suggests that the jumps are similar. However, the increased rate of force development seen in the countermovement jump suggests that it is the recommended jump to use in basketball field collections.

**CONCLUSIONS**

In assessing athletic performance, the tactical demands of the particular sport must be assessed ahead of technical considerations [7]. Using the countermovement vertical jump, the lower body power, force, and rate of force development can be assessed while also accounting for a greater vertical jump height than the squat jump. The sport-specific nature of the countermovement jump, combined with an arm swing, may permit basketball players to jump in a manner most natural to them without sacrificing data about the force profile of the jump itself.

**REFERENCES**


**Table 1**: Comparisons of correlations of the countermovement and squat jumps.

<table>
<thead>
<tr>
<th></th>
<th>Countermovement</th>
<th>Squat</th>
<th>Correlation Coefficient</th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Standard Deviation</td>
<td>Mean</td>
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<tr>
<td>Maximum Force (N)</td>
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<tr>
<td>Rate of Force Development (N/s)</td>
<td>1932</td>
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<td>1769</td>
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<td>Maximum Velocity (m/s)</td>
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<td>Maximum Power (W)</td>
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<td>6614</td>
<td>22940</td>
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</tbody>
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* Significant at $r = 0.01$ level (2-tailed)