Analysis of Counter Movement Jump and Standing Broad Jump among Athletes

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Summary

The study compared the Countermovement Jump (CMJ) and Standing Broad Jump (SBJ) to assess their biomechanical differences and the relationship between hamstring strength and performance. Kistler force plate and Vald Nord bord were used to measure the variables. According to the study, SBJ results in higher horizontal displacement and longer flight durations, whereas CMJ creates more vertical force. Stronger hamstrings improve SBJ performance ($r = 0.605$, $p < 0.01$), and there is a moderate correlation between CMJ and SBJ take-off forces ($r = 0.688$, $p < 0.05$), suggesting that these two jumps have similar muscular characteristics.

Introduction

The Standing Broad Jump (SBJ) and Countermovement Jump (CMJ) are frequently used tests to evaluate neuromuscular function and lower-limb explosive power [1]. SBJ needs both horizontal and vertical force components, whereas CMJ mainly concentrates on vertical force output. Among professional football players, the Nordic Hamstring curl is a very successful eccentric strengthening exercise that has been demonstrated to lower the incidence of both initial and recurrent hamstring injuries by 60% and 80%, respectively [2]. The architecture and stiffness of the hamstring muscles have been demonstrated to change with eccentric strength training. A biomechanical alteration brought about by these adaptations can enhance strength and dynamic performance, particularly vertical jump height [3]. The purpose of the study was to compare the important biomechanical parameters between CMJ and SBJ and relationship of hamstring strength and performance.

Methodology

The total 100 university level athletes were performed three trials of CMJ_h (hands on hips), CMJ_f (free hands) and SBJ on a Kistler force plate of dimension 1200 x 600 x 100 to measure peak forces and RFD in three dimensions (X = medio-lateral, Y = anterior-posterior, Z = vertical), flight time and jump height were derived from force-time data using BioWare software. The data were compared with CMJ_h, CMJ_f and SBJ. The hamstring strength was measured using VALD Nord Bord. The Dependent t test, Pearson Product Moment correlation and Regression statistical test were used to analyse the data in SPSS software.

Results and Discussion

The result shows the significant differences between the Standing Broad Jump (SBJ) and the Counter Movement Jump (CMJ) were found by statistical analysis. The CMJ_h and CMJ_f shows significant difference between the flight time. The CMJ produced a significantly greater peak vertical force ($p < 0.05$) and rate of force development, indicating superior force output in vertical movement, while the SBJ showed a bigger horizontal displacement (y-axis) ($p < 0.05$). Flight time were much longer in SBJ ($p < 0.01$). While a positive correlation ($r = 0.688$, $p < 0.05$) between CMJ and SBJ take-off forces suggests shared muscular characteristics, a positive correlation ($r = 0.605$, $p < 0.01$) between hamstring strength and SBJ jump distance suggests that stronger hamstrings contribute to better horizontal jump performance. The regression analysis shows that the vertical force (z-axis) was a good predictor of horizontal forces (x-axis and y-axis).

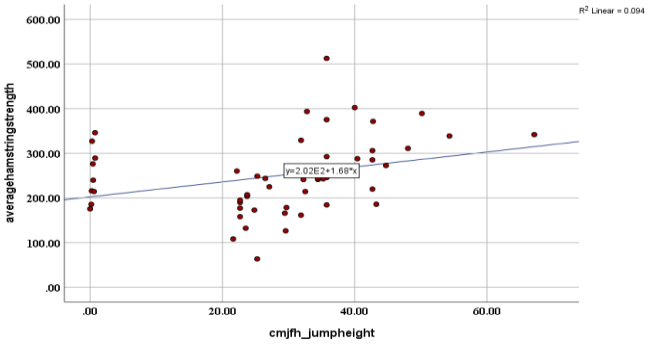

Figure 1: Graphs shows the relationship between CMJ jump height and hamstring strength.

Conclusions

The findings indicate that the CMJ allows a higher output of vertical force (z-axis), SBJ is better at producing horizontal displacement (y-axis). The associations with hamstring strength demonstrate how important muscle power is for both kinds of jump however SBJ had better correlation. The results shows that the horizontal forces (x and y) can be predicted using the vertical force (z) in one dimensional force plates.

References

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