CORRELATIONS BETWEEN MULTIDIRECTIONAL SINGLE LEG COUNTERMOVEMENT JUMP FORCE PRODUCTION AND EXIT VELOCITY

M.S. Ward[1], E.A. Perrero[1,2], J.H. Patel[1,2]

1. University of South Carolina, Columbia, SC 2. Prisma Health, Columbia, SC 3. San Diego Padres Organization, San Diego, CA

ABSTRACT

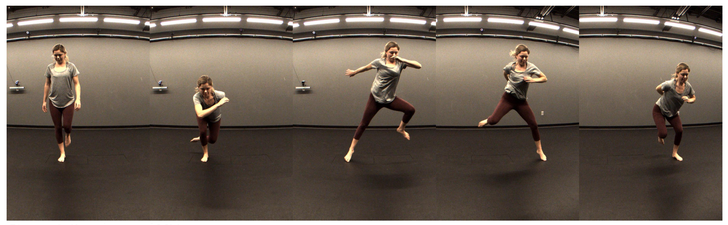
Like any other high velocity athletic movement, the softball swing consists of a quick, powerful motion utilizing a countermovement which incorporates the stretch-shortening cycle. Tests such as the countermovement jump (CMJ), single leg countermovement jump (SLCMJ), and single leg medial -to-lateral countermovement jumps (MLJ) for lower-body power. The multidirectional leg-power assessments provide coaches and strength training professionals with data that can be used for evaluating and monitoring. PURPOSE: The aim of this study is to identify correlations between multidirectional single leg countermovement jumps force production and exit velocity. METHODS: Data from 23 college female fastpitch softball players (20.5 ± 2.0 yrs, 1.7 ± 0.1 m, 72.5 ± 10.7 kg) ranging from different intercollegiate levels (D-I, D-II, D-III, and JUCO) were retrospectively analyzed in this study. Each of the participants performed two repetitions of a unilateral SLCMJ and MLJ on each leg while barefoot. The max concentric vertical ground reaction force (VGRF) were recorded and averaged between each jump trial per limb. The max concentric (VGRF) and max concentric medial-lateral ground reaction forces (MLGRF) were recorded for each leg and the averages calculated between jump trials. The participants performed a series of 3 swings, hitting a softball off of a tee at a self-selected ball contact height for exit velocity data. RESULTS: Mean and standard deviation (SD) data is presented in Table 1. A moderate positive correlation (r = .63) was observed between athlete exit velo and VGRF produced during a SLCMJ on the dominant leg. A low positive correlation (r = .38) was observed between athlete exit velo and VGRF produced during a SLCMJ on the non-dominant leg. A moderate positive correlation (r = .56) observed between athlete Exit Velo and %ML to VGRF produced during dominant leg lateral jumps. CONCLUSIONS: The results of the current study indicate VGRF kinetics of the stride leg as well as the concentric MLGRF and VGRF of the rear leg are important contributors in a softball player generating an increased batted ball exit velocity. These results imply that testing independent leg power capability of players in multiple directions can be beneficial to strength training professionals and coaches by determining lower limb asymmetries in addition to help drive successive training programs. PRACTICAL APPLICATIONS: The establishment of these relationships may emphasize alternate training techniques to develop a more efficient kinetic chain during a traditional fastpitch softball swing or specified resistance training to enhance unilateral strength, power, and balance.

INTRODUCTION

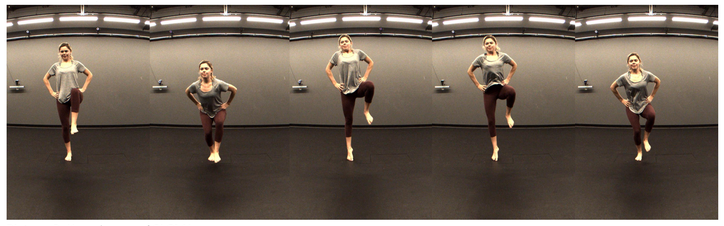
Like any other high velocity athletic movement, the softball swing consists of a quick, powerful motion utilizing a countermovement which incorporates the stretch-shortening cycle. Tests such as the countermovement jump (CMJ), single leg countermovement jump (SLCMJ), and single leg medial -to-lateral countermovement jumps (MLJ) for lower-body power. The multidirectional leg-power assessments provide coaches and strength training professionals with data that can be used for evaluating and monitoring. These tests are efficient to perform while providing a multitude of information based on athlete readiness and performance. PURPOSE: The aim of this study is to identify correlations between multidirectional single leg countermovement jumps force production and exit velocity

METHODS

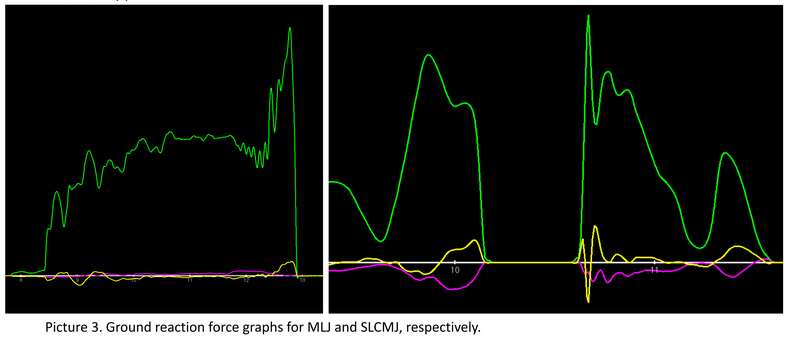
Data from 23 college female fastpitch softball players (20.5 ± 2.0 yrs, 1.7 ± 0.1 m, 72.5 ± 10.7 kg) ranging from different intercollegiate levels (D-I, D-II, D-III, and JUCO) were retrospectively analyzed in this study. Each of the participants performed two repetitions of a unilateral SLCMJ and MLJ on each leg while barefoot. The max concentric vertical ground reaction force (VGRF) were recorded and averaged between each jump trial per limb. The max concentric (VGRF) and max concentric medial-lateral ground reaction forces (MLGRF) were recorded for each leg and the averages calculated between jump trials. The participants performed a series of 3 swings, hitting a softball off of a tee at a self-selected ball contact height for exit velocity data.



Picture 1. Key phases of MLJ.



Picture 2. Key phases of SLCMJ.



Picture 3. Ground reaction force graphs for MLJ and SLCMJ, respectively.

	VGRF (dominant) during SLCMJ	VGRF (non-dominant) during SLCMJ	%ML & VGRF (dominant) during MLJ	%ML & VGRF (non-dominant) during MLJ
Exit Velocity	1.43 x BW ±.48	1.56 x BW ±.43	.32 x BW ± .06	.69 x BW ± .01
Correlation values	r = .63	r = .38	r = .56	r = .62

RESULTS

A moderate positive correlation (r = .63) was observed between athlete exit velo and VGRF produced during a SLCMJ on the dominant leg. A low positive correlation (r = .38) was observed between athlete exit velo and VGRF produced during a SLCMJ on the non-dominant leg. A moderate positive correlation (r = .56) observed between athlete Exit Velo and %ML to VGRF produced during dominant leg lateral jumps.

CONCLUSIONS

The results of the current study indicate VGRF kinetics of the stride leg as well as the concentric MLGRF and VGRF of the rear leg are important contributors in a softball player generating an increased batted ball exit velocity. These results imply that testing independent leg power capability of players in multiple directions can be beneficial to strength training professionals and coaches by determining lower limb asymmetries in addition to help drive successive training programs. The focus on the asymmetries can identify where there are deficits in training and performance, with a clear goal on how to improve them. The softball swing is a multiplanar movement that requires coordination and power, while being efficient. Improving this efficiency coincides with increased batted ball exit velocity, which can be translated to increased performance.

PRACTICAL APPLICATIONS

The establishment of these relationships may emphasize alternate training techniques to develop a more efficient kinetic chain during a traditional fastpitch softball swing or specified resistance training to enhance unilateral strength, power, and balance. Efficient training begins from the ground up; therefore, having the strong basis from unilateral training reinforces the importance of the kinetic chain, beginning at the foot and ankle before moving upwards to the upper extremities to complete the swing.

CONTACT INFORMATION

Megan Ward. University of South Carolina Department of Exercise Science, Columbia, SC. msward@email.sc.edu