

## ORIGINAL RESEARCH

## A BIOMECHANICAL COMPARISON AMONG THREE KINDS OF REBOUND-TYPE JUMPS IN FEMALE COLLEGIATE ATHLETES

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## ABSTRACT

**Background:** Single-legged drop jumps (SDJ), single-legged repetitive jumps (SRJ), and single-legged side hops (SSH) are often used as plyometric training and functional performance tests. Differences in the kinetics and kinematic characteristics of lower extremity joints during these jumps are unclear.

**Hypothesis/Purpose:** The purpose of this study was to investigate the joint motion and mechanical work of the takeoff leg from foot contact to foot-off during SDJ, SRJ, and SSH in the sagittal and frontal planes in female athletes. It was hypothesized that the joint motion and mechanical work of the lower extremity joints during the SDJ and SRJ would be larger than the SSH in the sagittal plane, those during the SSH would be larger than the SDJ and SRJ in the frontal plane, and during SRJ would be larger than SDJ.

**Study Design:** Cross-sectional study.

**Methods:** Seventeen female collegiate athletes participated and performed the SDJ (0.15-m box height), and SRJ and SSH (by crossing two lines 0.3 m apart). Three-dimensional coordinate data and ground reaction forces were collected. Contact time, jump height, jump index (i.e., the jump height divided by the contact time) of the SDJ and SRJ, and the total times of the SSH were calculated. Range of motion (ROM) from touchdown to the lowest center of mass, and the positive and negative (mechanical) work from touchdown to foot-off were analyzed.

**Results:** There were no significant differences in jump performance variables. Compared to the SSH, the SDJ and SRJ had significantly larger ankle and knee ROM and positive and negative work at the lower extremity joints, except for positive work at the hip joint, in the sagittal plane ( $p < 0.05$ ). Compared to the SDJ and SRJ, the SSH had a significantly larger ankle ROM and positive work at the knee joint in the frontal plane ( $p < 0.05$ ). Compared to the SDJ, the SRJ had a significantly larger ROM and negative work at each lower extremity joint in the frontal plane ( $p < 0.05$ ).

**Conclusion:** Although there were no significant differences in the jump performance variables, different characteristics of the takeoff leg ROM and mechanical work were found between three kinds of rebound-type jump tests. These findings may help clinicians choose jump methods to assess lower extremity function and to design plyometric training programs in sports and clinical fields.

**Level of Evidence:** 3b

**Key words:** mechanical work, plyometrics, three-dimensional motion analysis

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