The Relationship between Ground Reaction Force and Softball Pitch Velocity
Melissa A. Seldon, Benjamin F. Hodapp, Donald V. Fischer
College of Saint Benedict/Saint John’s University
Exercise Science and Sport Studies Department

Introduction
- The only external contact a pitcher has is with the ground. Therefore, ground reaction force is theorized to be important in determining pitch velocity.2
- Limited previous research suggests a positive relationship between ground reaction force (GRF) and softball pitch velocity.1
- Pitch velocity may be associated with the rate of force generation, or the peak slope of the force-time curve, of the stride leg.2

Purpose
- To examine the relationship between the GRF of the stride leg and softball pitch velocity.

Methods
- Three right-hand dominant female Division III intercollegiate softball pitchers (18.3 ± 0.6 years; 72.1 ± 1.6 kg; 168.0 ± 7.9 cm).
- Following a typical pregame warm-up, 15 maximal velocity pitches were thrown from a wood platform into a net, positioned approximately 10 feet in front of the platform, on two occasions separated by one week.
- The pitchers landed with their stride leg on an Accupower force plate which was embedded in a wood platform; GRF’s were recorded at 600Hz.
- Peak vertical and braking GRFs were normalized to body weight (BW).
- Ball velocity was measured to the tenth of one mile/hour using a Stryker radar gun and converted to meters/second.
- Rate of vertical and braking GRF generation were calculated by the peak force over the time to peak force (F/t).
- Time to peak force was defined as the time from the first upward deflection in GRF greater than 5% body weight to time of peak force.

Results
- A Pearson correlation was used to examine the relationship between GRF variables and ball velocity for all 90 pitches.
- A significant positive correlation was found between ball velocity (23.5 ± 0.9 m/sec) and vertical GRF (168 ± 48.6% BW; r(90) = .696, p < .001).
- A significant positive correlation was found between ball velocity (23.5 ± 0.9 m/sec) and braking GRF (109.6 ± 23.1% BW; r(90) = .854, p < .001).

Discussion
- Participants that generated large braking and vertical GRFs tended to generate greater ball velocity, which is consistent with previous research.1
- Positive, but less robust, correlations were found between the rate of GRF generation in both the vertical and braking directions and ball velocity, which is consistent with previous research.2
- Normalized vertical GRF was consistent with previous research using a similar population.1

Future Research
- Future research should utilize a larger sample size, measure stride length, and measure drive leg GRFs in addition to stride leg GRFs.

Conclusions
- There is a positive relationship between GRF variables and ball velocity. However, additional research is needed to establish a cause and effect relationship.
- The peak vertical and braking force are more strongly related to pitch velocity than the rate of GRF generation in those directions.

Literature Cited