

A Biomechanical Comparison of Youth Baseball Pitches: Is the Curveball Potentially Harmful?

From – The American Journal of Sports Medicine

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First Published November 30, 2007 Research Article [Find in PubMed](#)

<https://doi.org/10.1177/0363546507310074>

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Abstract

Background

The curveball has been anecdotally considered as a dangerous pitch among youth pitchers, especially for their ulnar collateral ligaments. No biomechanical studies have been conducted among youth pitchers comparing different types of pitches.

Hypothesis

The kinetics of the baseball throw varies significantly between the fastball, curveball, and change-up for youth pitchers. Kinematic and temporal differences are also expected.

Study Design

Controlled laboratory study.

Methods

Twenty-nine youth baseball pitchers (age, 12.5 ± 1.7 years) pitched 5 fastballs, 5 curveballs, and 5 change-ups with maximum effort in an indoor laboratory setting. Data were collected with a 3-dimensional motion analysis system. Kinetic, kinematic, and temporal parameters were compared among the 3 pitches.

Results

For elbow varus torque, shoulder internal rotation torque, elbow proximal force, and shoulder proximal force, the fastball produced the greatest values, followed by the curveball and then the change-up. The fastball also produced the greatest elbow flexion torque. Shoulder horizontal adduction torque and shoulder adduction torque were the least for the change-up. Several differences in body segment position, velocity, and timing were also found.

Conclusions

In general, elbow and shoulder loads were the greatest in the fastball and least in the change-up. Kinematic and temporal differences were also found among the 3 pitch types.

Clinical Relevance

The curveball may not be more potentially harmful than the fastball for youth pitchers. This finding is consistent with recent epidemiologic research indicating that amount of pitching is a stronger risk factor than type of pitches thrown.

Keywords

[shoulder](#), [elbow](#), [ulnar collateral ligament](#), [kinetics](#), [kinematics](#), [adolescent](#), [fastball](#), [curveball](#)