

# Early Decline in Finger Pinch Strength After 60 Pitches in High School Baseball Pitchers: A Potential Surrogate Marker for Elbow Injury Risk

KEISUKE TSUKADA, Youichi Yasui, Keisuke Yonezawa, Takuma Hagihara, Hironari Masuda, Jun Sasahara, Takumi Nakagawa, Hiroataka Kawano, Wataru Miyamoto

## INTRODUCTION:

Repetitive pitching generates substantial valgus stress on the elbow joint, heightening the risk of ulnar collateral ligament (UCL) injuries—particularly in adolescent athletes. Recent studies have suggested that intrinsic grip strength, including finger pinch force, contributes to medial elbow stability and may serve as an early indicator of impending fatigue-related injury. Although a pitch count threshold is commonly used to guide injury prevention strategies, its physiological validity remains debated, especially among younger populations.

The purpose of this study is to evaluate changes in finger pinch strength with increasing pitch counts in high school pitchers and to identify predisposing factors related to this decline.

## METHODS:

This descriptive laboratory study enrolled 15 male high school pitchers between January 2023 and June 2024. Each athlete threw 100 fastballs in a single session. Pulp and tip pinch strength (kgf), forearm and upper arm muscle stiffness (mm/10), upper limb fatigue and tightness (VAS), and perceived exertion (Borg scale) were measured at baseline and every 10 pitches. Pitch velocity (km/h), spin rate (rpm), and gyro angle (°) were recorded using the Rapsodo PITCHING system. Linear regression models were used to evaluate trends in pinch strength decline, while Pearson’s correlation and ROC analyses were employed to identify predictors and cutoff values.

## RESULTS:

Pulp pinch strength began to decline after approximately 60 pitches and decreased significantly beyond 80 pitches. Tip pinch strength exhibited a sharp reduction after 80 pitches. Pre-throw forearm muscle stiffness positively correlated with the rate of strength decline. ROC analysis identified stiffness cutoffs predictive of >10% decline in pulp (53.0 mm/10, AUC = 0.69) and tip pinch strength (57.0 mm/10, AUC = 0.64).

## DISCUSSION AND CONCLUSION:

Finger pinch strength declines significantly between 60–80 pitches in high school pitchers, with greater forearm muscle stiffness at baseline predicting more pronounced decline. Monitoring pinch strength may provide a practical, physiology-based adjunct to pitch count in guiding safe participation and preventing UCL injury.

Figure 1 : Motion Analysis During a Simulated Pitching Session

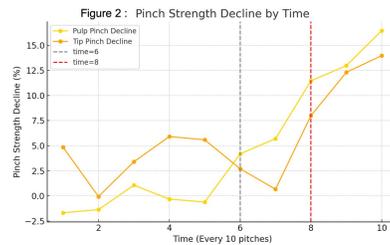


Figure 3

ROC Curve: Baseline Forearm Stiffness Predicting Tip Pinch Decline > 10%

