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“Per-Pitch Strength and ROM Trends in Live-Game Baseball Pitching”

Background: The throwing motion in baseball places a significant amount of mechanical stress on the throwing arm of the player. Pitchers are especially prone to injury due to the high forces accompanying repeated, high-velocity throws. The cumulative stress involved in baseball pitching has been associated with direct changes to throwing arm metrics both acutely and chronically over a season.

Objectives: The purpose of this retrospective study is to investigate the acute effect of pitch count on internal and external ROM, internal and external rotational shoulder strength, chuck pinch strength, and scaption strength, in the throwing arm of collegiate baseball pitchers.

Methods: Throwing arm range of motion (ROM) and strength were assessed before and after live-game outings using the ArmCare handheld dynamometer and inclinometer (Activebody Inc.). This device measures isometric force output and joint angles with high accuracy across multiple positions. Tests included internal and external rotation (IR/ER) ROM, IR/ER strength, scaption strength, and chuck pinch grip strength. ROM was measured in a standardized half-kneeling position with the elbow at 90°, while strength tests were performed supine using a fixed wall or box for resistance. Each strength assessment consisted of two maximal effort repetitions, and chuck pinch strength was measured in a simulated throwing grip position. Data were collected via the ArmCare app immediately before and after pitching to evaluate acute changes relative to pitch count.

Results: The study hypothesis was partially confirmed, as strength metrics decreased with increasing pitch count. For ER, IR, scaption, and chuck pinch, pitchers lost approximately 1 pound of strength per 10 pitches, suggesting a uniform decline across the throwing arm. In contrast, neither IR nor ER ROM showed significant pitch count–related changes.

Conclusions: These results align with prior simulated studies but extend their applicability by using live-game, per-pitch data, making results more generalizable. Chuck pinch strength emerged as a particularly useful mid-game metric given its practicality and link to flexor-pronator stabilization of the elbow and UCL injury risk. Although our self-administered testing introduces some variability, this method allowed for large-scale data collection under true game conditions, enhancing external validity. Future directions include incorporating pre-, post-, and 24-hour post-game testing to better capture recovery patterns—eventually leading to developing standardized fatigue profiles to guide workload management, bullpen roles, and injury prevention strategies beyond traditional pitch-count models.