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Predictors of throw velocity in youth and adolescent pitchers

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Introduction: Shoulder and elbow injuries are a common cause of pain, dysfunction, and inability to play in overhead throwers. Pitch velocity plays an integral part in the etiology of these injuries, however, the demographic and biomechanical correlates with throw velocity remain unknown.

Hypothesis: We hypothesized that pitchers with higher velocity would have shared demographic and kinematic characteristics.

Study Design: Cross-sectional study

Methods: Normal pre-season youth and adolescent pitchers underwent dual-orthogonal high-speed video analysis while pitch velocity was collected with a radar gun. Demographic and pitching history data was also collected. Kinematic data was recorded and observational mechanics were recorded. Multivariate regression analysis was performed.

Results: Four hundred and twenty pitchers were included, who pitched with a mean velocity of 64 ± 10 miles per hour (mph). After multivariate logistic regression analysis the most important correlates with pitch velocity were age ($p < 0.001$, $R^2 = 0.658$), height ($p < 0.001$, $R^2 = 0.076$), separation of the hips and shoulders ($p < 0.001$, $R^2 = 0.027$), and stride length ($p < 0.001$, $R^2 = 0.016$) – in combination these four variables explained 78% of the variance in pitch velocity. Each year of age was associated with a mean \pm standard deviation 1.5 ± 0.1 mph increase in velocity, each inch in height was associated with a 1.2 ± 0.2 mph increase in velocity, and separation of the hips and shoulders was associated with an 2.6 ± 0.5 mph increase in velocity.

Conclusion: Pitch velocity is most strongly correlated with age, height, separation of the hips and shoulders, and stride length.

Clinical relevance: These factors have implications with regards to the etiology of injury in youth pitchers, the rehabilitation of these injuries, as well as for improving pitching performance.