

INTRODUCTION

Softball windmill pitching is a dynamic movement requiring coordinated lower-body force production and transfer to generate high ball velocity upon release (1,3). Ground reaction forces (GRF) play a critical role in this process, as the only external contact a pitcher has during the pitch is with the ground through the feet (1). Current literature has shown that both the magnitude and timing of GRF—particularly vertical and anterior-posterior components—are closely associated with pitch velocity and the efficient transfer of kinetic energy from the lower to the upper body (1-4). Moreover, the sequencing of GRF may impact muscle contribution to the pitch thrown (4). Understanding these connections may help coaches and practitioners refine athlete monitoring strategies and identify more effective performance indicators for collegiate softball pitchers and identify more effective performance indicators for collegiate softball pitchers. Despite the existing literature, limited research has examined the relationship between force-time characteristics and the pitch velocity of different pitches thrown in softball over time. Therefore, the purpose of this study was to examine the longitudinal relationship between countermovement jump (CMJ) force-time characteristics and the velocity of different pitches in collegiate softball players. Based on the existing literature, it was hypothesized that pitch velocity would positively correlate with various force production metrics.

METHODS



- Five NCAA Division 1 softball pitchers (age: 20.0 ± 1.4 years, height: 175.3 ± 5.6 cm, body mass: 80.4 ± 11.6 kg) participated in weekly testing sessions over a five-month period.
- CMJ performances were assessed using dual Hawkin Dynamics force plates to measure jump height (JH), time to takeoff (TTT), and relative net propulsion mean force (PMF). Immediately following CMJ testing, pitchers threw fastballs and curveballs at maximum effort, with pitch velocities recorded using a Pocket Radar device. This protocol was repeated throughout the offseason and preseason to examine the relationship between CMJ force-time characteristics and pitch velocity.

RESULTS

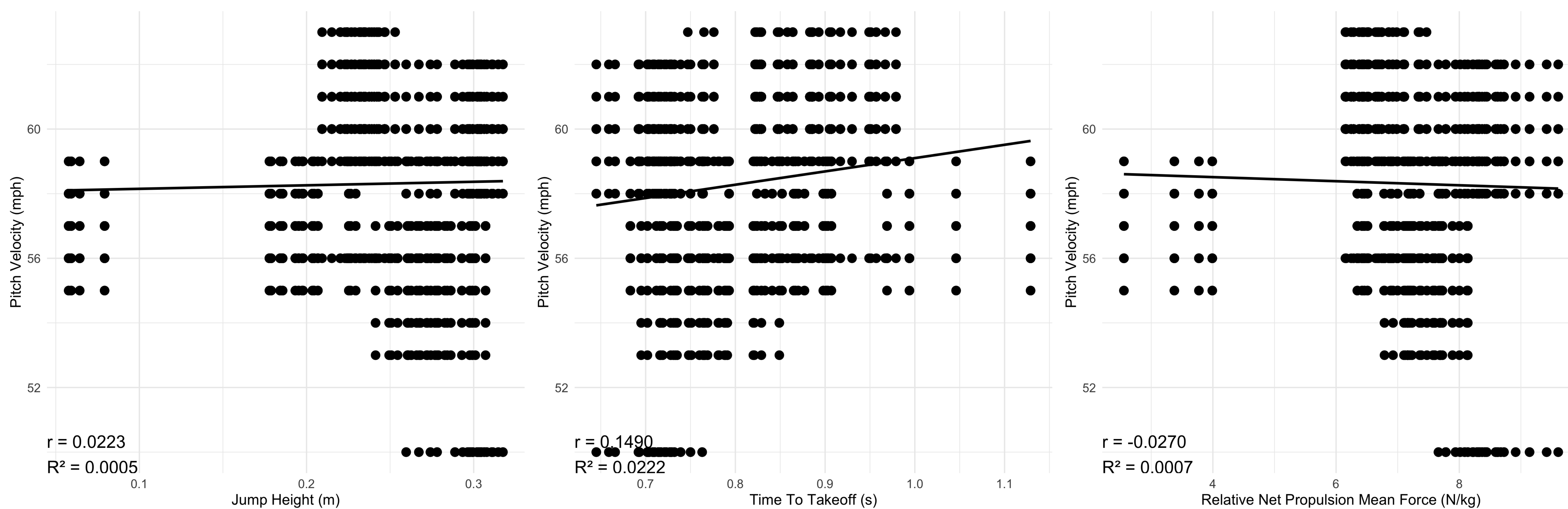


Figure 1. The relationships between CMJ force-time characteristics and pitch velocity. The performances of the pitchers over 5 months included: JH = 0.28 ± 0.05 m, TTT = 0.76 ± 0.08 s, PMF = 7.9 ± 1.0 N/kg, fastball speed = 58.7 ± 2.4 mph, and curveball speed = 57.6 ± 2.7 mph. The relationships between CMJ force-time characteristics and maximum pitch velocity are visible in Figure 1. The relationship between pitch velocity and TTT was statistically significant ($p < 0.001$); however, the relationships with JH ($p = 0.323$) and PMF ($p = 0.232$) were not. JH, TTT, and PMF explained 0.05%, 2.20%, and 0.07% of fastball and curveball speed variance, respectively.

CONCLUSIONS

- Despite a statistically significant correlation to pitch velocity, TTT only explained a small portion of the variance in pitch velocity.
- JH and PMF did not show significant or meaningful relationships with pitch velocity.

PRACTICAL APPLICATIONS

- It is important that practitioners identify the ability of different testing variables to explain different sport-specific performances to improve athlete monitoring protocols.
- CMJ height, TTT, and PMF do not appear to be effective performance metrics that may be used to monitor the technical skill of softball windmill pitching and thus, further research is necessary.

REFERENCES

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jac920@pitt.edu

