PREDICTIVE ABILITY OF SELECTED PACE BOWLING KINEMATICS AND PHYSICAL CAPACITIES TO BALL RELEASE SPEED IN CLUB-STANDARD CRICKETERS

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Pace bowling is a specialist role within the cricket team, where the objective is to minimize runs scored by opposition batters, and to also dismiss them (i.e., get them “out”; known a wicket).

To achieve this, pace bowlers adopt a 15–30-m run-up, followed by a jump into a back foot and front foot landing, executed in a split-leg manner (stride) similar to baseball pitchers or javelin throwers. However, the ball is to be bowled with a relatively straight arm.
A faster delivery speed simply reduces a batter’s reaction time and movement time, which may result in a greater likelihood of the batter not striking the ball, or mistiming the ball strike.
In order to better understand how faster ball release speeds are achieved, biomechanical analyses have been undertaken on elite fast bowlers to ascertain the associations with kinematic parameters [1,2].

Multiple regression models have also been developed from these kinematic data [1,2].

For example, Worthington et al. [1] reported 73.6% of the variation in mean ball release speed in elite pace bowlers was explained by approach speed, knee flexion angle at ball release, upper trunk flexion from front-foot contact to ball release, and shoulder angle (bowling arm to trunk) at front foot contact. However, this study [1] and the other [2] did not assess physical capacities of the fast bowlers.
To date, just one study has performed such a regression model for physical capacity data [3]. Pyne et al found that single leg static jump, bench throw, single leg countermovement jump, and body mass explained 74% of the variance in peak bowling speed for junior pace bowlers [3].

Fifty-four percent of the variance in peak bowling speed observed in senior pace bowlers was explained by the shoulder press throw, single leg static jump, single leg countermovement jump, arm length, and anterior-posterior chest depth [3]. While this study provided useful insight into the physical capacities that relate to ball release speed for both senior and junior bowlers, kinematic analysis of the bowlers was not performed and therefore this valuable data was absent from the regression model.

It is apparent that kinematic parameters and physical capacities should be included in subsequent modelling research to ascertain the variables most relevant in explaining the variance in ball release speed. This would provide a more useful framework for coaches to develop ball release speed in pace bowlers. Therefore, the purpose of this study was to examine the predictive ability of selected kinematic and physical capacities on ball release speed.
17 club-standard pace bowlers (age 21.5 ± 3.8 years) completed three separate testing sessions.

The first session comprised an eight-over pace bowling test. The test assesses bowling speed and accuracy.

2D kinematic data was collected from each ball.
The following kinematic variables were collected:

Approach speed – dual-beam electronic timing system
Delivery step length
Stride phase duration (back foot contact to front foot contact)
Power phase duration (front foot contact to ball release)
Front leg knee angle at front foot contact and at ball release.

The kinematic variables were captured with a video camera (25 Hz) and estimated with Dartfish Connect software.
Pearson correlation coefficients (2-tailed) were calculated to determine statistically significant correlations for entry into a multiple linear stepwise regression. Entry into the regression was set at $p < 0.05$, and a maximum of three variables were entered due to the small sample size. Statistical analyses were performed using IBM SPSS Statistics (Version 25.0, IMB Corp, Armonk, NY).
Ball speed was significantly correlated to 1-RM pull-up, 3-RM bench press, and delivery step length only. Therefore, these three variables were entered into the multiple linear stepwise regression. The stepwise multiple regression analysis indicated that 48.0% of the variance in mean ball release speed was explained by greater 1-RM pull-up strength.
Scatter plot with regression line ± 95% confidence bands, portraying the relationship between mean ball release speed and 1-RM pull-up strength.
Club-standard pace bowlers appear to rely on upper body strength to develop ball release speed. The absence of most physical capacities and all kinematic variables from the model may in part, explain why this sample of pace bowlers produced markedly slower ball release speeds to elite counterparts (range: 32.8–39.7 m/s, mean ± SD: 34.9 ± 1.7 m/s) [1].

Nevertheless, this study highlights the importance of pull-up strength and its relationship with ball release speed in club-standard pace bowlers. The pull-up exercise involves similar muscles to those used in pace bowling. Although speculative, bowlers that display greater strength in the pull-up exercise may rotate the bowling arm faster, or with increased torque, resulting in faster ball release speeds.

The approach speeds of bowlers in this study were also markedly lower than elite counterparts, which may be another reason for the increased reliance on the upper body to generate power for transfer to the ball.
Thank You

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