THE INFLUENCE OF CRICKET PITCH LENGTH ON BALL RELEASE BY JUNIOR BOWLERS

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Most junior cricket is played on pitches not much shorter than the 22 yards that adults play on. Young bowlers often struggle to bowl with good technique on these relatively long pitches, having to release the ball almost horizontally to achieve the distance, while adults typically bowl downwards at around 7° below horizontal. In this study ball release by 20 junior seam bowlers was analysed when they bowled on two different pitch lengths. It was found that the ball release angle was 3.4° lower on a 16 yard compared to a 19 yard pitch, while other release measures, including ball speed, were not substantially changed. Maintaining ball speed while bowling into the pitch more should enable players to achieve greater success and develop more variety in their bowling.

KEY WORDS: junior cricket, seam bowling, release angle, release speed

INTRODUCTION: Adult cricket around the world is played on pitches 22 yards (20.12 m) long, with junior players often using slightly shorter pitches. For some time the England and Wales Cricket Board (ECB) have recommended reduced pitch lengths for junior age groups ranging from 16 yards (14.63 m) at under 7, to 21 yards (19.20 m) at under 13. Anecdotally many junior bowlers still appear to struggle to project the ball the required distances and to do so they often release the ball travelling close to or even above the horizontal, while adult bowlers are able to bowl the ball at a downward angle, typically averaging around -7° for elite pace bowlers' stock deliveries (Justham, West & Cork, 2008; Worthington, 2010). A greater downward component of velocity elicits more bounce and increases the chances that the ball will deviate from its line as a result of the bounce, thereby deceiving the batter.
Cricket Australia made wide ranging changes to their junior formats for the 2016-17 season (see http://community.cricket.com.au/clubs/junior-formats/format-summary), which included reducing pitch lengths, however research quantifying the effects of bowling on shorter pitches is sparse. Elliott, Plunkett and Alderson (2005) found that when asked to bowl as fast as they could, junior fast bowlers were more accurate and under 11s and 13s bowled with a safer technique on 16 and 18 m pitches compared with 20.12 m. They found that ball speed didn't change significantly, although only three deliveries per bowler on each of three pitch lengths were analysed. More recently Harwood, Yeadon and King (submitted) found that playing on shorter pitches improved aspects of batting, bowling and fielding but looked only at game measures such as the number of playable deliveries, attempted shots and where the shots were fielded.
Other sports also modify the dimensions of aspects of the playing environment in junior age groups (e.g. tennis, baseball, basketball) and Buszard, Reid, Masters and Farrow (2016) highlighted the potential benefits of scaling equipment and play areas to suit junior participants, while noting the general lack of empirical evidence underpinning the changes.
The purpose of this study was to quantify the differences in ball release position, speed and angle by junior seam bowlers on two different pitch lengths. It was anticipated that bowlers would adapt the angle at which the ball was projected, releasing the ball with a more downward trajectory on the shorter pitch; however a change in length could also be accommodated by adjusting bowling speed, changing the point of release, or a combination of these parameters.

METHODS: Twenty male, junior, right-arm seam bowlers (aged 10.8 ± 0.63 years (mean ± SD); height 1.46 ± 0.058 m; mass 38.7 ± 7.3 kg), agreed to participate in the study, having been identified by their county or club coaches as being the best in their age group squads. The study was approved in accordance with the Loughborough University Ethical Advisory Committee guidelines and once the procedures had been explained to them, informed consent was obtained from the players and their parents.

Figure 1: Data collection environment in the National Cricket Performance Centre.

The study was conducted indoors at the ECB's National Cricket Performance Centre (Figure 1) where, following their individual bowling warm ups and familiarization with the procedure, each player was asked to bowl 12 good length deliveries on each of two different pitch lengths: 16 yards (14.63 m) and 19 yards (17.37 m; the recommended length for these bowlers during the preceding season). Players rested between deliveries as they desired and the total number of deliveries complied with the ECB Fast Bowling Match Directives (available at https://www.ecb.co.uk/governance/regulations/non-first-class-regulations). An 18 camera Vicon Motion Analysis System operating at 300 Hz was used to track 14 mm spherical reflective markers attached to the left heel, medial and lateral epicondyles of the right wrist and back of the right hand, as well as two 20 x 20 mm square patches of reflective tape diametrically opposite each other on a 135 g junior cricket ball. The system z-axis was in the upward vertical direction, the y-axis was defined to be parallel to the long axis of the pitch, the positive direction being measured from the bowling crease towards the batting end, and the x-axis was mutually orthogonal to y and z, positive from left to right from the bowlers' perspective. The calibrated volume included at least four steps prior to ball release and over 3.50 m of ball flight. Prior to the bowling trials, a static trial with the ball held at the tips of the first and middle fingers, as if just being released, was recorded for each bowler in order to calculate the distance between the ball and wrist centres at release.

For every trial the frame number when the front foot first contacted the ground in the delivery stride was identified from the Vicon Nexus graphics and all three-dimensional reconstructed marker coordinates were exported to MS Excel 2010. Ball release was taken to be the first frame where the ball-wrist centre distance exceeded the value from the bowler's static trial. A least squares fit to the ball displacement in each of the x, y and z directions as a function of time throughout the recorded flight enabled ball position and speed at release in each direction to be determined (vertical acceleration was constrained to be -9.81 $m.s^{-2}$). The magnitude (RelSp) and angle with respect to the horizontal (RelAng) of the resultant ball release velocity were calculated, along with the release height as a percentage of stature (RelHt%), the left heel position in the y direction at front foot contact ("front foot position"), and the y displacement (RelDist%) of the ball at release in relation to the front foot position, again as a percentage of stature (Figure 2).

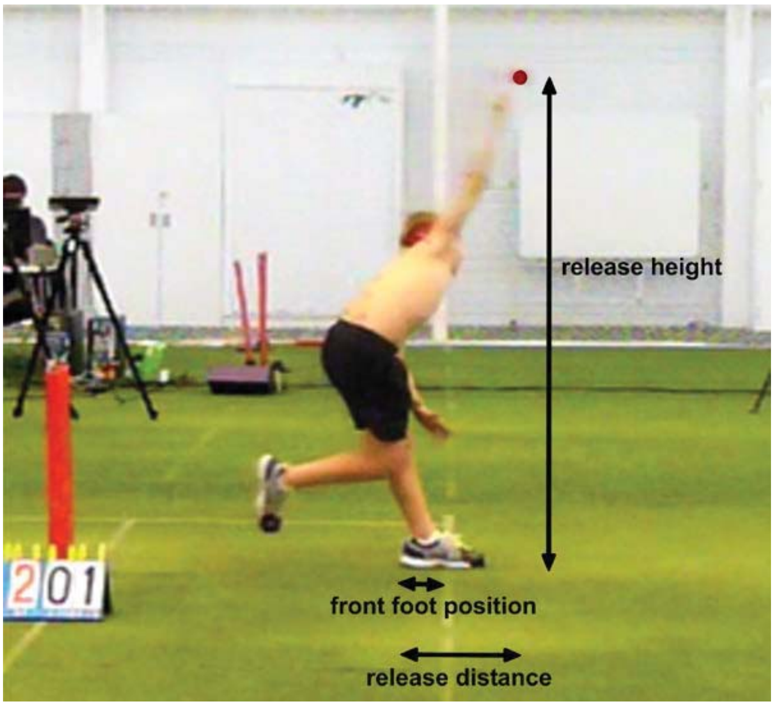

Figure 2: Bowler at the point of ball release.

For each bowler the median value for each of the five measures was calculated for the two pitch lengths separately and the means, standard deviations and 95% confidence intervals on the paired differences between means were determined for the group.

RESULTS AND DISCUSSION: The mean and standard deviation of the individual median bowling speeds across all bowlers on both pitch lengths was 21.1 ± 1.41 $m.s^{-1}$, which was faster than the 20.1 $m.s^{-1}$ Elliott et al. (2005) recorded for players the same age bowling as fast as they could, possibly indicating a slightly higher standard of player in this study.
On the 16 yard pitch the RelAng was 3.4° further below the horizontal than on the 19 yard pitch, while RelSp, RelHt%, RelDist% and front foot position (FFPos) changed little (Table 1).

Table 1
Means and differences between means for ball release parameters

	16 yd (mean ± SD)	19 yd (mean ± SD)	Difference	95% CI on Difference
RelSp ($m.s^{-1}$)	21.2 ± 1.43	21.1 ± 1.42	0.13	0.19
RelAng (°)	-4.16 ± 3.13	-0.74 ± 3.16	-3.4	1.41
RelHt% (% stature)	110 ± 4.3	112 ± 4.9	-1.8	0.55
RelDist% (% stature)	31 ± 6.9	28 ± 6.9	3.2	1.80
FFPos (m)	-0.36 ± 0.22	-0.35 ± 0.22	-0.01	0.03

As RelAng becomes more downward, the bowling hand becomes lower but slightly further ahead of the front foot at the point of release, hence the smaller RelHt% and larger RelDist% found here on the shorter pitch are consistent with the RelAng change. The minimal change in front foot position shows no evidence that the players tried to compensate for the pitch length change by adjusting their run ups (for example by bowling No Balls on the 19 yard pitch); in fact on both lengths front foot position averaged around 0.35 m short of the crease. Only one bowler persistently bowled in front of the crease, but he did so by a similar amount on both pitch lengths.

Elliott et al. (2005) suggested that on a shorter pitch bowlers “do not have to develop the same ball speed to attain a ‘good length’”, which is clearly true mechanically, but in this study as in theirs, RelSp changed very little, indicating that this wasn’t the means by which these bowlers adjusted for the pitch length alteration. Assuming negligible aerodynamic influences, for a ball projected horizontally from the average release height found in this study, a 0.13 $m.s^{-1}$ speed difference would make only a 0.08 m change to the horizontal range. By contrast, releasing the ball 3.4° below horizontal at the same speed would reduce the range by in excess of 2.3 m, around 85% of the pitch length change in this study. The implication is that controlling the ball release angle is important.

Compared to the 19 yard pitch, on 16 yards RelAng was closer to that of elite bowlers (Justham, West & Cork, 2008; Worthington, 2010) but did not match it. This might suggest that the pitch should be shortened further, however the 20 elite bowlers in Worthington (2010) were very tall (median 90^{th} percentile, compared with 58^{th} for juniors in this study) and so would be expected to release the ball at a more downward angle than average height players when bowling a good length delivery.

This study showed that a reduction in pitch length encourages bowlers to bowl “into the pitch” more which will enable them to get more movement and bounce off the pitch, but further research is required to determine optimum pitch lengths for junior age groups.

CONCLUSIONS: In response to an alteration to pitch length, junior bowlers adjusted the ball release angle without a substantial change to ball speed or release position. On the shorter pitch they bowled the ball with a more downward trajectory, approaching that of elite adult players. This should lead to greater success and enjoyment, as well as facilitating further technique improvements.

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