THE RELATIONSHIP BETWEEN ANTHROPOMETRIC AND KINEMATIC VARIABLES AND BALL RELEASE SPEED IN MEN'S SLOW-MEDIUM BOWLING

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INTRODUCTION
The speed of the ball is an important aspect of pace bowling, from slow-medium (<115kph) to fast bowling (130kph to 145kph). Every pace bowler aims to achieve this extra pace to take the batsman by surprise. Researchers have studied the parameters affecting the ball release speed and ways of increasing release speed of the ball, thus improving performance. Researches have already been conducted on influences of various kinematic [2,3,6,8] and anthropometric variables [3,5,7] on ball release speed. Kinematic variables like horizontal velocity during pre delivery stride [3], greater front leg knee extension during ball release and greater ankle height during the delivery stride [8] and final 5m run-up speed [2] has been found to contribute significantly to higher ball release speeds. Anthropometric variables like shoulder-wrist length and total arm length [3,5] have been found to have high positive correlation with ball release speed. Studies on influence of delivery stride length on ball release speed are scarce. Stride length has been found to be one of the with-in bowler factors which contributed to ball release speed [6]. Though lot of studies has been carried out to find the relationship between various anthropometric variables and ball release speed, relationship between leg length and height and ball release speed has not yet been studied. The main objective of this paper is to study the correlation between these selected anthropometric and kinematic variables and ball release speed.

METHODS
Twelve male slow-medium bowlers (age=21.33 ± 1.87years), representing various cricket clubs, playing at the divisional level of Coimbatore city voluntarily took part in the study. The bowlers were randomly selected based on the selection criteria of 18 years and above so as to ensure physical maturity. All the bowlers were right handed and have played at different divisional level tournaments. Written consent was signed by each subject before participation. The participants were asked to warm-up for five to ten minutes. The experimental protocol was then explained to the bowlers and was instructed to bowl three trial deliveries. Each bowler was then asked to bowl six deliveries at maximum effort.

A Panasonic NV GS 90 video camera was mounted on a tripod and placed perpendicular to the line of direction of bowling. The camera was placed in line with a line passing midway between the bowling crease and popping crease. Ball release speed was measured using Bushnell velocity speed gun 101911, which was placed behind the stumps pointing towards the bowler. Anthropometric measurements of leg length [1,4] and height was taken using standard tape measure.

Two hypotheses were set up, (i) an alternative hypothesis was proposed between delivery stride length and ball release speed and anthropometric variables and ball release speed (H1: r>0) and (ii) null hypothesis (H0: r=0). Pearson’s product moment correlation coefficients (r) was used to identify the significant correlation (d.f.=10, P<0.05, r crit=0.497 one tailed, 0.576 two tailed) between selected anthropometric and kinematic variables and ball release speed. The coefficient of determination r² was used as an effective way of interpreting the meaningfulness of the Pearson’s correlation coefficients r. The 95% confidence level was selected (5% level of significance, α=0.05). All statistical values are mentioned as mean ± standard deviation (s).

RESULTS AND DISCUSSION
The relationship between selected anthropometric variables and ball release speed and kinematic variable and ball release speed was identified using Pearson’s product-moment correlation coefficients (Table 1). The kinematic variable of delivery stride length (112.1 ± 10.4cms, r=0.611, P<0.05, r²=0.373) was strongly related to ball release speed (87.33kph ± 4.53kph). This strong positive correlation suggests that bowlers with long delivery stride lengths are able to achieve greater ball release speed. Coefficient of determination (r²=0.373) indicates 37.3% of the variance between delivery stride length and ball release speed and the remaining 63.6% of the variance is due to other factors of bowling.

High correlation was identified between the leg length (93.59 ± 4.37cms, r=0.578, P<0.05, r²=0.334) and ball release speed and total height (175.9 ± 8.56cms, r=0.582, P<0.05, r²=0.338) and ball release speed in this group of bowlers. A high correlation between leg length and height and ball release speed suggests that tall bowlers with long legs are able to release the ball with higher speeds. The variance between leg length and ball release speed and height and ball release speed was 33.4% and 33.8% respectively. From the above results it can be hypothesized that anthropometric characteristics of the bowler contribute significantly to the ball release speed. Upper limb length [3] has been found to have high correlation with ball release speed. These influences of limb length combined with bowling technique explain why world-class fast bowlers are tall.

CONCLUSION
The main objective of this present study was to identify the
relationship between selected anthropometric and kinematic variables and ball release speed in men’s slow-medium bowling. This study investigated delivery stride length, height and leg length and ball release speed of 12 divisional bowlers. A significant relationship was identified between these kinematic and anthropometric variables and ball release speed. This study will be primarily useful for cricket coaches during the selection of bowlers. It will also give an insight to the bowlers about the influences of anthropometric characteristics on ball release speed. It is identified that bowlers with longer delivery stride length, leg length and increased height are able to bowl faster.

REFERENCES

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Table 1: Pearson’s product-moment correlation coefficients (r) between selected anthropometric and kinematic variables and ball release speed

<table>
<thead>
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<th>Variable</th>
<th>r</th>
<th>r²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery stride length</td>
<td>0.611</td>
<td>0.373</td>
<td>0.035</td>
</tr>
<tr>
<td>Leg length</td>
<td>0.578</td>
<td>0.334</td>
<td>0.049</td>
</tr>
<tr>
<td>Height</td>
<td>0.582</td>
<td>0.338</td>
<td>0.047</td>
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