KINANTHROPOMETRY AND BIOMECHANICS APPLIED TO TALENT IDENTIFICATION OF BOWLERS IN CRICKET

Valandro L. [1*], Caimmi R. [2], Drusini A. [3], Glazier P. [4], Henneberg M. [5], Salvato B. [6], Secco E.L. [7]

[1, 3, 6] **Department of Biology, University of Padova, Padova, Italy**

[2] **Department of Astronomy, University of Padova, Padova, Italy**

[4] **School of Sport, Physical Education & Recreation, University of Wales Institute, Cardiff, Cardiff, United Kingdom**

[5] **Department of Anatomical Sciences, University of Adelaide, Adelaide, Australia**

[7] **Department of Computer Engineering & Systems Science, University of Pavia, Pavia, Italy**

Introduction

Notwithstanding the interest in biomechanics of throwing there is still not a clear picture of main anthropometric, kinetic and kinematic variables relevant for sport performances (1, 3). In cricket, fast bowlers are not permitted to throw and the bowling action is considered attack compared to a more defensive role of pitching in baseball (6). In this work we have focused not only on upper extremity limb lengths but also on proportions in relation to ball speed in cricket bowling. The importance of upper extremity limb length has been underlined in cricket and, according to Glazier et al (2000), ball release speed of fast-medium bowlers was significantly correlated with shoulder-wrist length.

Aim

The aim of this work was to demonstrate the importance of a newly defined efficacious brachial index (BI*) that lumps together shoulder-elbow, elbow-wrist and hand lengths, extending the concept of minimum jerk, from hints on hominid evolution (8) and modern human neuro-muscular evaluation (2) to talent identification in sports (Valandro et al, *in preparation*).

Methods

Top team right-handed collegiate male fast-medium bowlers delivered six balls with maximum effort using their normal bowling techniques. Each delivery was videoed using two gen-locked video cameras operating at 50 Hz and a Speedchek^{TM} Personal Sports Radar Gun was used to measure ball release speed. A Windows®-based Peak Motus^{TM} motion analysis package was used to digitize the delivery that produced the greatest ball release speed (5). Height, total body mass and upper extremity limb lengths were measured according to the standard anthropometric guidelines (7).

Simple linear regressions (bilateral) were performed considering p-values for reaching significance ($p<0.05$). Subject number 4 was excluded from the correlation graph, representing relative humerus length (humerus length/arm length) *versus* ball speed, following Chauvenet procedure for eliminating outliers or out of trend values.

A unilateral distribution of Pearson's coefficient of correlation was applied for ectomorphy, defined as the inverse of ponderal index ($m \cdot kg^{-1/3}$), *versus* speed, where the Fisher's Z value was also reported.

An efficacious index (e.g., BI* that lumps together shoulder-elbow, elbow-wrist and hand lengths) was calculated according to Secco et al. (2005).

Results

A re-evaluation of the results obtained by Glazier et al (2000) showed that the adimensional relative humerus length is even more significantly correlated to ball release speed after exclusion of subject number 4 ($p=0.006$; $N=8$; $R^2=0.73$). Interestingly, a significant correlation ($p=0.035$; z-Fisher=1.04; $N=6$) between ball release speed and ectomorphy, in bowlers classified as front-on was also found. This correlation greatly improved excluding subject number 2 ($R^2=0.93$).

[*] Present Address, University of Adelaide, SA 5005, Australia. E-mail: valandro@yahoo.com

However, the main finding was the definition of an efficacious brachial index (BI*) that lumps together shoulder-elbow, elbow-wrist and hand lengths and its non-linear correlation with ball speed (**Figure 1**).

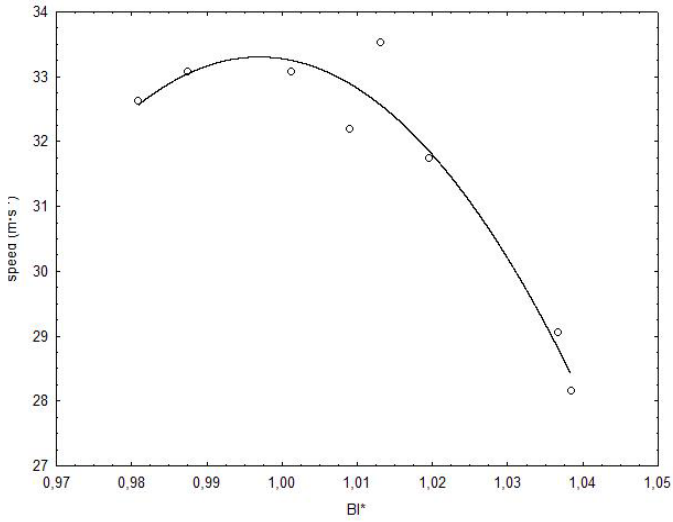

Figure 1 - Second order polynomial fit of ball speed and BI* for right-handed male fast-bowlers (R^2=0.85).

The choice of the best model has been made on the basis of the goodness of fit, the number of parameters (Akaike criterion) and theoretical insights.

Conclusions

Little attention has been devoted to the role of anthropometric factors in fast bowling performance possibly due to the great variability in body size and proportions and to the only recently advanced technological devices (speed guns). Higher ball release speeds of senior bowlers (up to 40 $m \cdot s^{-1}$ ~ 150 $km \cdot h^{-1}$) compared with junior bowlers have been attributed to longer limb lengths and higher approach speeds (1, 5). However, from the few data points available, a linear model could not theoretically be more reasonable than a second order polynomial relationship. Exclusion of subjects number 4 or 2 were justified by Chauvenet criterion and by the fact that the latter, notwithstanding having the shortest arm lengths, was a top bowler in the group.

Whether the more significant correlation of relative humerus length *versus* ball release speed is of any interest will be considered in a future study with a larger sample. Ectomorphy correlation with speed was proposed just as an indication of the relevance of body mass and height in the fast bowling technique of front-on bowlers (4) and a refined general model will be presented.

Genetic algorithms are being applied to both cricket fast bowlers and to baseball pitchers by using a five times greater sample size and selecting models on the basis of parsimony, goodness of fit and biomechanical insights (Valandro et al., *in preparation*).

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