



# Reproducibility of speed, agility and power assessments in elite academy footballers

Paul Harsley<sup>1,2</sup>, Daniel C. Bishop<sup>2</sup>, and Thomas I. Gee<sup>2</sup>

<sup>1</sup>Scunthorpe United Football Club Academy

<sup>2</sup>School of Sport and Exercise Science, University of Lincoln



## Introduction

Fitness testing is a visible part of many youth and senior football programs (Pyne et al. 2014). A high priority is given to physical assessments that relate to the demands of match performance (Rampinini et al. 2007). However somewhat surprisingly, the reproducibility of common assessments using elite football cohorts are not widely reported in the literature (Pyne et al. 2014). Field test assessments of speed, agility and power not only provide an indicator of sport-specific power producing ability but can also be used for diagnostic purposes to identify whether an athlete is suffering from fatigue, functional / non-functional overreaching or overtraining (Meeusen et al. 2013). The purpose of this study was to ascertain the reproducibility of testing protocols used to monitor speed, agility and power capabilities within elite academy footballers.

## Methods

### Participants

Ten male apprentice professional football players (mean  $\pm$  SD: age = 17.1  $\pm$  0.7 years, stature = 1.83  $\pm$  0.09 m, mass: 77.8  $\pm$  8.2 kg) participated in the study. All participants completed three separate identical trials with a day's recovery interspersed between each trial completing the assessments as listed below.

### The Assessments

**Countermovement jump test (CMJ):** The CMJ test is designed to measure lower body power producing capability. The participant stands with feet shoulder width apart, bends the knees to an angle of approximately 90° before jumping to a maximal vertical height whilst utilising a dynamic arm swing.

**Seated medicine ball throw test (Throw):** The throw test is designed to assess upper body power producing capability. The participant sits with their back and shoulder blades against a wall, with legs fully extended. The medicine ball (3kg) is thrown horizontally from chest via a full extension of the arms in an attempt to achieve maximal throw distance.

**40 m run sprint test (40 m), which incorporated a 0-10 m assessed phase (10 m):** The sprint test was used as an assessment of linear speed and acceleration. Each participant was positioned 1 m behind the start line and on the shout of 'go' the participant sprints maximally for 40 m. Timing gates (Brower timing, Utah, USA) were used to accurately collect the time at 10 m (acceleration phase) and at 40 m.

**Arrowhead agility test (Agility) (Figure 1):** This test was used as a measure of sport specific agility. Each participant was positioned 1 m behind the start line and on the shout of 'go' sprints forward 10 m to point A on the diagram. From here participants perform a right turn to point D before turning left to point B, turning left again from point B and accelerating in a straight line for 15 m over the initial start line to complete the run. Timing gates (Brower timing, Utah, USA) were used to accurately assess the time to completion.

### Data Analysis

Descriptive statistics are presented as mean ( $\pm$  SD). Statistical analyses were conducted using SPSS 16.0 (Chicago, IL, USA) with the alpha level for significance set at  $P < 0.05$ . A repeated measures ANOVA was used to investigate between trial differences for all assessments. Typical error as a percentage (TE %) [90% confidence intervals (CI)] for each assessment was established using a spreadsheet (Hopkins 2007). In assessing the variability of performance assessments measures low and moderate TE have been defined as under 2% (Hopkins et al. 2001; Stone et al. 2011) and between 3-10% (Stone et al. 2011) respectively. Smallest practical effect was calculated for each assessment from the product of 0.3 [which represents the smallest standardised change in mean for a group of trained participants; Hopkins et al. (2009)] multiplied by the between-participant standard deviation across the three trials.

## Results

Table 1. Mean (SD) for all physical assessments during each trial and associated typical error as a % (90% CI) for trials 1-2, 2-3 and as a mean across all trials and smallest practical effect (SPE) of change for each assessment

Assessment	Trial 1	Trial 2	Trial 3	TE Trial 1-2 (%)	TE Trial 2-3 (%)	Mean TE (%)	SPE
CMJ	60 (4) cm	61 (4) cm	60 (4) cm	3.3 (2.4-5.5)	3.1 (2.2-5.1)	3.2 (2.5-4.7)	1 cm
Throw	5.63 (0.22) m	5.69 (0.22) m	5.73 (0.20) m	1.3 (0.9-2.2)	1.4 (1.0-2.3)	1.4 (1.0-2.0)	0.06 m
10 m	1.87 (0.06) s	1.88 (0.06) s	1.86 (0.04) s	1.8 (1.3-3.0)	1.4 (1.0-2.4)	1.6 (1.3-2.4)	0.02 s
40 m	5.16 (0.13) s	5.19 (0.15) s	5.15 (0.13) s	1.4 (1.0-2.3)	1.4 (1.0-2.2)	1.4 (1.1-2.0)	0.04 s
Agility	7.98 (0.14) s	7.93 (0.14) s	7.94 (0.12) s	1.1 (0.8-1.8)	0.5 (0.4-0.9)	0.9 (0.7-1.3)	0.04 s

## Summary and Conclusion

Elite academy footballers were found to have consistent performance for assessments of speed, agility and power across three trials. Typical error was found to be low (< 2%) for Throw, 10 m, 40 m and Agility and low to moderate for CMJ, overall indicating a high level of reproducibility across repeated trials for the assessments (Hopkins et al. 2001). Therefore, these assessments can be confidently used in the physical fitness monitoring of elite academy footballers. By establishing the smallest practical effect for each assessment any performance increase above this level can be attributed as a worthwhile change in a player's functional capability.

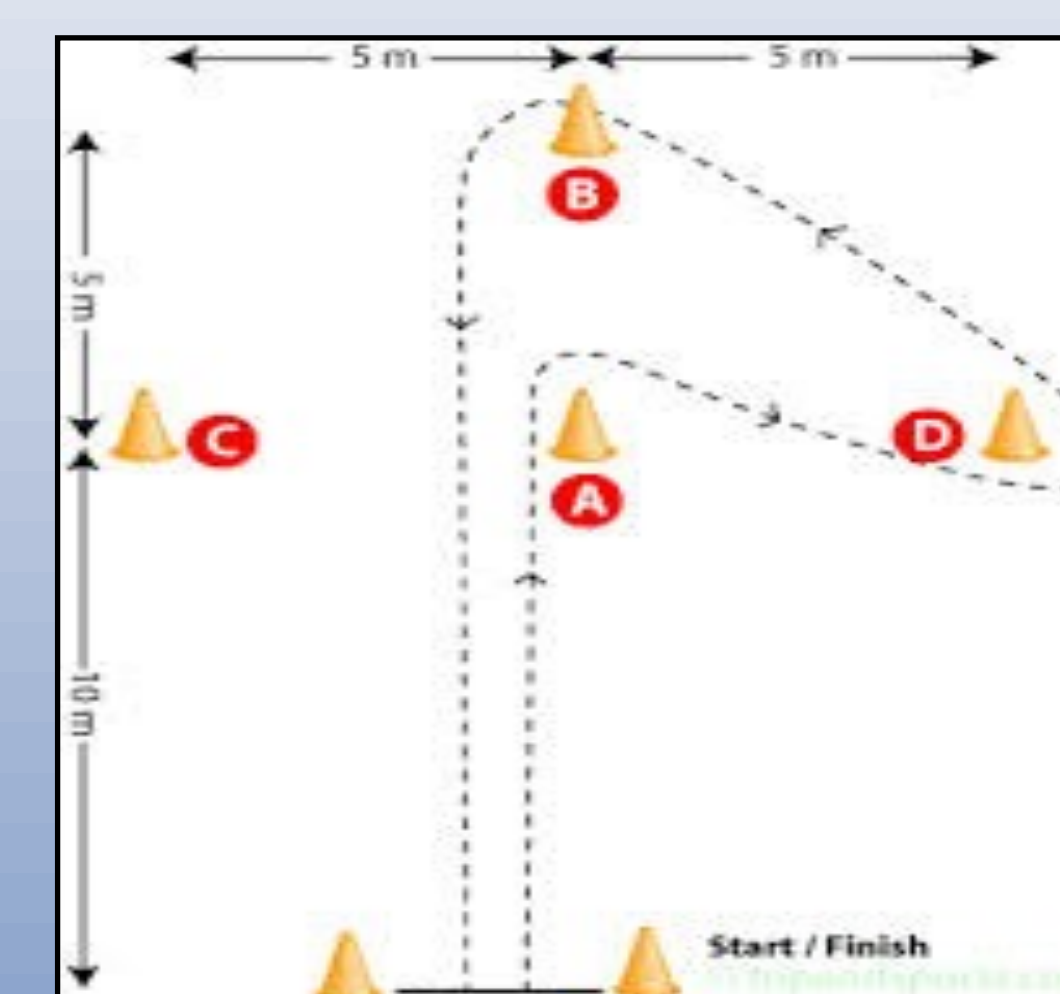


Figure 1. The arrowhead agility test is a specific test for agility including elements of speed, balance and change of direction. Agility is seen as a crucial physical component for professional footballers (Chan et al. 2011)

## References

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