Introduction

Greater accuracy of dual beam (DB) versus single beam (SB) photocell timing systems has been reported, as SB systems can be triggered early by lifted knees or swinging arms. Many scientists and practitioners continue to use SB systems, most likely due to lower cost and greater availability. The purpose of this investigation was to quantify potential sprint time differences between SB and DB timing systems. This information will be of benefit to practitioners and scientists wishing to derive accurate and reliable results, while identifying the most appropriate measurement system for use.

Methods

Data was collected in two phases. The purpose of Phase 1 was to compare the timing systems under ideal conditions. To eliminate the potential effects of the sensor beams being broken prematurely by swinging limbs, two recreationally active participants cycled as fast as possible through the 40 m track 25 times each with a 180 cm tube (18 cm diameter) vertically mounted in front of the bike. Using this protocol, the two systems should ideally generate 50 pairs of identical times. The purpose of Phase 2 was to quantify the magnitude and incidence of time differences between SB and DB under normal running sprint conditions. Twenty-five (15 females, 10 males) well-trained junior elite track & field athletes in the age range 18-20 yr (age 19 ± 1 yr, height 174 ± 8 cm, body mass 67 ± 10 kg) with at least two years of training background performed two 40 m sprints each. Single beam measures were taken using the Brower Timing System (TC, Brower Timing Systems, USA), which is a commonly used and previously validated system. The DB system was developed by Biomekanikk AS, Norway, with photocells mounted on separate tripods 1.10/1.30 m above the ground at start and 1.30/1.50 m above ground level at 20 and 40 m, with the trigger criterion being the first occurrence of both beams being broken.

Results and discussion

When arm and leg motion was controlled for (Phase 1), we observed identical times in 44% of the bicycle sprints, and 94% of all time comparisons were within ± 0.01 s for both distances (Figure 1, panel A). During normal running sprint action, absolute time differences for 0-20 m sprint times ranged from -0.05 to 0.06 s between the two timing devices (Figure 1, panel B). Identical times were observed in only 13% of the cases, while time discrepancies of ≥ 0.02 s were observed in 64% of the occasions. For this time interval, the results were positively skewed, meaning that SB timing yielded slower times on average. For 20-40 m sprint times, the absolute time differences ranged from -0.03 to 0.05 s. Identical times were observed in 30% of the cases, while time discrepancies ≥ 0.02 s were observed in 42% of the sprints.

This study demonstrated that a true 0-20 m sprint time of 2.75 s at worst could be quantified as 2.70 or 2.81 s by SB. Up to 0.06 s error based on timing equipment is a very big difference for short sprint distances. Among male soccer players, this represents the difference between the 75th and 25th percentile. The observed magnitude and incidence of time differences must be taken into account when selecting timing system. Single beam timing is not recommended for scientists and practitioners wishing to derive accurate and reliable sprint time results.