The effect of different starting procedures on sprinters’ reaction time

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Introduction
Standardized starting procedures and reaction time monitoring in athletics is important to ensure fair start conditions. The IAAF false start rules have changed significantly in the last ten years. Until the end of 2002 every athlete was allowed one false start before being excluded on their second offence. From 2003 to the end of 2009 only one false start per race was allowed. Since 2010, any athlete who “jumps the gun” is automatically disqualified from the race. The potential effects of different starting procedures on sprinters’ reaction times are currently unknown. The purpose of this study was to examine the effect of different false start rules and starters’ holding time on sprinters’ reaction times.

Methods
Sprint results from IAAF World championships and European Athletic Association championships with corresponding reaction times were collected from IAAF’s and EAA’s websites. To ensure valid and comparable reaction times, the competitions had to use the silent gun system provided by Seiko. Reaction times of 571 elite sprinters (100-m), participating in international championships for seniors from 1997 to 2011, were analyzed in this study. Television recordings from the competitions were analyzed using Dartfish ProSuite 5.0 to estimate the starters’ holding time (Dartfish, 2012).

Results
Figure 1 shows that the women had significantly (p<0.01) lower reaction times during the first false start rule (0.149 ± 0.026 s) compared to the second (0.160 ± 0.019 s) and third rule (0.179 ± 0.031 s). In addition, women’s reaction times differed between the second and third rule (p<0.01). Men had significantly lower reaction times during the first rule (0.148 ± 0.027 s) compared to the second (0.152 ± 0.021 s) (p<0.05) and third rule (0.178 ± 0.038 s) (p<0.01). Furthermore, the men’s reaction times differed between the second and third rule (p<0.01).

Discussion
The main finding in the present study was that different false start rules affect sprinters’ reaction time. Stricter rules lead to longer reaction times. When one false start was allowed for each athlete (rule 1) before 2003, the mean reaction times were 0.149 and 0.148 s for women and men, respectively. When one false start per heat (rule 2) was permitted from 2003 to the end of 2009 the reaction times increased by a small but significant margin (0.011 and 0.004 s for women and men, respectively). Finally, when no false starts were allowed (rule 3) after 2009, the reaction times increased further by 0.019 and 0.027 s for women and men, respectively. Overall, mean reaction times for both men and women have increased by 20% (0.03 s) during a 15 year period. Furthermore, there was a positive but small relationship between starters’ holding time and sprinters’ reaction times. However, holding time affected male and female sprinters differently in terms of reaction time spread and the degree of equal starts among competitors.

Figure 1: 95% CIs of sprinters’ reaction times as a function of false start rules. Differing letters indicate significant differences in reaction time among false start rules.