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Performance, physiological, and perceptual responses of a full sprint cross-country skiing competition

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INTRODUCTION:
Sprint cross-country skiing involves ~3 min efforts in undulating terrain, starting with a qualifying time-trial (TT) followed by three subsequent knock-out heats (quarterfinals [QF], semifinals [SF], and final [F]) separated by ~15-90 min recovery periods. However, the actual physiological responses during a full sprint competition, including warm-up, recovery between heats, and cool-down has not yet been investigated. Therefore, this study investigated performance, physiological, and perceptual responses of a full sprint cross-country skiing competition.
METHODS:
Eighteen national-level male junior skiers performed a simulated sprint competition in the skating technique consisting of an individual TT followed by 3 heats (QF, SF, and F). A promotion-relegation system was used instead of the regular elimination system so that each skier completed all heats. The skiers were monitored by heart rate (HR) and global navigation satellite system (GNSS) sensors. Perceived readiness (RED, 1-10), rating of perceived exertion (RPE, 6-20), and blood lactate concentrations [La-] were taken at different time points during the competition.
RESULTS:
The total time and distance covered during the full sprint competition were 03:30±00:06 h and 25.2±2.9 km, respectively. The skiers spent 02:19±00:27 h between 60-85% of maximal HR (HRmax) and 00:16 ± 00:04 h above 85% of HRmax. Average speed in SF was higher than TT, QF, and F (2.2±2.6%, 1.5±1.8%, 3.9±5.3%, respectively, all $P<0.05$). Average HR was reduced from TT to F (90.5±2.2% vs. 88.0±1.8% of HRmax, $P<0.01$) while [La-] was higher after F compared to TT, QF and SF (10.9±1.4 vs. 9.8±1.6, 9.1±19, and 8.8±1.8 mmol·L-1, respectively, all $P<0.05$). [La-] before F was also higher compared to TT, QF and SG (4.5±2.1 vs. 2.9±1.3, 2.7±1.4, and 2.2±0.6 mmol·L-1, respectively, all $P<0.01$). RED was lower before F compared to TT, QF and SF (6.7±1.3 vs. 8.0±1.0, 7.6±1.2, and 7.4±1.4, respectively, all $P<0.05$) while RPE was highest after TT compared to QF, SF, and F (17.7±0.9 vs. 15.5±1.1, 16.6±1.2, and 16.8±1.8, respectively, all $P<0.01$).
CONCLUSION:
This study provides new insight into the physiological demands of a full sprint cross-country skiing competition, emphasizing the need for maintaining high physiological and perceptual effort throughout the competition. The relatively long competition day consisting of repeated efforts of high intensity interspersed with periods of low intensity is unique for sprint cross-country skiing and should be considered while designing corresponding training programs.

Topic: Training and Testing

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