Heart Rate Recovery in Competitive Curlers After Maximal Effort Sweeping

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Introduction

Traditionally acknowledged as a social game, curling has rapidly evolved into an internationally recognized high performance sport since its return as an official sport to the Olympic Winter Games in 1998. Those striving for success in the sport are athletes who train year round preparing mentally and physically to improve their on- ice performance.

Sweeping, one of the most physically demanding skills in the sport, requires balance, coordination, strength, and endurance. Using a specialized brush, the ice in front of a moving rock is swept to maintain its momentum. Skilled curlers use sweeping to manipulate a rock after it is thrown allowing the thrower a larger margin of error. Sweeping can influence the distance a rock will travel and the amount a rock will curl. Effective sweeping is characterized by a large downwards force on the broom and a rapid movement of the broom where it contacts the ice (broom head) (Marmo, Farrow, Buckingham, & Blackford, 2006). Decrease in either of these factors will result in a decreased ability to manipulate the outcome of the rock.

Players may be required to sweep for up to 26 seconds per shot, with an average of 6 seconds for men and 9 seconds for women (Arnold, Morgan, & Ronnebeck, 2007). Sweeping is followed by a 30-180 second rest period while the other team is shooting (Arnold et al., 2007). During sweeping, athletes may experience heart rates as high as 94% of their heart rate reserve (Kivi & Auld, 2008). This repetitive, short duration, high intensity activity creates conditions that leave the athletes' muscles prone to fatigue. Fatigue experienced due to repetitive maximum effort sweeping causes a decrease in downwards force and broom head speed (Buckingham, Marmo, & Blackford, 2006). The ability to recover rapidly is therefore an important factor for curlers who are looking to improve sweeping performance by decreasing the effects of fatigue.

Oxygen uptake (VO_2) remains elevated 2-3 minutes post exercise to replenish the oxygen (O_2) debt accumulated within the body during activity (Powers & Howley, 2007). Oxygen debt is one factor that interferes with metabolic processes and energy production causing muscle fatigue (Powers & Howley, 2007). Aerobically fit individuals are better able to meet increasing demands for oxygen within working muscles (Powers & Howley, 2007) and therefore accumulate less O2 debt and are able to recover more rapidly than their less fit counterparts.

Heart rate is linearly related to VO_2 (American College of Sports Medicine, 2006) and is a more practical and accessible measure of recovery after on ice sweeping than measuring VO_2 directly. The purpose of this study was to measure heart rate recovery of competitive curlers after different durations of maximal effort sweeping.

Methods

Eight men and seven women (mean age = 24 ± 3 y, years curling = 15 ± 4 y) with experience playing various positions volunteered to participate. All participants were members of the Men's or Women's Major League of Curling in Thunder Bay, ON. Each participant swept a curling stone with maximum effort for three trials (5s, 15s, and 25s), as outlined in the Protocol for the Progressive Sweep Recovery Curling Fitness Test from the Canadian Curling Association. Heart rates were collected using a Polar S410 heart rate monitor, and were taken at 5 intervals (0s, 30s, 60s, 90s, and 120s) after each sweeping performance. Maximum heart rate was estimated using the predictive formula from Inbar (1994).

Results and Discussion

Mean heart rates measured after sweeping are presented in Figure 1. The results indicate that mean maximum heart rates after sweeping were not significantly different ($p > 0.05$) between men and women across trials. Mean heart rate was 71.5 ± 5.4% and 71.7 ± 6.0% of the predicted maximum after the 5s trial, 82.9 ± 6.4% and 81.9 ± 4.9% after the 15s trial, and 90.3 ± 4.6% and 89.9 ± 4.7% after the 25s trial, for the men and women, respectively.

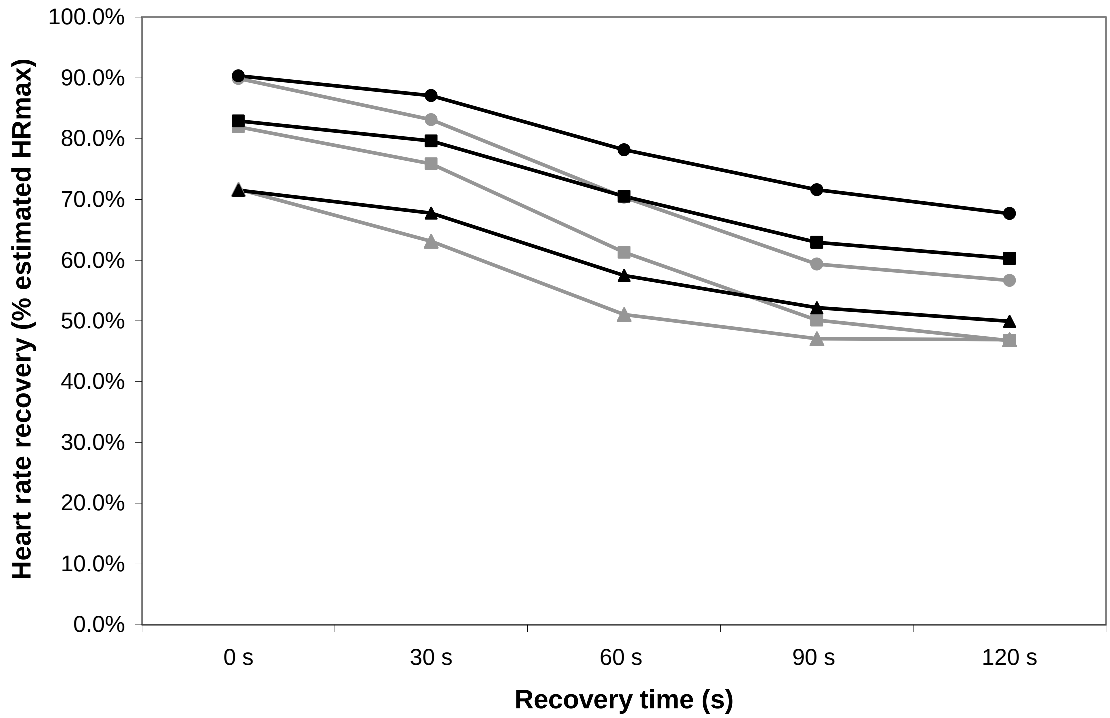

Figure 1: Mean heart rate recovery for men and women as a percent of the estimated maximum heart rate.

No significant differences ($p > 0.05$) were found in the mean recovery rate across trials for the men or women. Women, however, recovered significantly faster ($p < 0.05$) over the recovery period after the 15s and 25s trials (Figure 2). Mean heart rate for women was 25 beats per minute slower after two minutes of recovery for the 15s trial, and 21 beats per minute slower after recovery for the 25s trial, than for men.

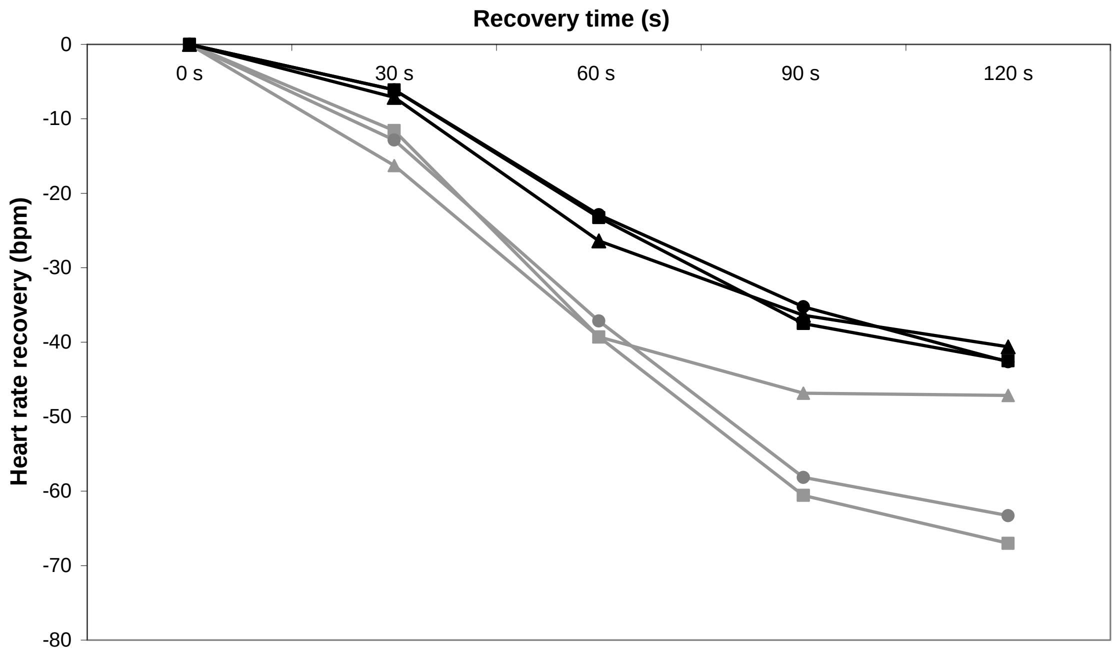

Figure 2: Mean heart rate recovery for men and women as a decrease from peak heart rate in beats per minute.

Faster heart rate recovery of the women in this study suggests that the they may be more aerobically fit than the men (Short & Sedlock,1997), however, no resting heart rates were taken in this study. If resting heart rate values of the men were higher than the women's both may have actually reached resting values. Future testing should include resting values and results presented as a percent of the heart rate reserve.

The recovery heart rates at 120 seconds in the 15 second and 25 second trial remain elevated compared to the values seen after the 5 second trial. This indicates that curlers are not able to fully recover in between sweeping intervals with a 120 second rest period. The rest period between sweeping intervals in a game situation may vary between 30-180 seconds (Arnold et al., 2007) which may not leave the athlete with enough time to fully recover after maximal effort sweeping. As the rate of recovery for heart rate appears to be independent of the time swept, players would benefit from sweeping for shorter intervals. They would be able to maintain a lower percent of the maximum heart rate when sweeping and post exercise heart rate would approach resting in less time during recovery. In a game, sweeping for only short intervals may not be sufficient to manipulate the speed or line of the rock enough to improve the outcome of the shot. In these situations a player can not avoid longer durations of sweeping. This emphasizes the importance of fitness training as a means of avoiding fatigue during curling. Players can not always control the recovery time or the amount of sweeping, but they can control the amount of time and effort that is dedicated to fitness training. Increasing aerobic fitness will theoretically increase the body's ability to cope with increased oxygen demand during sweeping (Powers & Howley, 2007). No research to date has been completed on the effects of aerobic fitness training on curlers performance. Future studies in curling should include aerobic fitness assessment and the impact of increased aerobic capacity on heart rates and heart rate recovery in curling.

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