

## **Physical and Physiological Assessment of Competitive Junior Curlers**

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### Introduction

To become a successful curler requires the contribution and development of a number of physiological factors. The curling delivery requires both a technical proficiency to deliver the curling stone accurately at a target, and a kinaesthetic awareness of the speed of the movement. During the delivery, curlers must propel the 18.6 kg granite stone a distance of approximately 42 metres. When this is performed as a “take-out” with high velocity, a large amount of force is required from the legs, and stability must be maintained in order to ensure the stone is released in the proper direction. Sweeping is one of the most physically demanding skills in the sport, requiring balance, coordination, strength, and endurance. Effective sweeping is characterized by a rapid movement of the broom head combined with a large downwards force (Marmo et al., 2006). Players may be required to sweep for up to 26 seconds per shot, which is then 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). A typical curling game lasts 2.5 hours. At major national or international competitions, teams could play as many as 14 games in 8 days (Bradley, 2009). This requires a strong aerobic capacity in order to minimize the effects of fatigue experienced during the prolonged competition (Behm, 2007).

Behm (2007) suggested that curling is a sport in which balance, muscular endurance, trunk strength, aerobic capacity, and flexibility are factors which influence performance and should be incorporated into a training program. To date, however, there has been no research conducted examining the physiological characteristics of competitive curlers. This research is necessary in order to assess current training practices and to make suggestions for methods of improving performance.

The purpose of this study was to examine the physical and physiological characteristics of competitive male junior curlers.

### Methods

Fourteen male curlers were recruited for this study, all had competed in regional, provincial, or national curling events in the junior age category (17-20 years). The participants played each of the positions on a curling team, including lead (n

= 3), second (n = 4), third (n = 4), and skip (n = 3). Testing took place in the fall, prior to the start of the competitive season. Ethical approval was obtained from the Lakehead University Research Ethics Board prior to the start of testing. Testing was completed in the Exercise Physiology Labaoratory at the CJ Sanders Fieldhouse at Lakehead University. A series of anthropometric and physiological tests were completed in one testing session. The testing protocol was designed to assess the various physiological factors involved in curling.

The tests followed the methodology and guidelines as outlined by the Canadian Physical Activity, Fitness, and Lifestyle Approach (CPAFLA) manual, and included:

**Standing Height** – was measured using a metric wall tape.

**Body Mass** – was measured using a standard balance scale.

**Body Composition** – was estimated using the sum of 5 skinfolds, and included triceps, biceps, subscapula, iliac crest, and medial calf measurements.

**Flexibility** – was assessed using the sit and reach test.

**Upper Body Muscular Endurance** – was measured using the push-up test.

**Abdominal Muscular Endurance** – was measured using the partial curl-up test.

**Lower Back Muscular Endurance** – was measured using the back extension test.

**Lower Extremity Power** – was assessed using the vertical jump test.

**Aerobic Fitness** – was estimated using the 20-meter multistage shuttle run test of aerobic fitness (Leger’s test)

## Results and Discussion

Table 1 presents the anthropometric data for participant by position (lead, second, third, and skip), as well as for the entire group of participants. The mean height and mass were  $179.0 \pm 7.8$  cm and  $72.3 \pm 7.9$  kg, respectively. The mean sum of 5 skinfolds was  $41.0 \pm 12.0$  mm.

**Table 1:** Anthropometric test data.

	<b>Age (yrs)</b>	<b>Height (cm)</b>	<b>Mass (kg)</b>	<b>Skinfolds (mm)</b>
<b>Lead (n=3)</b>	$17.7 \pm 1.5$	$179.7 \pm 8.4$	$69.0 \pm 13.9$	$35.9 \pm 7.1$
<b>Second (n=4)</b>	$17.8 \pm 1.7$	$176.5 \pm 11.2$	$73.3 \pm 6.6$	$41.5 \pm 16.6$
<b>Third (n=4)</b>	$18.3 \pm 1.0$	$180.9 \pm 4.1$	$73.9 \pm 4.6$	$44.3 \pm 11.6$
<b>Skip (n=3)</b>	$17.7 \pm 1.5$	$175.5 \pm 7.2$	$74.8 \pm 12.7$	$49.1 \pm 11.1$
<b>Group (n=14)</b>	$17.9 \pm 1.3$	$179.0 \pm 7.8$	$72.3 \pm 7.9$	$41.0 \pm 12.0$

The results of the physiological tests are seen in Table 2. When analyzing the results for the entire group, the participants demonstrated “excellent” performance on partial curl-ups (mean =  $86.9 \pm 57.0$  completed) and back extension ( $161.3 \pm 26.2$  sec), and “very good” on vertical jump ( $52.2 \pm 7.0$  cm), when compared to CPALFA healthy musculoskeletal fitness norms for gender and age. “Good” performances were seen for sit and reach ( $28.7 \pm 10.1$  cm) and push-ups ( $23.5 \pm 8.0$  completed). The participants completed an average of  $7.3 \pm 1.7$  stages of the 20-meter multistage shuttle run test of aerobic fitness.

**Table 2:** Physiological test data.

	Vertical Jump (cm)	Sit & Reach (cm)	Push-ups (# completed)	Curl-ups (# completed)	Back Extension (sec)	20m Shuttle (# stages)
Lead (n=3)	$56.3 \pm 9.7$	$23.5 \pm 3.2$	$20.3 \pm 8.7$	$97.3 \pm 37.2$	$156.7 \pm 21.4$	$6.7 \pm 0.6$
Second (n=4)	$52.1 \pm 7.3$	$32.7 \pm 9.8$	$25.5 \pm 11.6$	$104.8 \pm 83.7$	$180.0 \pm 0.0$	$7.9 \pm 2.7$
Third (n=4)	$49.3 \pm 4.6$	$28.7 \pm 13.8$	$24.0 \pm 3.5$	$61.3 \pm 38.7$	$146.0 \pm 34.3$	$7.3 \pm 1.3$
Skip (n=3)	$50.2 \pm 7.9$	$18.7 \pm 2.2$	$19.0 \pm 9.0$	$94.0 \pm 113.6$	$145.0 \pm 30.6$	$7.7 \pm 2.1$
Group (n=14)	$52.2 \pm 7.0$	$28.7 \pm 10.1$	$23.5 \pm 8.0$	$86.9 \pm 57.0$	$161.3 \pm 26.2$	$7.3 \pm 1.7$

The results of this study support the recommendations provided by Behm (2007), in which muscular endurance, trunk strength, aerobic capacity, and flexibility are factors which influence performance and should be incorporated into a training program. Core strength, including both abdominal and lower back, appear to be particularly important for curlers as was seen in the excellent performance in the sit-up test and back extension test. A strong core would provide a strong foundation for the torques generated by the limbs during sweeping, as well as offsetting the destabilizing action of the stone during the delivery (Behm, 2007). Similarly, the very good performance in the vertical jump test supports the need for a strong lower body necessary for balance and stability during sweeping. For the delivery, lower body strength is important in reducing the relative percentage of maximal force applied, which will help improve precision by allowing for a greater percentage of slow-twitch fibres to be recruited (Behm, 2007).

The lowest level of performance was observed in flexibility (sit and reach test) and upper body muscular endurance (push up test). Flexibility is important in maintaining balance during the crouched position seen during the delivery, and upper body muscular endurance is necessary for the rapid and forceful movements of the broom during sweeping (Marmo et al., 2006) which may be required for up to 26 seconds (Arnold et al., 2007). It is recommended that the participants in this study focus their training in these areas.

When comparing the test results by position, the best physiological performances were seen by among the participants who play lead or second. These curlers make up the “front end” and are responsible for the greatest contribution to sweeping by the team. It would therefore be expected that these curlers

demonstrate the highest level of overall fitness. In comparison, the skip showed the poorest performance in various tests, as well as having the highest sum of 5 skinfold measurements. This is not unexpected, as the skip is primarily responsible for team strategy and calling each shot, and contributes minimally to sweeping. It is important, however, that players of this position maintain a high level of fitness as is required for the physiological demands of the sport.

This study provided insight into the physiology of competitive junior male curlers, but also revealed the specific deficiencies in this group of athletes which may be limiting performance. Further research into the physical and physiological characteristics of curlers, including males and females of different age categories, is required.

### References

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