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Characteristics of Heart Rate response in elite Japanese Paralympic athletes with and without spinal cord injury during arm crank ergometer test

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INTRODUCTION:

It is well documented that heart rate (HR) is a useful tool for determining training prescription in able-bodied participants. However, limited HR-based training prescription or assessment is available for Paralympic sitting sports athletes who depend mainly on upper body work. In addition, their HR response could be different for their disabilities, e.g., with/without spinal cord injury. Previous research indicates that a slightly lower HR max is generally obtained during arm than during leg exercise testing [1]. Thus, this study aimed to compare the HR response of elite Japanese Paralympic athletes with spinal cord injuries to those without them during an arm crank ergometer incremental test.

METHODS:

The participants were 20 Paralympic athletes. They were divided into two groups: athletes with spinal cord injuries (SCI: n=10) or athletes without them (Others: n=10, leg amputation, etc.). HR and Blood lactate concentration (BLA) were measured during the arm crank ergometer incremental test. Protocols of the incremental test were tailored to individual athletes according to their disabilities: one typical example, for male wheelchair tennis players, was that the load was started at 40W and was increased by 20 W in every 3 minutes stage, with 1-minute rest between stages. The athletes were asked to maintain a cranking speed of 60 rpm until BLA exceeded 4 mmol/L. The HR and workload equivalent to 2 mmol/L and 4 mmol/L of BLA were calculated. Also, body weight, lean body mass (LBM), and body fat percentage were assessed by means of the air displacement plethysmography method. Mann-Whitney U tests were applied for examining the difference in those indices between SCI and Others.

RESULTS:

No statistically significant difference was found in HR at 2 mmol/L (118 ± 10 bpm vs 118 ± 12 bpm) and in HR at 4 mmol/L (147 ± 9 bpm vs 148 ± 15 bpm) between SCI and Others. The workload for the arm crank incremental load test at these intensities was comparable (at 2 mmol/L: 52.0 ± 15.8 W vs 52.5 ± 19.8 W, at 4 mmol/L: 81.5 ± 20.3 W vs 79.3 ± 26.3 W, respectively). Body composition indices were also comparable (body weight: 61.6 ± 11.9 kg vs 54.4 ± 12.4 kg, LBM: 44.2 ± 7.1 kg vs 41.5 ± 10.4 , body fat percentage: $27.2 \pm 7.5\%$ vs $24.0 \pm 3.6\%$, respectively).

CONCLUSION:

The current results suggest that the HR responses of SCI showed similar responses to Others. Previous studies reported that athletes with spinal cord injuries were not sufficiently able to increase their HR compared to able-bodied athletes [2], implying that they have a disadvantage in aerobic work. However, our results showed that SCI was very well trained, and their HR responses were comparable to those of other Paralympic athletes without spinal cord injuries. It is important to keep in mind that HR-based training prescription for athletes with spinal cord injuries could be the same with other disability athletes.

REFERENCES:

1. Fardy et al. (1977)
2. Leicht et al. (2013)

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