Physical Activity Patterns and Cardiorespiratory Fitness in Men with Cardiovascular Disease
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ABSTRACT

Purpose: Cardiorespiratory fitness (CRF) is generally regarded as an objective and reproducible measure of recent habitual physical activity (PA). Considering that the majority of daily PA is performed at light intensity, it is likely that CRF benefits will be detected at submaximal rather than maximal exercise. The purpose of this study was to evaluate daily minutes of light (LIPA), moderate (MIPA) and vigorous (VIPa) intensity physical activity among men with cardiovascular disease (CVD), and to determine the relation between PA and submaximal (oxygen uptake efficiency slope (OUES)) and maximal (VO2 peak) indices of CRF.

Methods: A total 32 male participants (mean ± SD): age of 60.0 ± 8.7 yr, VO2 peak (L/min) 2.0 ± 0.45, VO2 peak (ml/kg/min) 23.3 ± 5.7, were recruited during an induction to a community based exercise referral program following completion of phase 2 cardiac rehabilitation. Participants underwent a graded exercise test on a cycle ergometer with breath by breath open circuit spirometry after which they wore a wrist worn accelerometer (Actigraph) for 7 d. Absolute and relative submaximal OUES were calculated by plotting VO2 in ml/min on the x axis, and the log transformed VE on the y axis (VO2 = a log10 VE + b). Exercise data up to the ventilatory anaerobic threshold was included in the analysis.

Results: Participants performed 589.05 ± 69.41 min of daily LIPA, 161.38 ± 66.16 min of MIPA and no daily min of VIPa. There was no significant relation between peak VO2 and either LIPA or MIPA. There was a significant correlation between submaximal OUES (r=0.44; p<0.01) and LIPA. The relation between submaximal OUES/kg and LIPA min almost reached statistical significance (r=0.33; p=0.07).

Conclusion: Men with CVD spend the majority (78%) of their day performing LIPA. OUES, a submaximal measure of CRF was related LIPA whereas no relation was found between VO2 peak and LIPA.

Participants

Men (n=32) with documented CVD were recruited during an induction to a community based exercise referral program after completion of phase 2 (hospital based) CR program. Physiological and physical characteristics and cardiovascular events and medications are summarized in the table.

Table. Physiological and physical characteristics, cardiovascular events and medications

<table>
<thead>
<tr>
<th>Variable</th>
<th>Values</th>
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<tbody>
<tr>
<td>Age (y)</td>
<td>60.0 ± 8.70</td>
</tr>
<tr>
<td>VO2 peak (L/min⁻¹)</td>
<td>2.00 ± 0.45</td>
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<tr>
<td>VO2 peak (ml/kg/min⁻¹)</td>
<td>23.3 ± 5.70</td>
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<tr>
<td>VE (L/min⁻¹)</td>
<td>65.68 ± 21.56</td>
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<tr>
<td>Peak workrate (watts)</td>
<td>135.71 ± 40.49</td>
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<tr>
<td>Peak heart rate (b/min⁻¹)</td>
<td>134.21 ± 19.58</td>
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<tr>
<td>BMI (kg/m²)</td>
<td>29.24 ± 4.10</td>
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<tr>
<td>Waist:Hip</td>
<td>0.97 ± 0.040</td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td>136.86 ± 17.37</td>
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<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td>84.98 ± 10.99</td>
</tr>
<tr>
<td>Resting heart rate (b/min⁻¹)</td>
<td>68.24 ± 11.36</td>
</tr>
</tbody>
</table>

Cardiovascular Event

PEd 16 (50)
STEMI 9 (28)
NSTEMI 6 (19)
PCI 25 (78)
CABG 2 (3)

Medications

Statins 24 (75)
Anti-platelets 24 (75)
Beta blockers 22 (68)
ACE inhibitors 16 (50)
ARB's 3 (9)

Methods

Participants made a single visit to Dublin City University. Height, weight, hip and waist circumference were measured and participants performed a maximal cardiopulmonary exercise test (CPET) with a 12-lead ECG.

Breath-by-breath gas collected during the CPET was averaged at 20 s intervals.

OUES was calculated using the equation: VO2 = a logVE + b where the constant ‘a’ represents OUES, logVE represents the logarithm of VO2 and the constant ‘b’ represents the intercept (Figure 1).

The ventilatory breakpoint method was used to determine VAT (Figure 2).

Exercise data up to the ventilatory anaerobic threshold (Figure 2) and VO2 peak were used to calculate submaximal and max OUES, respectively.

Participants wore an accelerometer (Actigraph) continuously for 7 d.

Results

LIPA accounted for 78% of PA undertaken during waking hours. No VIPa was undertaken during the 7 d period. There was a sig. relation between submax OUES and LIPA (r=0.44; p<0.01). The relation between submaximal OUES/kg and LIPA min almost reached statistical significance (r=0.33; p<0.07).

No significant relation between VO2 peak and either LIPA or MIPA. No significant relation between MIPA and OUES or OUES/kg.

Conclusion

Men with documented CVD accumulate their daily min of PA by undertaking primarily repeated bouts of LIPA. No VIPa was undertaken during the 7 d period. The findings indicate that measures of maximal/peak metabolic rate may lack external validity with the regard to the daily challenges faced by the O2 transport and utilization pathways in men with CVD and a low functional capacity. OUES may be a more useful parameter for quantifying functional capacity in this cohort.

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