Evaluation of the physiological responses to fitLight Trainer exercise

Methods

The evaluation of fitLight Trainer was performed as case studies with 2 healthy, trained male volunteers (V1, V2). The volunteers came into the laboratory twice. At the 1\textsuperscript{st} visit, the volunteers performed an incremental running test to exhaustion on a treadmill (Woodway Pro, Weil am Rhein, Germany) to determine oxygen uptake (VO\textsubscript{2 max}), heart rate (HR\textsubscript{max}) and blood lactate (Lactate\textsubscript{max}) during maximal work intensity (Table 1).

At the 2\textsuperscript{nd} visit (a week after the 1\textsuperscript{st} visit), the volunteers returned to the laboratory to perform a fitLight Trainer exercise protocol. For the purpose of this laboratory test, two vertical poles were placed 2.5m apart with 3 LED powered lights mounted on each of the poles (0.25m, 1.10m, and 1.95m from the ground).

The training protocol was configured by the PDA controller and consisted of 6 bouts of 29 lights in randomized order, with 30 s of rest between each bout. The volunteers were instructed to deactivate the lights as fast as possible by placing one hand in close proximity to the activated light. After each bout, volunteers were given feedback about their performance (i.e., time required to deactivate 29 lights). Prior to the testing session, volunteers were allowed to practice the protocol (1 bout).

Heart rate and oxygen uptake (Oxycon Pro, Gentofte, Denmark) were measured continuously during the training protocol, and blood lactate (YSI 1500 SPORT, Yellow Spring, Ohio, USA) was obtained at the end of the 6\textsuperscript{th} bout.

Results

Table 1. Characteristics of the volunteers, and measures obtained from VO\textsubscript{2 max} (treadmill) test

<table>
<thead>
<tr>
<th></th>
<th>Age (yrs)</th>
<th>Height (m)</th>
<th>Body mass (kg)</th>
<th>VO\textsubscript{2 max} (L/min)</th>
<th>HR\textsubscript{max} (bpm)</th>
<th>Lactate\textsubscript{max} (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>33</td>
<td>1.81</td>
<td>69.0</td>
<td>4.83</td>
<td>171</td>
<td>8.3</td>
</tr>
<tr>
<td>V2</td>
<td>28</td>
<td>1.85</td>
<td>76.0</td>
<td>5.16</td>
<td>189</td>
<td>8.6</td>
</tr>
</tbody>
</table>

The volunteers were able to maintain performance throughout the protocol, verified as time to complete each bout (V1: 29.9-33.5s; V2: 29.1-32.2s).

The training protocol elicited a large increase in heart rate and oxygen uptake. Specifically, the volunteers reached a heart rate corresponding to 92-95% of HR\textsubscript{max}, and an oxygen uptake level equivalent to 82-88% of VO\textsubscript{2 max} (Figure 1).
Blood lactate values (5.5 and 9.6 mmol/L, respectively) were comparable to the levels attained during the VO2\textsubscript{max} test.

**Figure 1. Continuous measures of oxygen uptake for V1 during the 6 min exercise protocol**

![Graph showing continuous measures of oxygen uptake](image)

**Conclusions**

The results from the laboratory tests indicate that fitLight Trainer exercise can elicit substantial cardiovascular and muscular responses in highly trained individuals (Table 1).

Specifically, during a relatively short interval-style protocol (~3 min of exercise, 6 min total), heart rate and oxygen consumption reached values at a high percentage of the level attained during a running test to exhaustion. These results suggest that fitLight Trainer can be used as an alternative to conventional training routines (e.g., running, rowing, cycling) in order to enhance aerobic exercise capacity.

Blood lactate levels measured immediately after completion of the 6 min training protocol provided evidence of considerable activation of anaerobic glycolysis, suggesting that interval-style fitLight exercise can induce conditions with high muscular energy demands.

Collectively, these observations suggest that fitLight Trainer provides a training system that effectively can be used to perform exercise training for conditioning in a variety of sports.

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