NEW FIELD TEST TO TRACK CHANGES OF FLATWATER PADDLING PERFORMANCE: A PRELIMINARY STUDY¹, ², ³

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Summary.—A new test sensitive to changes in training was developed for well-trained flatwater paddlers. The test is easily carried out on open water and is sensitive to changes in the volume of high-intensity paddling sessions that occur during preparation for the international competitive season.

Kayakers and canoeists are usually tested on a kayak ergometer to adjust their training throughout the season, but some differences, such as technique, exist between ergometer vs open water paddling. The aim of this preliminary study was to assess performance of highly-trained paddlers with an open water test in which rated perceived exertion (RPE) was specified (e.g., Foster, Hector, Welsh, Schrager, Green, & Snyder, 1995). This test was repeated three times during one season in a small sample (N = 11) of well-trained paddlers to investigate whether a change in the training stimulus that occurs between the basic preparation and the pre-competitive period (e.g., Hill, Cureton, Grisham, & Collins, 1987) was associated with physiological adaptations and improvement in performance, as evaluated by the concomitant recordings of heart rate (HR) and speed during the tests.

METHOD

Eleven well-trained participants [7 male kayakers, 2 male canoeists, and 2 female kayakers; M age = 20 yr. (SD = 5), M height = 179 cm (SD = 9), M weight = 76 kg (SD = 10), M training experience = 8 yr. (SD = 6)] gave their informed consent to participate in the study in accord with the guidelines of the University of Evry. Participants were involved in three identical sessions corresponding to the beginning (November, Test 1) and the end (January, Test 2) of the basic preparation training period and the

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² The authors thank Xavier Quilliet for synchronization of heart rate and speed data, Denis Clet and Frédéric Imbert for help in data collection, as well as all the paddlers who volunteered to participate to this study.
³ A more detailed version of this report is available from the Archives for Psychological Data, APD2012-006. Remit $10.00 for a photocopy to the Archive for Psychological Data, P.O. Box 7922, Missoula, MT 59807-7922, for recipients inside the USA. Contact APD for shipping rates outside the USA.
end of the pre-competitive period (April, Test 3). The three sessions were conducted on the same open water lake without currents and with no variation in water depth. For the tests, participants were equipped with a heart-rate monitor (Polar® Accurex Plus, Polar Electro, Finland) and a global positioning system (GPS; Garmin® Forerunner 201, USA) and used their own flatwater racing boats (5.2 m length, 12 kg mass) and paddle. The exercise was a continuous incremental task based on participants’ perceived exertion, while speed and HR were recorded. The continuous 8-min. paddling was partitioned in 4 steps, each of 2 min. duration. Participants were asked to perform the four steps while increasing the intensity of paddling as follows: 0–2 min.: “easy paddling”; 2–4 min.: “moderate paddling”; 4–6 min.: “hard paddling”; 6–8 min.: “as fast as you can for 2 min.” These intensities corresponded to overall ratings of perceived exertion of 10, 12, 15, and 19 on the 6–20 Borg scale (1974) and are routinely used by the athletes throughout the season. The GPS was firmly fixed on the top of the boat behind the paddler to occlude visual information about the speed and to focus on perceived exertion. HR and speed values were recorded every 5 sec. during the test. Training content was examined before the first test (from mid-September to early November, i.e., 8 wk.) and between the two last tests (from mid-November to late January and from early February to early April, i.e., 10 and 9 wk., respectively) to assess the proportion of time spent in kayaking or canoeing training relative to total training (which also included weight lifting, running, cross-country skiing, and swimming). The athletes reported their training sessions (duration of the workout, as well as number of kilometers and intensity of the paddling sessions) daily in a table and every individual table was analyzed at the end of the period. The proportion of high-intensity paddling, defined as kilometers performed above ~90% of racing speed over 500 m, was also quantified throughout the period of investigation. Separate analyses of variance (ANOVAs) with Fisher-LSD post hoc analyses were used to determine statistical significance, set at .05.

Results

Boat speed and HR increased (effect sizes, $\eta^2 = 0.60$ and 0.73, respectively) with paddling intensity in each of the three sessions (Table 1). When the sessions were compared, in April the speed in the last step (RPE = 19) was improved compared with the two previous tests by ~4% ($\eta_p^2 = 0.01$, Table 1). No statistically significant difference was found between the other intensities ($p > .05$). Similarly, HR was lower in April compared with November regardless of paddling intensity ($\eta_p^2 = 0.02$, Table 1).

Examination of the training programs showed that the paddlers trained ~14 hr. weekly on average from mid-September to early April. However, the proportion of kayaking or canoeing training relative to total train-
ning was statistically different between tests (~56% before Test 1; ~36% between Test 1 and Test 2 and ~59% between Test 2 and Test 3, $\eta^2 = 0.74$). High-intensity paddling ($>90\%$ of racing speed over 500 m) represented only ~3% of the total kilometers performed in kayaking or canoeing before Test 1 and Test 2 but increased to ~10% of the total kilometers between Test 2 and Test 3 ($\eta^2 = 0.88$), i.e. from ~2 km/wk.$^{-1}$ before Tests 1 and 2 to ~8 km/wk.$^{-1}$ before Test 3.

**Discussion**

The test detected subtle variations in the speed associated with maximal RPE, i.e., close to the speed used in competition. This improvement in performance at the end of the pre-competitive period was associated with (a) an overall decrease in HR and (b) an increase in training intensity over those measured during the basic preparation period. We ascribed the improvement in performance to change in the quality of training performed throughout the period investigated. Indeed, in addition to an increased overall kayak training, high intensity paddling distance was, on the average, more than three times higher before the test in April than before the two other tests to reach ~10% of total paddling distance. This preliminary development has yielded in a test sensitive enough to detect seasonal changes in performance by highly trained paddlers, mediated at least partly by a change in training content between the basic preparation period and the pre-competitive period. This attempt may encourage the design of a similar field tests in other endurance sports.

**Table 1**

**Heart Rate (HR) and Speed Averaged During Each 2-min. Step for the Tests Conducted in November, January, and April**

<table>
<thead>
<tr>
<th>RPE</th>
<th>November</th>
<th>January</th>
<th>April</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>HR† (beats/min.$^{-1}$)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>143</td>
<td>16</td>
<td>142</td>
</tr>
<tr>
<td>12</td>
<td>164</td>
<td>13</td>
<td>162</td>
</tr>
<tr>
<td>15</td>
<td>178</td>
<td>9</td>
<td>176</td>
</tr>
<tr>
<td>19</td>
<td>186</td>
<td>6</td>
<td>184</td>
</tr>
<tr>
<td>Speed* (km/hr.$^{-1}$)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10.4</td>
<td>1.3</td>
<td>10.6</td>
</tr>
<tr>
<td>12</td>
<td>12.4</td>
<td>1.1</td>
<td>12.4</td>
</tr>
<tr>
<td>15</td>
<td>13.4</td>
<td>1.1</td>
<td>13.0</td>
</tr>
<tr>
<td>19</td>
<td>14.2</td>
<td>1.5</td>
<td>14.1</td>
</tr>
</tbody>
</table>

*Speed in April greater in November and January at RPE = 19, $p < .05$; †April HR lower than November at all RPE levels, $p < .05$. 
REFERENCES


BORG, •. (1974) *AUTHOR: PLEASE ADD REFERENCE.*


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