Heart rate responses and blood lactate concentration of goal ball players during the game

Pilianidis Theophilos, Christodoulos Antonios, Douda Helen, Anastos Antonios, Tokmakidis P. Savvas
Democritus University of Thrace, Department of Physical Education and Sports Science, GR-69100 Komotini

Introduction
Goal Ball is a competitive game for people with visual impairments and this make the event more demanding. In order to achieve a successful performance, Goal Ball athletes ought to have technical skills, cardiorespiratory endurance, strength, speed, quick reflexes, team spirit, flexibility and orientation skills (Winnick 2000, Paciorek & Jones 2001). The fast pace of the game during the competition and the rapid movement from defence and offence require a high intensity effort. This can be recorded with the measurements of heart rate responses and blood lactate concentration during the game. Nevertheless there is no such data during the competitive effort in a Goal Ball game. The purpose of the present study was to determine the intensity of effort and estimate the metabolic demands of this discipline, using field tests measurements during a training game.

Methods
Nine Goal Ball players (n=9), age 26.4±4.4 yrs, height 177.3±7.5 cm, weight 78.4±14.3 kg, body fat 10.7±4.4% and training age 2.1±0.2 yrs, members of the Greek National Team, participated in the study. Players were classified in the Β1, Β2 or Β3 classes based on the level of visual acuity and their visual field. They were divided into three groups of three players each. All three groups played two games alternatively. Each game was consisted of two halves of ten minutes each with 3-minute break in between. The intensity of exercise and the indirect estimation of energy demands were assessed during the games by the measurements of heart rate and lactate in the field. Heart rate (HR) was continuously monitored using Polar Sport Tester (S810i), while figure blood lactate (La) was measured 3 minutes after the end of each game.

Results
Table 1 presents the results obtained after the field measurements and Figure 1 illustrates the time and the percent of total play time spent in different intensity zones estimated according to the heart rate responses during the game. The HR response gave moderate to high values, indicating the high intensity and energy demands during the game. The blood lactate values revealed individual variations among players but, its concentrations remained low.

Table 1. Descriptive statistics (Mean±SD, range) of the study sample for all studied variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean± SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactate, 1&lt;sup&gt;st&lt;/sup&gt; game (mmol/l)</td>
<td>9</td>
<td>3.6±1.6</td>
<td>1.9-7.1</td>
</tr>
<tr>
<td>Lactate, 2&lt;sup&gt;nd&lt;/sup&gt; game (mmol/l)</td>
<td>9</td>
<td>2.9±0.8</td>
<td>2.1-4.5</td>
</tr>
<tr>
<td>HR&lt;sub&gt;average&lt;/sub&gt; (b/min)</td>
<td>9</td>
<td>137±10.8</td>
<td>124-157</td>
</tr>
<tr>
<td>HR&lt;sub&gt;max&lt;/sub&gt; (b/min)</td>
<td>9</td>
<td>182±9</td>
<td>168-197</td>
</tr>
</tbody>
</table>

Discussion/Conclusion
The results of the present study indicated that Goal Ball is a demanding team game. More than 40% of the time spend during the game was found to be at a high intensity (above 85% and up to 100% of HR<sub>max</sub>, see Figure 1). Most likely, this intensity requires energy from anaerobic sources. Our blood lactate values, however, failed to demonstrate a high participation of anaerobic glycolysis. During this high intensity of exercise the energy phosphate sources (ATP-PCr) seem to satisfy the immediate action of goalball athletes. The intermitted efforts of the goalball athletes were therefore supplied by both anaerobic (mostly ATP-PCr) and aerobic energy metabolism. Almost thirty five percent (35%) of the total time during the game was performed at an intensity ranging between 50% to 75% of HR<sub>max</sub>. Thus, in order to improve training, coaches should consider the fact that their players require anaerobic as well as aerobic capability in order to satisfy the energy demands required during the game.

References
Paciorek MJ, Jones JA (2001) Sports and recreation for the disabled