Heart rate patterns during the preparation period of an acrobatic element on the balance beam: a case study

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Introduction
Preparatory heart rate deceleration is believed to be an indicator of optimal attention, which leads to optimal performance (Tremayne & Barry, 2001). This is demonstrated in target sports as archery, rifle shooting, and golf. However, it is not clear if this effect also occurs in more dynamic sports where attention also plays a crucial factor. Attention is very important in women gymnastics, where difficult acrobatic movements are performed on a 10 cm wide balance beam. The purpose of this case study was to investigate the existence of a preparatory heart deceleration in gymnasts under different anxiety levels.

Methods
One elite-level female gymnast performed 4 attempts of an acrobatic element (double flic-flac) on the balance beam on three different heights (normal: 1.25 m, low: 0.20 cm, high: 1.70 m). Before the element, a standard preparation period of five seconds was respected. Heart rate was measured beat-per-beat (Polar Vantage M) during the tests and anxiety was measured just before the preparation period by scoring the level of anxiety on a self report intensity scale ranging from 0 (not at all) to 10 (very, very much) (Cottyn et al., in press). Performance score was obtained by a jury who rated the elements on video according to FIG-rules. The images of the elements were edited so that it was impossible for the jury to know on which height the element was performed. After elimination of the highest and the lowest score, the mean score was calculated. A 3 (heights) x 6 (time: second 0 to second 5) repeated measures design was used to detect significant differences.

Results
There was a significant main effect for height \( (F_{4,2}=21.96, \ p<0.01) \) and for time \( (F_{4,2}=9.37, \ p<0.001) \). There was no significant interaction between height and time \( (F_{4,10}=0.59, \ ns) \). Post hoc tests revealed that the gymnast had a significantly higher heart rate on the highest balance beam compared to the lowest and the normal height. A significant heart rate acceleration was found on the three heights with significant post hoc tests between the first measurement (0 second) and the other time points and between the second and the third time point.

Fig. 1: Heart rate patterns (mean of 4 attempts) during the 5 second preparation period before an acrobatic element on the balance beam on 3 different heights.

<table>
<thead>
<tr>
<th>Height</th>
<th>Low</th>
<th>Normal</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>3.03 (0.84)</td>
<td>2.99 (0.94)</td>
<td>3.20 (0.98)</td>
</tr>
<tr>
<td>Anxiety</td>
<td>2.25 (1.26)</td>
<td>2.09 (0.64)</td>
<td>1.25 (0.95)</td>
</tr>
</tbody>
</table>

There were no significant differences between heights neither for the performance score \( (F_{2}=0.08, \ ns) \), nor for the self report of anxiety \( (F_{2}=0.92, \ ns) \).

Table 1: Mean and SD of the 4 attempts on the different heights.

Discussion/Conclusion
The results of the present study show a preparatory heart rate acceleration before the execution of an acrobatic element on the balance beam instead of the expected heart rate deceleration. Performing the element on the highest balance beam lead to a higher heart rate, but did not influence the heart rate acceleration profile. Preparatory heart rate acceleration has been explained in other studies in terms of increased motor activity (Landers et al., 1994). However, this explanation does not hold in this study because the gymnast remained in the same upright position during the preparation period. Moreover, the magnitude of the acceleration (+17 bpm on the highest beam) is much more than the acceleration reported in literature. A possible explanation for the acceleration is a ‘psyching up effect’ to assure optimal levels of arousal for performing the acrobatic element. Further research on a greater test group is necessary to reveal the true nature of this preparatory heart rate acceleration.

References