CASE STUDY

Cortisol and testosterone responses to training and competition stress in ice-dance skaters — a case study

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Introduction

Extensive research exists on the skating sports of ice hockey and speed skating. This research shows that these sports are physically demanding and stressful activities. Figure skating and ice-dance skating are Winter Olympic sports, yet little is known about the level of physiological stress in these sports. To address this lack of information, metabolic markers of stress (serum cortisol, testosterone and lactate) were measured in an ice-dance couple preparing for the 1998 Winter Olympics in Nagano, Japan. These metabolic markers were chosen based on previous work by Viru et al.12 with the intent of looking at both the acute and long-term consequences of training and competing on these parameters.

Case report

An elite Polish ice-dancing couple gave written informed consent to participate in the study. They were monitored throughout their 1997 training and competitive season (Polish National Championship (NC) December 1997, European Championships (EC) December 1997) before the Winter Olympics (January 1998). Their physical characteristics were as follows: male dancer – age 22 years, height 177 cm, weight 76 kg, 16 years sports training; female dancer – age 21 years, height 170 cm, weight 59 kg, 16 years sports training.

A single random blood sample was collected from the dancers in the morning during the pre-season training period (June 1997). Subsequently, resting blood samples were collected from the couple in the morning during their in-season training period (July - November 1997). Specifically, 18 days were selected for the in-season blood sampling (~1 week apart). In December 1997, during their competitive season, resting blood samples were taken on the mornings that any competitive activity was scheduled to be performed and in the afternoon immediately after dance routines (competitive - practice routines at the NC and EC). Following the EC, the couple underwent tapering in training to prepare for the Olympics. Resting blood samples were collected on the last three mornings of this taper immediately before they flew to Nagano, Japan.

All morning resting bloods were taken at ~08h00 before the dancers performed any physical activity. These samples were assessed for testosterone and cortisol only. As noted, on select afternoons (~17h00) of the NC and EC competitions blood samples were collected immediately after selected ice-dance routines (within 1 minute of ending the routine). These latter samples were examined for post-routine lactate concentrations to assess the physical demand of ice-dancing. Table I shows the details of all blood sampling times and procedures.

All serum samples were collected from whole-blood specimens which were stored appropriately until later analysis. Cortisol and testosterone were assayed using commercial enzyme-linked immunosorbent assay (ELISA) kits (Orion Diagnostica, Finland) and lactate was analysed spectrophotometrically (Lange, Germany).

Fig. 1 depicts the cortisol response of the dancers. The resting morning cortisol levels in the male and female dancers decreased during the in-season and competition period compared with pre-season levels. Interestingly, both dancers showed an elevation in the resting cortisol levels during the 3-day rest period before leaving for the Olympics. It also appears that the male’s overall responses were more variable than those of the female dancer.

Fig. 2 depicts the testosterone response of the dancers. There is a noticeable gender-related difference in the rest-
**TABLE I. Blood sampling protocol**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Time of year</th>
<th>Blood sampling condition</th>
<th>Frequency of blood sampling</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-season (PRE)</td>
<td>June 1997</td>
<td>Resting (morning)*</td>
<td>Single</td>
<td></td>
</tr>
<tr>
<td>In-season training (IN)</td>
<td>July - Dec 1997</td>
<td>Resting (morning)</td>
<td>Single, daily over 18 days throughout the season</td>
<td>4-minute 'free-dance' routine at competition in the NC</td>
</tr>
<tr>
<td>Competitive season</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Championships (NC)</td>
<td>Dec 1997</td>
<td>Resting (morning)</td>
<td>Single</td>
<td>4-minute 'free-dance' routine during practice session at the EC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post ID routine (afternoon)*</td>
<td>Single</td>
<td>4-minute 'tango' routine during practice session at EC</td>
</tr>
<tr>
<td>European Championships (EC)</td>
<td>Dec 1997</td>
<td>Resting (morning)</td>
<td>Single, daily over 3 days of competition</td>
<td>2.5-minute 'jive' routine during practice session at EC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post ID routine (afternoon)</td>
<td>Single</td>
<td></td>
</tr>
<tr>
<td>Pre-Nagano Olympics (POG)</td>
<td>Jan 1998</td>
<td>Resting (morning)</td>
<td>Single, daily over 3 days before leaving.</td>
<td></td>
</tr>
</tbody>
</table>

* Morning = ~ 08h00  
† Afternoon = ~ 17h00  
ID = ice-dancing

**Fig. 1.** Resting (morning) serum cortisol responses of the dancers during training and competition, until immediately before the Winter Olympics. (PRE = pre-season; IN = in-season training (mean ± SD); NC = national championship; EC = European championships (1, 2, 3 = day 1, 2 and 3); POG = immediately pre-Olympic Games (1, 2, 3 = day 1, 2 and 3 before leaving)).

**Fig. 2.** Resting (morning) serum testosterone responses of the dancers during training and competition, until immediately before the Winter Olympics. (PRE = pre-season; IN = in-season training (mean ± SD); NC = national championship; EC = European championships (1, 2, 3 = day 1, 2 and 3); POG = immediately pre-Olympic Games (1, 2, 3 = day 1, 2 and 3 before leaving)).

Discussion

The data in this study are limited in nature, but nonetheless several compelling observations can be made. First, ice-dance training at this elite level is associated with a decrease in resting cortisol levels. However, these levels show marked fluctuations over time, as has been noted in other studies. Three days before leaving for the Nagano Olympics further declines in testosterone occurred. The decrease was more noticeable in the male dancer.

Lactate responses after the routines were similar in both dancers, ranging from 8.2 to 12.4 mmol/l. A lactate level of ~10 mmol/l or greater is considered maximal with regard to exercise. Therefore, the dancers responses suggest that the ice-dancing routines placed considerable stress on anaerobic exercise metabolism.
is in keeping with the results from other studies. The reduction in serum testosterone levels 3 days before leaving for the Nagano Olympics could represent a stress response, as has been suggested by others. Finally, the lactate findings suggest that the physical demands of both training and competition associated with ice-dancing can produce a response similar to other maximal exercise.

In conclusion, these results would suggest that international-level ice-dance skating is both physically and psychologically demanding.

REFERENCES


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