The day-to-day workload of ballet dancers

Matthew Wyon¹,², Emily Twitchett¹, Yiannis Koutedakis¹, and Manuela Angioi¹

¹ School of Sport, Performing Arts and Leisure, University of Wolverhampton, UK
² National Institute for Dance Medicine and Science, UK

Professional ballet dancers typically face long work days, and many complain of fatigue, particularly as a cause of injury. However, little information exists regarding the daily physiological demands of a dancer. The aims of the present study are to examine daily activity and sleep patterns of professional ballet dancers. Data regarding a single “work day” (09.30-18.30 hours) were collected from 84 ballet dancers over a three-week period to ensure that data were representational of a “typical” day. Seven dancers were from the corps de ballet, 16 were first artists, 12 were soloists, and 16 were principal dancers. Results indicated significant differences between dancer rankings for mean exercise intensity and the percentage of time spent at sedentary intensity (<3 METS), moderate intensity (3-6 METS) (p<0.005), and vigorous intensity (6-9 METS) (p<0.05). The rest versus work time were also significantly different (p<0.001) between rankings. It was concluded that (1) the average daily workload of professional ballet dancers varied significantly according to roles and gender and (2) the scheduled rest breaks were insufficient in length to combat fatigue, or that dancers were not utilizing their breaks to rest properly.

Keywords: ballet; work; recovery; fatigue; injury

The majority of research on the physical demands of dance has focused on the individual demands of class (Cohen et al. 1982b, Dahlstrom et al. 1996, Rimmer et al. 1994, Schantz and Astrand 1984, Wyon et al. 2002), rehearsal (Rimmer et al. 1994, Wyon et al. 2004) and performance (Cohen et al. 1982a, Schantz and Astrand 1984, Wyon et al. 2004) without looking at the effect of how these interact over a whole day. Monitoring training load is a vital component of athlete/dancer welfare, especially as dancers perceive that the main
Table 1. Participant details.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age (years)</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>Smokers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corps de ballet Female (n=7)</td>
<td>25 ± 3.27</td>
<td>165.0 ± 2.67</td>
<td>45.0 ± 6.20</td>
<td>2</td>
</tr>
<tr>
<td>Male (n=31)</td>
<td>20 ± 1.47</td>
<td>182.0 ± 2.00</td>
<td>67.3 ± 5.37</td>
<td>5</td>
</tr>
<tr>
<td>First Artist Female (n=16)</td>
<td>26 ± 4.35</td>
<td>161.6 ± 2.89</td>
<td>47.0 ± 7.21</td>
<td>1</td>
</tr>
<tr>
<td>Male (n=12)</td>
<td>22 ± 1.13</td>
<td>179.0 ± 3.00</td>
<td>70.8 ± 5.87</td>
<td>3</td>
</tr>
<tr>
<td>Soloist Female (n=12)</td>
<td>25 ± 3.51</td>
<td>159.2 ± 5.20</td>
<td>44.3 ± 5.51</td>
<td>1</td>
</tr>
<tr>
<td>Principal Female (n=16)</td>
<td>33 ± 2.99</td>
<td>161.9 ± 1.25</td>
<td>46.3 ± 2.63</td>
<td>0</td>
</tr>
</tbody>
</table>

cause of injury is fatigue/overwork (Brinson and Dick 1996, Laws 2005). The aims of the present study are to examine daily activity and sleep patterns of professional ballet dancers.

METHOD

Participants

Data regarding a single “work day” (from 09:30-18:30) were collected from 84 dancers over a three-week period (to ensure that data were representative of a “typical” day) from one international touring ballet company. Measurements of height and weight, along with the participants’ dates of birth and their smoking habits, were recorded (see Table 1).

Procedure

Participants wore an armband containing the “Sensewear” (Bodymedia Inc., Pittsburgh, Pennsylvania, USA) multiple accelerometer (SWA) device on their right upper arm throughout the day. At the end of the dancers’ work day the armbands were removed and the data downloaded.

Data collection

The SWA includes a 2-axis accelerometer, a heat-flux sensor, galvanic skin response sensor, and both skin- and near-body ambient-temperature sensors. The device estimates energy expenditure in terms of kilocalories (kcal) and exercise intensity (EI) in metabolic equivalents (METS). Its accuracy for estimating energy expenditure (EE) during physical exertion has been confirmed through several reliability and validity studies. The mean exercise intensity for the day—i.e. the amount of rest (<1.5 METS) versus work time
(in minutes)—was documented, as was the amount of the day spent in each intensity band (sedentary=<3 METS, moderate=3-6 METS, vigorous=6-9 METS, and very vigorous=>9 METS) as both the absolute time (in minutes) and time expressed as a percentage of the dancers’ working day. The length of periods at rest (<1.5 METS) was also documented in minutes. The greatest single amount of time spent below 1.5 METS for each day was documented as the dancers’ greatest “rest break” (GRB), while the mean length of all rest breaks (MRB) throughout each day was also calculated.

**Statistical analyses**

The pre-analyses Chi-Square and Kolmogorov-Smirnov normality tests were used to detect if variables were normally distributed. Non-parametric Kruskall Wallis test was used for the following variables, which were not normally distributed (p<0.05): mean length of rest break (MRB), longest rest break (GRB), work-to-rest ratio, percentage of day at 6-9 METS, and percentage of day at >9 METS. One-way ANOVA was used to analyze the following variables, which were normally distributed: mean exercise intensity for the day, percentage of day at <3 METS, and percentage of day at 3-6 METS. Descriptive statistics were also used to report the results. Statistical significance for all analyses was set at p<0.05.

**RESULTS**

Analysis indicated no gender differences, though this is probably due to lack of male soloists and principals. The percentage of the day that was spent in each intensity band, grouped by dancer ranking within the company showed significant differences (p<0.05) between rankings. Significant differences between rankings (p<0.005) for the mean exercise intensity were reported, where soloists had a significantly greater workload than did artists and first artists. The mean daily workload between dancer rankings show that soloists worked at a significantly greater intensity over the day than the first artists and corps (p<0.01) (Figure 1).

First artists and the corps de ballet dancers worked at a similar mean intensity, while principal dancers worked at a mean intensity that was greater than these two groups, but still less than the soloists. While the mean exercise intensity (all dancers) remained fairly low (<4 METS), the highest intensities dancers reached were 11.2 min⁻¹ ±3.32 for principal dancers, 11.3min⁻¹ ±4.02 for soloists, 9.7 min⁻¹ ±3.16 for first artists, and 10.1 min⁻¹ ±3.83 for corps de ballet dancers. These higher intensities were reached on few occasions during
each dancer’s day, and were only sustained for a very short period of time; less than 5% of the day in most cases (Figure 2).

Significant differences between rankings for the amount of time at “rest” versus the time above resting intensities were reported (p<0.001). This variable can also be expressed as a ratio of work-to-rest over the whole day. It can be observed that the only group of dancers to spend more time resting (<1.5 METS) than working was the corps de ballet. Of the other dancers it can be seen that principal dancers and soloists spent less than half a minute at rest for every minute danced, while first artists spent just over half a minute. The greatest amount of rest time seen throughout the day, at any one time (GRB),
were analyzed; results revealed GRB times of 36.0±31.35 minutes. Forty-six out of 51 dancers (90%) had GRB times of fewer than 60 minutes; 17 dancers (33.3%) spent fewer than 20 consecutive minutes at rest at any one time.

Data on sleep time indicated that dancers spent a mean time of 6:45 (hours:minutes) ±1:35 (range=3-9 hours) lying down at night, but only a mean time of 5:20±1:30 (range 2:20 – 8 hours) in a deep sleep mode.

**DISCUSSION**

The present study has demonstrated the variety in workload for dancers across ranks in a professional ballet company. Though the mean METS are similar for all ranks, it is the soloists that have the hardest work schedule. One dancer had 9 hours 39 minutes of dancing (3+ METS) in one day with 2 hours spent at 6-9 METS, and he expended 5417 kcal. The data also highlight the lack of rest periods during the day that are long enough for eating and subsequent digestion. Deep sleep also varied greatly; research has shown that the hormones related to muscular repair and healing are only released during stage 3 and 4 of sleep (Holl et al. 2011). These data could possibly be linked to the high injury rate seen within dancers as the lack of overnight healing would exasperate chronic injuries.

This schedule is the opposite of that employed within the majority of sports where the focus has shifted to quality rather than quantity of training and rest has been recognized as part of the training regime (Bompa 1999, Issurin and Kaverin 1985, Matveev 1965, Wyon 2010).
Address for correspondence

Matthew Wyon, School of Sport, Performing Arts and Leisure, University of Wolverhampton, Gorway Road, Walsall, West Midlands WS1 3BD, UK; Email: m.wyon@wlv.ac.uk

References


