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Physical and mental training: jet lag and fast cognitive-emotional recovery

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Abstract

Several studies have underlined that the rapid long-haul transmeridian flights cause a circadian dyschronism, entailing physical upsets and psychological consequences (Winget et al. 1984). This research was aimed to evaluate the impact of time zone transitions on self-perception of mood, concentration, and time reactions, in a sample of 21 fencers, participating in the 2011 World Fencing Championships. Two self-report instruments were administered: the Profile of Mood States and a questionnaire assessing travel, sleep habits, and sleep-wake cycle in the first week after the arrival. Results of the mixed-method analysis and possible educational intervention on athletes’ psychophysical recovery were discussed.

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Keywords: Jet-lag; circadian dyschronism; mood alteration; cognitive-emotional recovery; physical and mental training.

1. INTRODUCTION

Since the diffusion of the modern sports, the number of élite athletes, with their staff, undertaking long-distance flights has continued to increase. For many athletes, this leads to a condition defined jet-lag.

The Jet lag Syndrome is a circadian rhythm disorder caused by a displacement between internal and external clock. It is the result of a temporary desynchronization of circadian rhythms by psychophysiological functions (such as attention, memory, and concentration) and performance

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abilities. Jet lag is characterized by a general psychological and physical discomfort associated with a typical fatigue accompanying long trips (Waterhouse, Reilly, Atkinson, & Edward, 2007).

The disorder is transient and disappear after a few days, with the realignment of the rhythms. The jet-lag produces a number of undesirable effects including disturbed sleep, loss of concentration, decreased efficiency, and depressed mood. These effects result from an individual's inability to adjust quickly the circadian clock to the requests of the new time zone. Generally, the duration and intensity of the jet lag symptoms is proportional to the number of time zones crossed, even if it depends on the traveler's characteristics (Winget, 1984).

Jet lag also depends on the direction of travel. Many studies (Comperatore, Lieberman, Kirby, Adams, and Crowley, 1996; Petrie, Conaglen, Thompson, and Chamberlain, 1989; Waterhouse, Reilly, Atkinson, 1997) showed that the eastward travel is often more difficult than westward travel, because the subject is forced to a shortened day and this made it harder to support the adaptation to the new time zone. However, Reilly and Waterhouse (2005) showed that élite athletes were affected by jet lag, regardless of the direction of travel.

It also has often been assumed that jet-lag can affect the psycho-physical wellness of the athletes and can cause detrimental effects on their performance in training and competition. In their study, Reilly et al. (2009) involved the British Olympic Team, after a flight from the United Kingdom to Florida. Athletes reported symptoms, such as a decreased strength in the legs and a slower reaction time, which lasted for five days after the travel. Pirritano, Cei, Lucidi, and Violani (1997) showed that about 80% of the italian élite athletes involved in their study was affected by the jet lag in the days following the transoceanic flights. 65% believed that jet lag does not directly affect the performance in the competition, but 31% suspected that the performance could be negatively affected.

Studies on the relationship between jet-lag and athletic performance have focused on the physiological adaptation of the athletes. Only few studies have also investigated psychological variables and results are not definitive.

Bullock, Marti, Ross, Rosemond, and Marino (2007) analyzed the impact of the long-haul flights to the east (from Australia to Canada) on the diurnal variations in cortisol, the psychological sensations, and daily measurements of physical performance in a sample of skeleton athletes. Five elite Australian skeleton athletes undertook the flight compared with seven athletes did not travel. In both groups were recorded the amount of cortisol after 60 and 120 minutes of waking, the psychological sensations were assessed with a questionnaire on the jet-lag, and maximal 30 m sprints were performed once a day between 09:30 and 11:00 h local time. A distinct phase change in salivary cortisol rhythmicity were registered and the athletes perceiving themselves as “jet lagged”, but
minimal disturbances in their physical performance were seen in the group of elite skeleton athletes after long haul eastward travel.

Waterhouse et al. (2002) conducted a study with 39 british athletes traveling to Australia, in order to investigate the relationship between the jet lag symptoms and adjustment time to the new time zone.

Each athlete was asked to evaluate the jet-lag, five times a day (at 8:00, 12:00, 16:00, 20:00, and 24:00 h) and fill out a questionnaire on the Jet Lag. The results showed a relationship between jet-lag and both physical and psychological symptoms, such as the alteration of sleep, daytime fatigue and loss of concentration, but there was no correlations between jet lag and other physical consequences, such as loss of appetite and gastrointestinal problems.

Several meta-analytical studies have confirmed the impact of sleep deprivation on psychomotor performance (Reilly and Edwards, 2007). The effect on performance depends on the period without sleep and the decreases in speed were greater than decrements in accuracy (Koslowsky and Babkoff, 1992). Pilcher and Huffcutt (1996) analysed 143 study coefficients and suggested that mood is more affected by sleep deprivation than cognitive tasks, which were more sensitive than motor tasks. Reilly and Edwards (2007) noted that “sports skills frequently incorporate decision-making as well as physical components, errors in either of which are reflected in performance outcomes. Any deterioration in mood is also likely to affect performance where maximum effort and determination are required of the participant” (Reilly and Edwards, 2007, p.276).
2. Method

2.1. Purpose

The general purpose of this study was to evaluate the psychological recovery in a sample of near-élite fencers.

The initial hypothesis was to verify a direct correlation between crossed time zones and perception of mood, concentration, and time reactions.

*We also analyzed the relationship between sleep-wake cycle changes and psychophysical problems reported by the athletes in the week after their arrival in Italy.*

2.2. Participants

This study involved 21 male fencers, from 21 to 38 years old (M = 25,80; sd. = 4,58), from different countries, participating in the World Championships, held in Catania from the 8th to the 16th of October, 2011.

2.3. Instruments

Two self-report instruments were administered:
- the Profile of Mood States (POMS)
- a questionnaire assessing travel, sleep habits, and sleep-wake cycle in the first week after the arrival in Italy.

Subjects were asked to answer about demographic information, flight, and sleep habits; as far as the first week after the travel, they asked to indicate their total sleep time, night-time awakenings, day-time rests, bedtime and awakening time. Furthermore, a last section of the questionnaire contained items related to the jet-lag symptoms and other psychophysiological complaints (concentration and mood problems, gastrointestinal problems, fatigue, slow reflexes, physical weakness, insomnia, sleep disturbances).
2.4. Procedures

All of the subjects were informed about the purposes and instruments of the study and then were asked to give an informed consent.

Participants were assessed over a 7-day period for 5-10 minutes each day.

On Day 1, participants were asked to complete the self-report questionnaires. Every morning, each athlete was asked to report information about the previous night's sleep (total sleep time, night awakenings, bedtime and awakening time). On Day 7, each athlete completed the last section of the questionnaire about the psychophysiological problems.

3. Results

The descriptive analysis highlighted that eastward travelling athletes slept fewer hours during the first two nights after the travel than usual. Within the group of westward travelling athletes, only two subjects had problems in sleep duration.

These frequencies also reflected in the descriptive analysis of nocturnal awakenings during the first week after the arrival in Italy.

As expected, the disturbances reported by the athletes include a general physical weakness and other physical problems. Compared to the Psycho-physical problems Checklist, westward travelling athletes reported more physical troubles than mood problems. Eastward travelling athletes reported both physical and psychological disorders.

3.1. Correlations

Pearson's correlations showed a positive significant correlation between the physical strength recovery time and number of physical bothers (p <0.05), tiredness (p <0.05), and also the subscales tension (p <0.01), depression (p <0.01), and hostility (p <0.01) of the POMS.

Furthermore, there was a significant positive correlation between concentration problems perceived and recovery times of concentration and mood (Table 1). There was no significant correlation between the number of hours of the flight and the number of time zones crossed.
Table 1. Correlations between Flight (n. of hours), Time zones, Recovery time, Psycho-physical problems, and Profile of Mood State Questionnaire (POMS)

<table>
<thead>
<tr>
<th></th>
<th>N. of hours of the flight</th>
<th>N. of Time zones (a)</th>
<th>Recovery time of physical strength (b)</th>
<th>Recovery time of concentration (b)</th>
<th>Recovery time of mood (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Psycho-physical problems Checklist:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical bothers</td>
<td>0.332</td>
<td>0.005</td>
<td>0.548*</td>
<td>0.469</td>
<td>0.374</td>
</tr>
<tr>
<td>Problems in Concentration</td>
<td>-0.095</td>
<td>-0.282</td>
<td>0.159</td>
<td>0.579*</td>
<td>0.684**</td>
</tr>
<tr>
<td>Problems in Mood</td>
<td>0.076</td>
<td>-0.216</td>
<td>0.236</td>
<td>0.406</td>
<td>0.639</td>
</tr>
<tr>
<td>Tiredness</td>
<td>0.332</td>
<td>0.005</td>
<td>0.528*</td>
<td>0.469</td>
<td>0.374</td>
</tr>
<tr>
<td>Reflex slowness</td>
<td>-0.176</td>
<td>0.053</td>
<td>0.053</td>
<td>0.290</td>
<td>0.204</td>
</tr>
<tr>
<td>Weakness, physical strength problems</td>
<td>0.049</td>
<td>-0.293</td>
<td>0.034</td>
<td>0.201</td>
<td>0.339</td>
</tr>
<tr>
<td><strong>POMS subscales:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tension</td>
<td>0.234</td>
<td>-0.168</td>
<td>0.605**</td>
<td>0.438</td>
<td>0.389</td>
</tr>
<tr>
<td>Depression</td>
<td>0.209</td>
<td>0.136</td>
<td>0.579**</td>
<td>0.391</td>
<td>0.332</td>
</tr>
<tr>
<td>Anger</td>
<td>0.388</td>
<td>0.102</td>
<td>0.462**</td>
<td>0.300</td>
<td>0.303</td>
</tr>
<tr>
<td>Vigour</td>
<td>0.058</td>
<td>0.181</td>
<td>-0.230</td>
<td>-0.398</td>
<td>-0.401</td>
</tr>
<tr>
<td>Fatigue</td>
<td>0.121</td>
<td>-0.019</td>
<td>0.408</td>
<td>0.442</td>
<td>0.454</td>
</tr>
<tr>
<td>Confusion</td>
<td>0.255</td>
<td>-0.174</td>
<td>0.412</td>
<td>0.343</td>
<td>0.474</td>
</tr>
</tbody>
</table>

* p<0.05; **p<0.01

(a) from the City of departure to Italy

(b) in days
3.2. Comparisons

Comparison between groups were made using the Student t test and one-way ANOVA.

Participants were divided according to the median of time zones crossed (until 4 time zones, more than 4). Then, comparisons between these groups showed only a significant difference in the Vigour subscale of the POMS (p=0.03). Athletes travelling more than four time zones have significantly higher average than athletes traveling four time zones or less (Table 2).

Comparison between groups were made using the Student t test and one-way ANOVA.

Participants were divided into two groups, according to the median of time zones crossed (until three time zones and more than three time zones). Then, comparisons between these groups showed only a significant difference in the Vigour subscale of the POMS (p=0.03). Athletes travelling more than three time zones have significantly higher average than athletes traveling three time zones or less (Table 2).

Table 2. Comparisons between athletes grouped according to the median of the time zones crossed

<table>
<thead>
<tr>
<th>Profile of Mood State Questionnaire (POMS)</th>
<th>Until 3 time zones (n=11)</th>
<th>More than 3 time zones (n=9)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tension</td>
<td>Mean: 7.00, SD: 4.38</td>
<td>Mean: 9.78, SD: 6.32</td>
<td>-1.159</td>
<td>ns</td>
</tr>
<tr>
<td>Depression</td>
<td>Mean: 4.40, SD: 5.10</td>
<td>Mean: 10.11, SD: 8.43</td>
<td>-1.808</td>
<td>ns</td>
</tr>
<tr>
<td>Anger</td>
<td>Mean: 4.45, SD: 3.17</td>
<td>Mean: 10.78, SD: 7.17</td>
<td>-2.455</td>
<td>0.03</td>
</tr>
<tr>
<td>Vigour</td>
<td>Mean: 12.00, SD: 3.71</td>
<td>Mean: 14.00, SD: 5.50</td>
<td>-0.968</td>
<td>ns</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Mean: 6.64, SD: 6.53</td>
<td>Mean: 8.33, SD: 5.96</td>
<td>-0.601</td>
<td>ns</td>
</tr>
<tr>
<td>Confusion</td>
<td>Mean: 5.20, SD: 3.39</td>
<td>Mean: 7.89, SD: 2.76</td>
<td>-1.881</td>
<td>ns</td>
</tr>
</tbody>
</table>
Comparison between athletes, grouped according to travel direction (to the west, the east, and within the same time zone), showed that in the Vigour subscale of the POMS (p = 0.03), athletes traveling westward have significantly higher average than athletes traveling eastward, and than athletes remaining within the same time zone (Table 3).

Table 3. Comparisons between athletes, grouped according to travel direction

<table>
<thead>
<tr>
<th>Profile of Mood State Questionnaire</th>
<th>Eastward (n=11)</th>
<th>Westward (n=5)</th>
<th>Northward or Southward (n=4)</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Tension</td>
<td>8,55</td>
<td>5,663</td>
<td>7,60</td>
<td>5,079</td>
<td>8,25</td>
</tr>
<tr>
<td>Depression</td>
<td>6,70</td>
<td>8,731</td>
<td>9,20</td>
<td>5,541</td>
<td>5,50</td>
</tr>
<tr>
<td>Anger</td>
<td>7,00</td>
<td>6,403</td>
<td>9,20</td>
<td>7,120</td>
<td>5,75</td>
</tr>
<tr>
<td>Vigour</td>
<td>11,45</td>
<td>1,753</td>
<td>17,40</td>
<td>6,877</td>
<td>11,25</td>
</tr>
<tr>
<td>Fatigue</td>
<td>7,45</td>
<td>6,758</td>
<td>7,80</td>
<td>7,430</td>
<td>6,75</td>
</tr>
<tr>
<td>Confusion</td>
<td>7,20</td>
<td>2,936</td>
<td>6,20</td>
<td>3,271</td>
<td>5,00</td>
</tr>
</tbody>
</table>

Finally, comparisons between groups, divided according to the number of hours of flight, there were no statistically significant results in perceived mood states.

4. Discussion and conclusions

Past research on jet lag and athletic performance focused more on physiological variables than psychological dimensions. Findings of this study show that there are differences among athletes related to the number of time zones crossed and travel direction, concerning a subscale of the Profile of Mood State, the vigor. Perceived tension, hostility, and depression are significantly related to
strength and physical fatigue recovery times, but there are no significant correlations among these variables and the number of hours of the flight and time zones crossed.

The self-perception of the mood could be caused by jet lag, as suggested by the psychological and physical disorders related. However, both the perception of mood and jet lag symptoms could be due to different causes, for example the perceived tension for the competition.

Nevertheless, the evidence suggests that a non-pharmacological intervention might be effective in managing the jet lag symptoms and perceived mood state.

From a research perspective, more research is needed in order to define a causal model with psychological variables related to performance in competition.

A limitation of this research concerns the assessment instruments. The different nationalities of athletes has limited the use of standardized psychometric tests, especially for the assessing of cognitive tasks. Further research could assess the athletes in attentional, perceptual and mnestic tasks, comparing the results with their state of mood profile and response patterns in motor tests.

The tests should be administered in two stages, before and after the travel, in order to establish the baseline scores and check for the pre-post differences.

Finally, further investigation should consider the perceived precompetition anxiety, in order to analyze the relationship between this variable and perceived psychological and physical symptoms.

Previous research analysed the pharmacologic approaches and their effects on travellers, aircrew, and athletes (Reilly, Waterhouse & Edwards, 2005. The pharmacologic treatments include the use of zolpidem and specific GABA agonists, antidepressants, and melatonin (Leger, Metlaine, Chudat, 2005). Other studies investigated the effects of the exposure to bright light in order to facilitate the resynchronization of the sleep-wake cycle (Czeisler, Richardson, Moore-Ede, and Wetzman, 1981; Manfredini, Manfredini, Fersini, and Conconi, 1998; Postolache and Dan Oren, 2005). Furthermore, athletes could benefit from nonpharmacologic techniques for promoting sleep onset. Several studies investigated these simple and self-administered techniques, including sleep hygiene, inverted posture, stimulus control, breathing techniques, motor and cognitive relaxation, and cognitive behavioral therapy (Hauri, 1982; Cole, 2005; Leger, Metlaine, Chudat, 2005; Reilly, Waterhouse, and Edwards, 2005).

From an applied perspective, it could be useful to combine a psychoeducational intervention with motor and cognitive relaxation techniques and mental training.

The intervention should begin in the flight preceding period to allow an optimal management of the athlete's psico-physical recovery.
Mental training should be provided in conjunction with the physical and technical training and it should include relaxation techniques as well as pre-competition mental preparation strategies.

Relaxation techniques, such as autogenic training (Schultz, 1932) or the progressive relaxation (Jacobson, 1938), could be used to encourage an awareness process of muscle tension during the rest periods and work sessions, managing the stressful situation.

Finally, the mental imagery, ideomotor training, and breathing relaxation techniques could facilitate a positive emotional and cognitive involvement of the athlete.

A psychoeducational intervention on the long-distance travel effects could help the athletes in managing the psychological consequences of the jet lag.

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References


