Sleep habits, quality and chronotypes of Paralympic athletes in the preparation for Tokyo 2020 Games

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Sleep is a vital pillar of an athlete’s health
Sleep in Athletes

- Both athletes and coaches rate sleep as critical to optimal performance, yet only a few studies have investigated the sleep quality and quantity of the athletic cohort.

- Some authors suggest athletes should sleep between 9 and 10 h, whilst others recommend that 7–9 h is enough for healthy adults.

- Recent evidence suggests that athletes sleep far less than either of these recommendations [Sargent C, Halson S, Roach GD. Sleep or swim? Early-morning training severely restricts the amount of sleep obtained by elite swimmers. Eur J Sport Sci. 2014;14:5310–5.]

- Although sport scientists and researchers are aware of the negative effects of sleep loss on athletic performance, such knowledge needs to be supplemented with sufficient understanding of sleep’s role in recovery, and possible sleep hygiene strategies to overcome these issues.
Sleep is a differentiator in performance
When optimal sleep opportunity is provided

- Basketball shooting accuracy can be improved by **9%**
- A tennis player’s serving accuracy can be increased by **24%**
- A 15-meter sprint swim time can be reduced by **0.51 sec.**

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Mah, C.D., Mah, K.E., & Dement, W.C. 2008. Extended sleep and the effects on mood and athletic performance in collegiate swimmers. Sleep
Mah CD, Mah, K.E., Dement, W.C. 2009 Athletic performance improvements and sleep extension in collegiate tennis players. Sleep
Better sleep reduces the risk of injuries

**ATHLETES SLEEP IS CHALLENGED**
- Irregular schedules and seasonality
- Frequent travel and jet lag
- Bright light at wrong times
- Pain

**CAUSING**
- Altered muscle and bone repair
- Altered reaction time and attention
- Impairments in cognitive function
- Fatigue
- Mood instability

**RESULTING**
- 4 times more injuries in players reporting 6 hours of sleep per night compared to those getting 9 hours of sleep
- Suboptimal performance

Introducing SleepRate for Performance

ATHLETES

COACHES
Research Goal

to evaluate the quality of sleep, sleepiness and chronotype of Israeli Paralympic athletes, as a pre-intervention step, selecting athletes for applying SleepRate monitoring (sensor and App)

Monitoring sleeping with 
Sleeprate:
• Provides insight into athletes’ sleep, including intra-personal variations

To allow
• Adjusting training load to improve performance
• Meeting sleep needs to prevent injury
• Improving overall daytime function and wellbeing
Methods

- On-line survey (Qualtrics, USA)
- **Sleep quality** was evaluated using the **Pittsburgh Sleep Quality Index (PSQI)**
- **The Epworth Sleepiness Scale** was used to evaluate sleepiness during the day (ESS)
- **Chronotype** was assessed by the **Morningness-Eveningness questionnaire** by Horne and Östberg (MEQ)
- The study was approved by the ethical committee of TLV University

Methods

Sleep quality - the Pittsburgh Sleep Quality Index

- Consists of 21 items that evaluate sleep quality and disturbances (last month report)
- Includes 7 components: sleep subjective quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleeping pills and daytime dysfunction.
- Cut-off point
  - ≥5 poor quality
  - <4 is good sleeping quality
Methods

The Epworth Sleepiness Scale - sleepiness during the day

- Athletes determine **the chance of falling sleep** in active and passive situations: Sitting and reading; watching TV; sitting in a public place; sitting on a train, car or bus, lying down for an afternoon nap; sitting and talking to someone; sitting quietly after lunch; abstaining from alcohol use; and driving while stuck in traffic for a few minutes

- Scoring likelihood from 0 (no chance) to 3 (high chance)

- The reference values are: Epworth Sleepiness Scale (SE) **normal**, from 0 to 6
  SE **limit**, from 7 to 9
  SE **slight**, from 10 to 14
  SE **moderate**, from 15 to 20
  SE **high (severe)**, above 20
Methods

- Chronotype – MEQ questionnaire
- 19 questions, each with a number of points
- Scores can range from 16-86
  - Scores of 41 and below indicate "evening" types
  - Scores of 59 and above indicate "morning" types
  - Scores between 42-58 indicate "intermediate" types
Result

Demographic

✓ 52 Para-athletes (32 men and 20 women)
✓ Average age of 31.2 ±11.9 years
✓ All prepare to major competitions in 13 para-sports

Paralympic Sports

- Para Table Tennis
- Wheelchair Basketball
- Hand Cycling
- Badminton
- Para Swimming
- GoalBall
- Boccia
- Shooting
- Kayaks
- Wheelchair rugby
- Power lifting
- Para Rowing
- Wheelchair Tennis
Result

Descriptive statistics

- 63.4% of the athletes reported sleep duration of less than 7 hours
- 26.9% slept less than 6 hours per night during the last month
- 30.7% were classified as morning type while the majority were classified as Intermediate type (61.5%)
- 32.6% of the athletes reported moderate to severe excessive daytime sleepiness and were referred to relevant professional personnel.
- 14 athletes presented moderate to poor sleep quality and were selected for the future intervention with SleepRate (PSQI ≥6)
Result

Subgroup comparison (one way ANOVA)

Athletes with **poor sleep quality** showed

- **Significantly lower sleep efficiency** ($p=0.028$, $F=5.11$, partial $\eta^2=0.093$)
- **Greater daytime dysfunction** ($p<0.001$, $F=14.1$, partial $\eta^2=0.221$)
- **Greater sleep latency** ($p<0.001$, $F=15.08$, partial $\eta^2=0.232$), than athletes with good sleep quality
- No significant differences in quality of sleep between the sleepiness and non-sleepiness groups ($P=0.324$, $F=0.994$. partial $\eta^2=0.19$)
- No significant differences in quality of sleep for athletes with different chronotypes
Example:

<table>
<thead>
<tr>
<th>Level</th>
<th>Age</th>
<th>Male</th>
<th>Female</th>
<th>Sport Type</th>
<th>Years practicing this sport</th>
<th>Chronotype</th>
<th>PAQI Score</th>
<th>ESS Score</th>
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<td>8</td>
<td>Intermediate</td>
<td>8</td>
<td>11</td>
<td>Pain</td>
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<tr>
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<td>Shooting</td>
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<td>7</td>
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<tr>
<td>Silver</td>
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<td></td>
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<td>7</td>
<td>morning</td>
<td>6</td>
<td>12</td>
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<tr>
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<td></td>
<td>Power lifting</td>
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<td>7</td>
<td>11</td>
<td></td>
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<tr>
<td>National</td>
<td>37</td>
<td>1</td>
<td></td>
<td>Wheelchair Rugby</td>
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<td>Intermediate</td>
<td>14</td>
<td>9</td>
<td>Thoughts</td>
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</table>
Conclusion

Personalized sleep strategies are essential, and could have an impact on optimizing performance, preventing injuries & improving overall wellbeing.
Current situation

- Following the study, each athlete received a report with his/her results, and personalized recommendation in order to improve the quality of sleep.

- The 14 athletes that presented moderate to poor sleep quality in the survey, were selected for the intervention with SleepRate and are being monitored since March 2019. They are already showing changes in their sleeping state.
Example (1 night of a swimmer):
Main Dashboard

Training readiness

The monitored athletes

Training readiness
Research Dashboard

Heart Rate

Average Heart Rate: 36 BPM
Resting Heart Rate: 34 BPM

Recovery Index (RMSSD)

RMSSD (Average): 82 msec

Heart Rate Variability: Stress

Sympathetic / Parasympathetic Ratio (Average): 3.70
Soon, the sensor will be replaced by a Garmin watch, allowing monitoring of both sleep-related information, and training intensity.
Thank you