

The Effect of Sleep Extension Strategies on Sports Performance in Trained Athletes

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BSc Sport & Exercise Science Poster Day, Spinnaker Building, June 2022



Introduction

Sleep and recovery are two key components that have an effect on sporting performance, appropriate sleep quality and quantity have been reported as the best recovery strategy that is accessible to elite athletes (Hals0n et al., 2013). Sleep extension strategies are methods put in place where participants increase their sleep durations and time in bed past habitual levels (Mantua et al., 2019). Sleep deprivation is a common issue for university students (Lack, 1986), This can be due to the student culture of partying including alcohol and caffeine in combination with early lectures, these factors can ruin sleep schedules (Brown et al., 2002). This in turn can negatively affect performance for university student athletes (Fullagar et al., 2015).

The aim of this study was to explore the effect of sleep extension strategies on the performance of university student athletes, with the inclusion of the strategies a positive effect on both athletic and cognitive performance should be seen.

Methods & Materials

21 participants (age 21.6 ± 2.5 years, height 178.3 ± 5.5 cm, mass 82.4 ± 6.9 kg) completed 4 testing blocks. Each participant experienced the sham and experimental conditions in a repeated measure design.

As all data collected was parametric, the paired t-test was used to compare the sham and experimental interventions. Significance was set at 0.05 and the statistical analyses were completed on IBM SPSS statistics 28 (Chicago Illinois, USA).

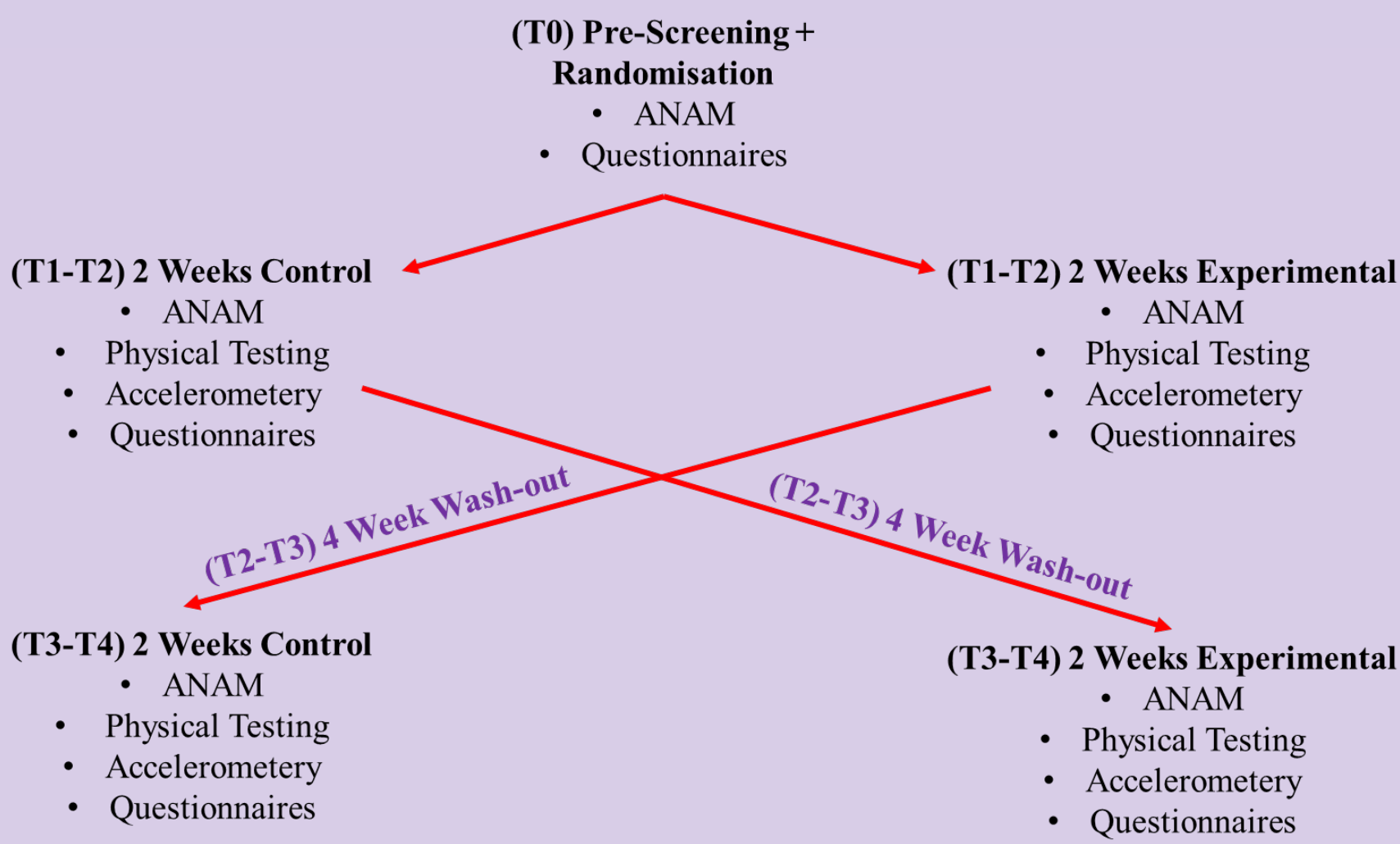


Figure 1. Study design

Table 1. Shows all questionnaires and tests and when they were used throughout the study.

Type of Questionnaire	Type of Test
Epworth Sleepiness Scale (ESS) – <i>T0-T4</i>	Automated Neuropsychological Assessment Metrics (ANAM) - <i>T0-T4</i>
Morning-Eveningness Questionnaire (MEQ) – <i>T0</i>	Counter-movement Jumps - <i>T1-T4</i>
Pre-screening Questionnaire – <i>T0</i>	20m Sprint - <i>T1-T4</i>
Ford Insomnia Response to Stress Test (FIRST) – <i>T0</i>	5-0-5 Agility - <i>T1-T4</i>
Napping Behaviour Questionnaire – <i>T0-T4</i>	Yo-Yo Intermittent Recovery - <i>T1-T4</i>
Health History Questionnaire (HHQ) - <i>T0</i>	

*T = testing block.

Results

Cognitive Data

- No significant difference was found in cognitive data for percentage correct (PC) or speed (S) during the two-choice test when comparing between T2 sham and T4 experimental (PC: 96 ± 3.37 vs 94 ± 3.37 , $p = 0.3$; S: 158.61 ± 12.46 vs 156.13 ± 15.69 , $p = 0.64$).
- No significant difference was found in cognitive data for PC or S during the mannequin test when compared between T2 sham and T4 experimental (PC: 92.27 ± 5.69 vs 91.26 ± 5.04 , $p = 0.0712$; S: 61.08 ± 21.5 vs 49.66 ± 12.16 , $p = 0.214$).

Table 1. Mean difference $\pm$ SD between T2 sham & T4 experimental and T2 experimental & T4 sham cognitive variables.

Type of test	T2 sham vs T4 experimental	T2 experimental vs T4 sham
2CH PC	2.00 ± 5.75	$3.50 \pm 4.44^*$
2CH SP	2.48 ± 16.39	5.49 ± 17.42
MKN PC	1.02 ± 8.41	6.10 ± 30.53
MKN SP	11.42 ± 27.03	$13.28 \pm 14.76^*$

* ($p \leq 0.05$) different between conditions. 2CH = two choice, MKN = mannequin, PC = percentage correct, SP = speed.

Physical Performance Data

Jump data

- Jumping performance showed significant differences for power but not height between T2 sham and T4 experimental (Jump height: 33.16 ± 7.62 vs. 35.38 ± 9.11 cm, $P = 0.287$; Power: 29.52 ± 9.17 vs. 34.42 ± 8.40 w/kg, $P = 0.045$).

Running related data

- There was a significant improvement in agility between T2 sham and T4 experimental (Mean time: 2.74 ± 0.18 vs. 2.61 ± 0.15 s, $P = 0.020$).
- 20m sprint performance significantly improved between T2 sham and T4 experimental (Mean time: 3.12 ± 0.11 vs. 2.74 ± 0.18 s, $P = < 0.001$).
- There was a significant improvement in endurance between T2 sham and T4 experimental (Mean distance: 904.00 ± 277.26 vs. 1304.00 ± 326.71 m, $P = 0.015$).

Table 2. Mean difference $\pm$ SD between T2 sham & T4 experimental and T2 experimental & T4 sham performance variables.

Type of test	T2 sham vs T4 experimental	T2 experimental vs T4 sham
Jump height (cm)	2.22 ± 6.20	0.88 ± 9.51
Jump power (w/kg)	$4.90 \pm 6.66^*$	4.83 ± 10.85
5-0-5 agility test time (s)	$0.14 \pm 0.15^*$	0.06 ± 0.41
20 m sprint time (s)	$0.38 \pm 0.22^*$	0.008 ± 0.42
Yo-yo intermittent recovery test distance (m)	$400 \pm 423.32^*$	296 ± 492.14

* ($p \leq 0.05$) different between conditions.

Questionnaire Data

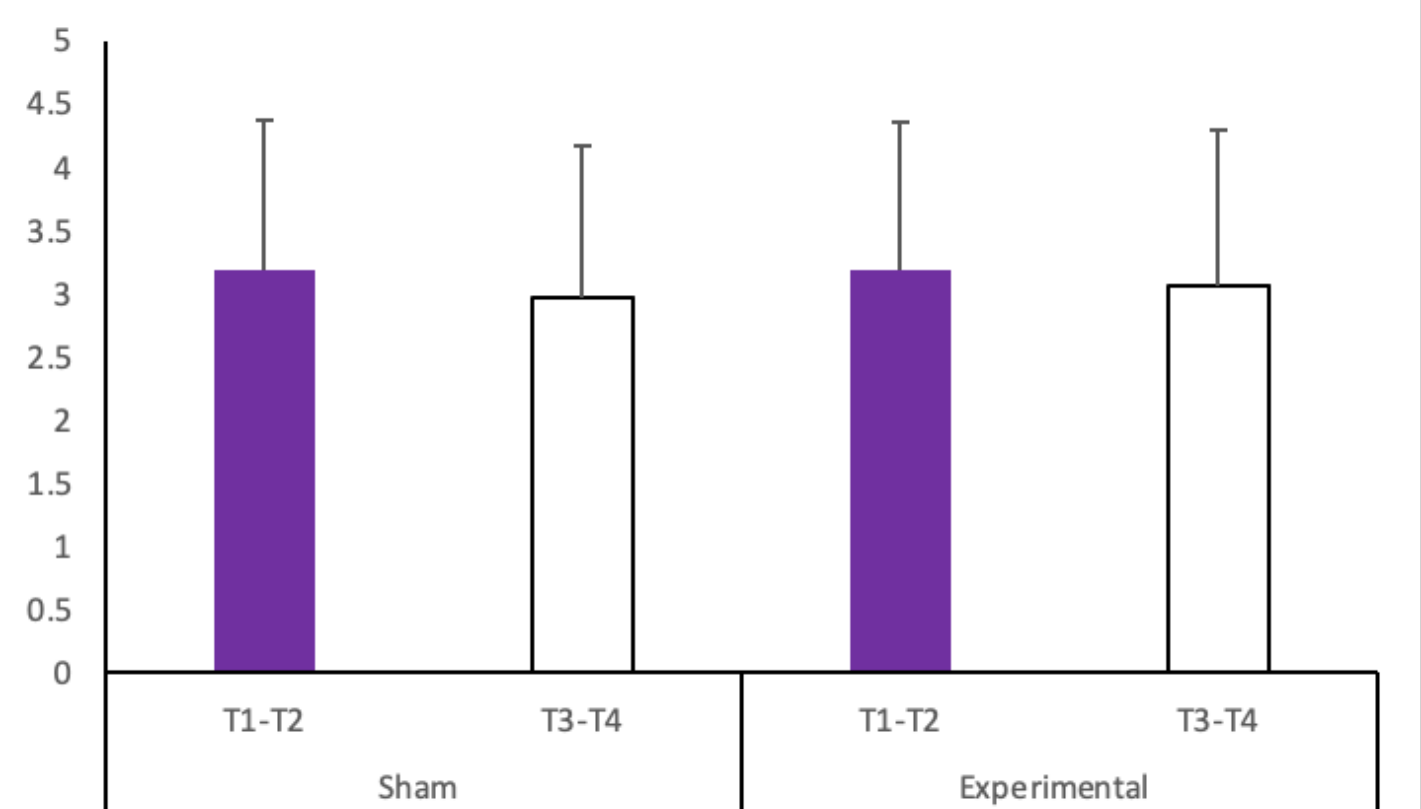


Figure 2. Shows mean $\pm$ SD sleep scores collected during NHS sleep diary

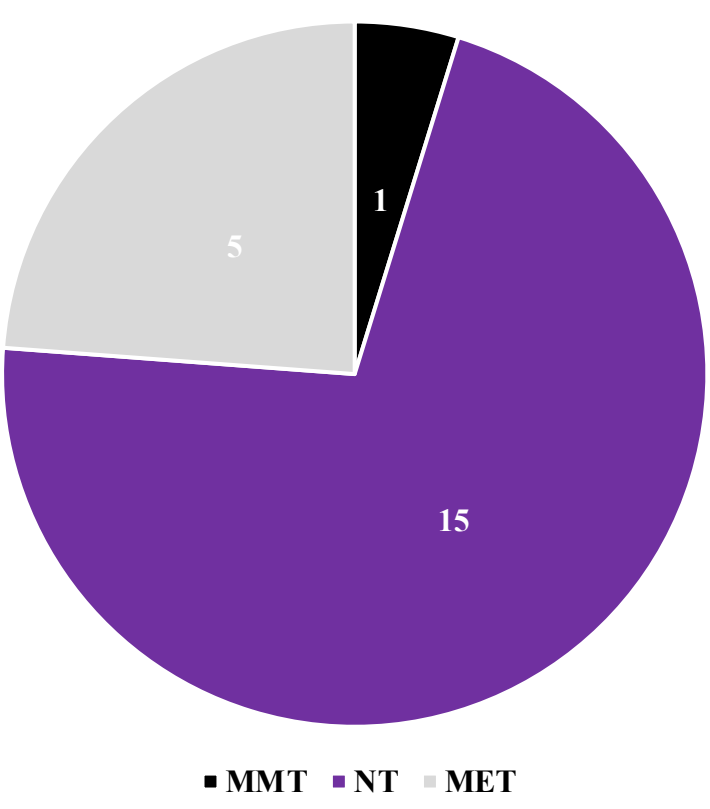


Figure 3. Shows the split of participants between Moderately Morning Types (MMT), Neither Type (NT) and Moderately Evening Types (MET)

Discussion

Sleep extension was shown to improve the majority of physical performance variables in the form of jump power, agility, sprint time and endurance. However, neither cognitive or jump height performance was significantly improved following the intervention.

- Similar studies including Bonnar *et al.*, (2018), suggest that sleep extension had the most beneficial effects on subsequent physical performance following a systematic review.
- A study looking at basketball performance and sleep extension showed improved sprint time (Mah *et al.*, 2011).
- Wenger (2019), studied the effects of sleep extension on the agility of 15 varsity students through the use of both the pre-planned change of direction (COD) test, and the reactive agility test (RAT) which both improved supporting the findings of the current study.
- Endurance results contradict the work of Fullager et al., (2016) who found no effect on running endurance however the study used a shorter invention period therefore showing the importance of the longer duration used in this study.
- Findings in relation to cognitive data contrast to that of existing literature as the majority of studies, of which are limited, have found that sleep extension does in fact improve cognitive functions (Mah *et al.*, 2011; Schwartz & Simon, 2015; Watson, 2017). This may be due to other studies using the psychomotor vigilance task (PVT) (Ritland et al., 2019) rather than ANAM meaning results could differ.
- The average sleep score decreased when comparing T1-T2 sham to T3-T4 experimental. This proves that the data is reliable as if the time spent in bed increased then the sleep extension has been followed leading to the improvement of performance.

Conclusion

Regarding the results of this study, sleep intervention strategies had a positive effect on sports performance as shown when comparing T2 sham and T4 experimental however there is little to no change in ability for cognitive performance due to the interventions.

Future Recommendations

- Larger study size as sample size of 21 is relatively small
- Physiological bias between sports leads possible differences in results (Drust et al., 2007; Higham et al., 2013).
- Other studies use the psychomotor vigilance task (PVT) (Ritland et al., 2019) rather than ANAM meaning results could differ.
- Time of testing can affect individual advantages and disadvantages as MEQ shows that people have different circadian rhythms (Heitian, 1999).

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