Impact Of Sleep Restriction And Recovery On Motivation During Repeated Cognitive Performance Testing

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Introduction and Purpose

Both motivation and sleep deprivation affect cognitive performance. Especially during long-lasting studies with repeated cognitive performance tasks there is concern that subjects will lose motivation over time. Results may be confounded due to changes in motivation.

Methods/Study design

36 healthy volunteers performed 55 cognitive performance tasks at three-hourly intervals in a 11-day inpatient study:

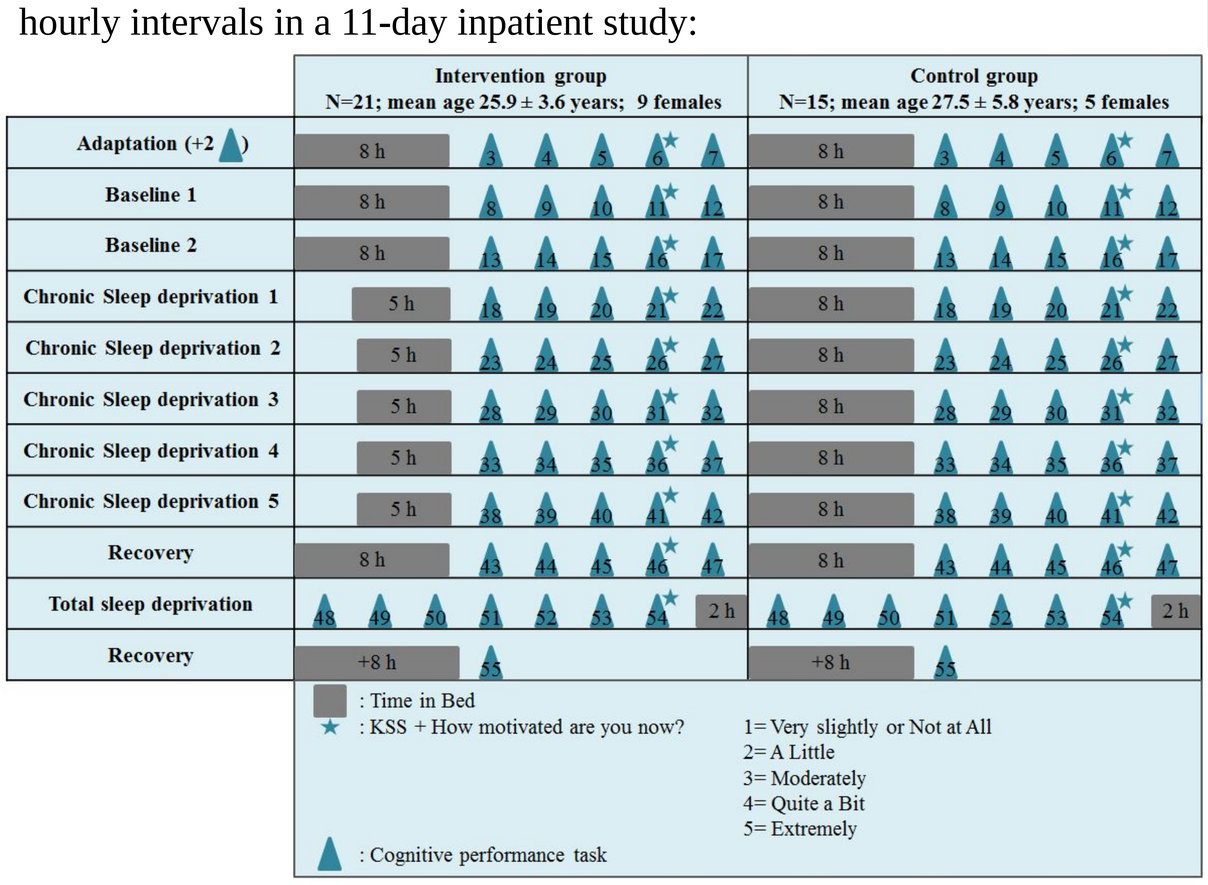

Figure 1: Study protocol

After two baseline nights with 8 h time in bed (TIB) the intervention group underwent chronic sleep deprivation (CSD) for 5 nights (5 h TIB) with a following recovery night of 8 h TIB. The control group had the opportunity to sleep 8 hours every night. After that both groups were kept awake for 38 h, which was followed by a 10 h recovery night. Participants completed the Karolinska Sleepiness Scale (KSS) and a questionnaire about their motivation (from 1=very little/not motivated to 5=very motivated) at 6 p.m. on all days.

Results

Sleepiness increased in the course of chronic sleep deprivation and resulted in a significant difference after total sleep deprivation (TSD) between control and intervention group (Figure 2, A). A significant difference between the two groups according to motivation is already found at the fifth chronic sleep deprivation day (control: 3.0 ± 1.3, experimental: 2.2 ± 0.6) and remained after recovery sleep (control: 3.1 ± 1.0, experimental 2.3 ± 0.6) and total sleep deprivation (control: 2.9 ± 1.3, experimental: 1.8 ± 0.8) (see Figure 2, B).

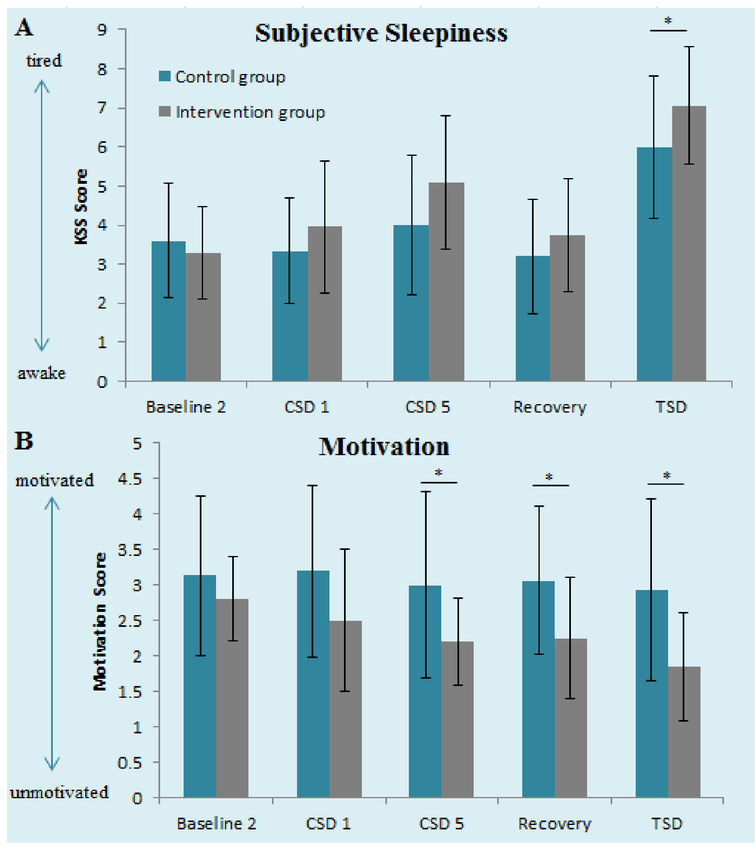

Figure 2: KSS (A) and Motivation (B) Score in control and intervention group.

A: KSS Score on total sleep deprivation for control group 6, for intervention 7.05 (p=0.0284)

B: Significant difference in motivation for chronic sleep deprivation 5 (p=0.0347), recovery (p=0.0205) and total sleep deprivation (p=0.0096).

Figure 3, A illustrates a significant increase in subjective sleepiness from baseline (3.3 ± 1.2 (SD)) to the first (4.0 ± 1.7) and last (5.1 ± 1.7) day of chronic sleep restriction for the experimental group. For total sleep deprivation, both groups show a highly significant increase in subjective sleepiness.

In comparison with baseline, motivation shows a significant decrease to the last day of chronic sleep restriction, to recovery and to total sleep deprivation for the experimental group.

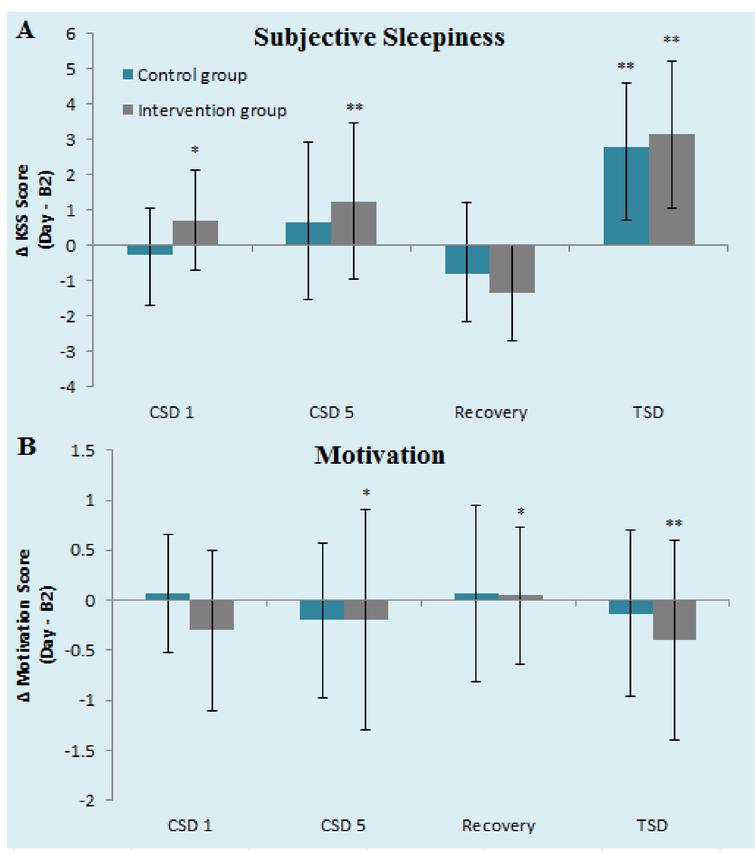

Figure 3: Δ KSS (A) and Motivation (B) Score between study-day and baseline.

A: Δ KSS Score is highly significant (control: p=0.0002, experimental: p=0.001) on total sleep deprivation.

B: Δ Motivation is significant on chronic sleep deprivation (p=0.0088), recovery (p=0.0164) and total sleep deprivation (0.0005).

Increase in sleepiness showed a significant Spearman correlation with loss of motivation ($r = -0.47$, $p<0.001$).

Conclusions:

- Chronic sleep restriction for five days leads to an increase in sleepiness and a decrease in motivation
- One night of recovery is insufficient to reverse the motivation loss, contrasting with the beneficial effect on sleepiness
- Subjective motivation seems to decrease as a function of subjective sleepiness
- Without sleep loss, motivation remains high during long-lasting studies

Cognitive performance task results base on study design and not on motivation loss

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