Results: Results demonstrate significant changes in vigilance, decision-making, and sensory perception during sleep deprivation with associated altered brain activity. Cohort-related differences in performance and brain activity were detected.
Conclusion: This study shows that training and individual differences contribute to impaired cognition and altered brain activity during sleep deprivation.
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CAFFEINE EFFECTS ON VIGILANCE, MELATONIN AND CORTISOL UNDER HIGHER AND LOWER SLEEPINESS LEVELS

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Introduction: It is suggested that the initial activation level influences the effects of caffeine but no study has directly compared the effects of similar doses of caffeine in situations of varying sleepiness levels produced by homeostatic/circadian sleep pressure. Also, effects of caffeine on melatonin/cortisol levels are still a matter of debate and it is unknown whether time of caffeine administration influences these results. This study compares the effects of caffeine in two situations of varying levels of sleepiness (i.e. in the evening after a normal day and during a night of sleep deprivation).
Methods: Fifty moderate caffeine consumers (mean age: 38.3) were assigned to an Evening protocol (EP) or a Night protocol (NP). All subjects participated in both caffeine (200 mg) and placebo (lactose) conditions in a double-blind crossover design. In the EP, subjects received 100 mg of caffeine (or placebo) 3 hours and 1 hour before habitual bedtime. In the NP, subjects were sleep deprived for one night and received 100 mg of caffeine (or placebo) 2 hours before and at habitual wake time. All measures were collected between 30 and 45 minutes after the second dose.
Results: Compared to placebo, caffeine increased subjective alertness and decreased median reaction time for psychomotor vigilance measure (PVT) similarly in the EP and NP. However, the effect of caffeine on PVT slowest reaction time was more prominent in the NP than in the EP and caffeine decreased the number of PVT laps in the NP only. Caffeine increased melatonin secretion in both protocols, but increased cortisol secretion in the NP only.
Conclusion: In conclusion, caffeine shows stronger effects on vigilance in high sleepiness conditions induced by enhanced homeostatic/circadian sleep drive. The effects of caffeine on cortisol but not on melatonin are influenced by time of day.

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ATHLETIC PERFORMANCE IMPROVEMENTS AND SLEEP EXTENSION IN COLLEGIATE TENNIS PLAYERS

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Introduction: Few previous studies have focused on the impact of extended sleep and the effects over a prolonged period of time. The present study investigated sleep extension over multiple weeks with a specific focus on the relationship between obtaining extra sleep and assessments of athletic performance. These trials were part of an ongoing study examining varsity sport teams at Stanford University.
Methods: Five healthy students (age 18-21) on the Stanford women's tennis team maintained their habitual sleep/wake patterns for a 2-3 week baseline during their regular tennis season. Athletic performance assessments were reported after every practice throughout the study including sprinting and hitting drills. Both deuce and ad sides were conducted for hitting drills which included valid serves and a depth exercise targeting within 3 feet of the tennis court baseline. Athletes then extended their sleep aiming for 10 hours each night for 5-6 weeks. Profile of Mood States (POMS) was conducted weekly to evaluate mood changes and Epworth Sleepiness Scale assessed daytime sleepiness. Daily sleep/wake activity was monitored by actigraphy and participant reported sleep journals.
Results: Sleep extension was associated with significant improvements in measures of athletic performance. Athletes executed a faster sprinting drill (19.12 ± 0.55 seconds at baseline, 17.56 ± 1.23 seconds at end sleep extension, $p<0.05$) and increased hitting accuracy including valid serves (12.60 ± 2.23 serves vs. 15.61 ± 1.48 serves, $p<0.05$) and hitting depth drill (10.85 ± 2.21 hits vs. 15.45 ± 1.97 hits, $p<0.05$). Athletes reported improved ratings during practices (5.80 ± 1.50 vs. 8.41 ± 1.03, $p<0.05$) and Epworth scores decreased (7.60 ± 3.21 vs. 2.40 ± 2.07, $p<0.05$). POMS vigor scores increased (16.12 ± 4.80 vs. 23.40 ± 3.05, $p<0.05$) and POMS fatigue scores decreased (7.75 ± 3.74 vs. 3.70 ± 3.67, $p<0.05$).
Conclusion: Sleep extension significantly improved assessments of athletic performance and mood in collegiate tennis players.

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THE EFFECT OF IN-FLIGHT SLEEP ON FATIGUE-RISK IN ULTRA-LONG-RANGE (ULR) FLIGHT - COMPARISON OF 4-PILOT ULR TO 4-PILOT NON-ULR FLIGHTS

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Introduction: Ultra-long range (ULR) flights are flights greater than 16 hours in duration for more than 10% of flights. To reduce the risk of error, incident, and accident from fatigue, ULR flights are required by the Federal Aviation Administration to have 4-pilot crews and the opportunity for in-flight sleep. To evaluate the relative fatigue-risk of ULR vs. non-ULR flights, we used mathematical modeling to predict the performance effectiveness of Captains flying ULR vs. Captains flying non-ULR flights. In this study, we compared predicted effectiveness of ULR 4-pilot crews with non-ULR 4-pilot crews. Each ULR pilot had the opportunity for 6-7.5 hours in-flight sleep. Each non-ULR pilot had the opportunity for 5-7.5 hours in-flight sleep.
Methods: We used the schedules of 114 Boeing 777 Captains flying both ULR and non-ULR flights. There were 252 ULR flights and 385 non-ULR flights. We estimated in-flight, layover, and at home sleep based on rules taking sleep opportunity and circadian factors into account. The resulting sleep/wake histories were inputted into the SAFTE™/FAST™ mathematical model providing a minute-by-minute effectiveness prediction (scaled 0-100) based on sleep/wake history and circadian rhythm. The first and last hours of flight (critical periods of flight) of the 4-pilot ULR flights were compared to those of the 4-pilot non-ULR flights.
Results: There was no significant difference between the predicted performance effectiveness of ULR Captains (88.7 ± 0.2) and non-ULR Captains (88.6 ± 0.1) averaged across both critical periods of flight ($t[635]=1.7$, $P<0.1$). The ULR Captains predicted performance effectiveness (92.0 ± 0.2) over the first hour of flight was significantly better than the non-ULR Captains predicted performance effectiveness (88.6 ± 0.4) ($t[535] = 9.0$, $P<0.001$). For the last hour of flight the reverse was true. The non-ULR Captains predicted performance effectiveness (88.1 ± 0.3) over the last hour was significantly better than the ULR Captains predicted performance effectiveness (85.4 ± 0.2) ($t[632] = -6.7$, $P<0.001$).