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HUNGER RATINGS CHANGE WITH CIRCADIAN MISALIGNMENT AND SLEEP DEPRIVATION

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Introduction: Increased risk of obesity and other metabolic diseases observed in shiftworkers is thought to be related to consumption of the majority of calories at adverse circadian times. How the circadian system influences appetite at night is largely unknown and was therefore examined in two studies: a simulated shiftwork (SW) protocol with feeding at night and a total sleep deprivation (TSD) protocol with fasting at night.
Methods: Ten healthy adults (4 males) aged 26.3 ± 4.8 y, BMI 22.3 ± 1.7 participated in SW and seven healthy adults (5 males) aged 22 ± 5 y, BMI 22.9 ± 2.4 participated in TSD. Participants maintained ~8 h/night habitual sleep schedules the week prior to study. SW was a 5 day in-laboratory protocol simulating three consecutive nightshifts with Day 2 as baseline, Day 3 as transition to night work, which occurred Nights 3-5. TSD was a 3 day in-laboratory protocol with Day 1 as baseline and Days 2-3 40 h of TSD. Participants were fed meals meeting their daily caloric needs and in both studies, meals were given at approximately 1.5 h, 5.5 h, 10.5 h and 14.5 h awake. Thus, participants were fed at night during SW and fasted at night during TSD. Hunger ratings were assessed every 1-2 h with visual analog scales. Data were analyzed by Mixed Model ANOVA and planned comparisons.
Results: Hunger ratings for sweets, fruits, dairy, meats, and vegetables were lower when food was consumed during the nightshift compared to daytime levels at baseline ($p < 0.05$). Hunger ratings for these foods were also lower when fasting at night during TSD ($p < 0.005$) compared to when feeding during the daytime.
Conclusion: Although shiftworkers are reported to eat the majority of their calories at night, findings from the current study suggest that this pattern is not due to increased hunger at night, rather the circadian clock appears to reduce hunger at night regardless of food intake.
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CIRCADIAN MISALIGNMENT INCREASES CARDIOVASCULAR RISK INDEPENDENTLY OF SLEEP LOSS

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Introduction: Shift work, characterized by irregular schedules resulting in sleep loss and misalignment of circadian rhythms, is associated with increased incidence of cardiovascular disease. We tested whether circadian misalignment has an adverse impact on cardiovascular function independently of sleep loss.
Methods: 19 healthy adults were studied using a parallel group design comparing two interventions. Both interventions involved 3 inpatient days with 10-h bedtimes (B1-B3) followed by 8 inpatient days with 5 hours in bed (D4-D10), either with fixed nocturnal bedtimes (circadian alignment, n = 8, 3 women, 24.5 ± 2.7 years old, 23.6 ± 2.5 kg/m^2) or with bedtimes delayed by 8.5 hours on 4 of the 8 days (circadian misalignment, n = 11, 4 women, 22.5 ± 1.6 years old, 22.1 ± 2.6 kg/m^2). Both interventions were followed by 3 nights of recovery sleep, 2 nights with 12-h bedtimes (R12-13) and 1 night with 10-h bedtimes (R14). During each night, heart rate (HR) and cardiac sympathovagal balance (assessed via the ratio of low frequency to high frequency [LF:HF] in the ECG) were estimated over a 5-min period during stable NREM stage 2, slow wave sleep (SWS) and REM sleep. Only 5-min-periods free from artifacts, arousals, leg movements, breathing instability and ectopic beats were analyzed. A generalized linear model for repeated measures was used to examine between-group differences after adjusting for age and BMI.
Results: Total sleep time during the intervention was almost identical in the two groups (4h49min [4 min] vs. 4h46min [6 min]). When compared to the aligned condition, the increase of HR from baseline (B2) was 8 to 10 bpm higher in the misaligned condition during stage 2 (p:0.0009), SWS (p:0.0492) and REM sleep (p:0.0083). LF:HF was higher in the misaligned condition during stage 2 (p:0.0284), SWS (p:0.0450) and REM sleep (p:0.0338).
Conclusion: Circadian misalignment as occurs in shift work may impair autonomic cardiac modulation and increase cardiovascular risk, independently of sleep loss.
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DIFFERENTIAL SLEEP DISTURBANCES IN TWO PHENOTYPES OF SHIFT WORK DISORDER

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Introduction: Most patients meeting diagnostic criteria for Shift Work Disorder (SWD) report insomnia, but only a portion of these insomniacs also report excessive sleepiness. We hypothesize that two phenotypes of SWD, characterized by the presence or absence of excessive sleepiness, experience similar diurnal sleep but different nocturnal sleep.
Methods: 35 night workers completed a sleep diary for two weeks before an overnight phase assessment. Subjects with a history of insomnia or other sleep disorders prior to shift work were excluded. At 17:00, each subject completed an Insomnia Severity Index specific to daytime sleep (ISI-D) and an Epworth Sleepiness Scale (ESS). 12 subjects with normal scores on both scales were classified as controls. 12 subjects with ESS < 10 and ISI-D > 10 were classified "alert insomniacs" (AI). 11 subjects with ISI-D > 10 and ESS > 10 were classified "sleepy insomniacs" (SI). We used t-tests to compare diary-reported sleep parameters between subgroups.
Results: Dim-light melatonin onset was significantly ($p < 0.01$) delayed in controls (04:54 ± 3.7 h) than in both SWD groups: AI (22:45 ± 4.9 h) and SI (20:55 ± 4.6 h). For daytime sleep, both SWD groups reported lower sleep efficiency (82.35% AI; 88.71% SI) and more awakenings (1.62 AI; 1.79 SI) than controls (95.78%; 0.54 awakenings, $p < .05$). The AI group also reported longer daytime latencies than controls (34.59 vs. 13.73 minutes, $p < .05$). At night, however, only the AI group differed from controls ($p < .05$), reporting lower sleep efficiency (81.84% vs. 93.38%), longer latencies (43.97 vs. 17.74 minutes) and more awakenings (1.90 vs. 0.80).
Conclusion: Although both phenotypes of SWD show a nighttime phase and disrupted sleep during the day (a time outside of their circadian sleep phase), the AI phenotype shows sleep disturbances at night that are not seen in controls or the SI group. Since the AI phenotype

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