Baseline Slow-Wave Sleep Negatively Relates to Energy Balance Responses during Sleep Restriction in Healthy Adults

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Introduction: Sleep restriction (SR) leads to increased daily caloric intake, late-night eating and weight gain. However, not all subjects respond to SR to the same degree (some gain a significant amount of weight while others maintain or lose weight). The amount of time spent in sleep stages 3 or 4 (slow-wave sleep [SWS]) is stable and trait-like within individuals but highly variable between individuals. The current study examined if individual differences in baseline SWS associated with energy balance responses to SR.

Methods: N=36 healthy subjects (31.1±8.3y, 25.8±2.7 BMI, 20 females) participated in a laboratory protocol including 2 baseline nights (BL1-2; 10-12h time in bed [TIB]/night) followed by 5 consecutive SR nights (4h TIB/night). Polysomnography was recorded on BL2 and scored using standard criteria. Duration of each sleep stage was calculated as a percent of total sleep time (%TST). Weight was measured at admittance and discharge. Food/drink consumption was ad libitum and recorded daily. Partial correlations controlling for age, gender, race and BMI were used for analyses.

Results: Subjects consumed 20.8% more calories during SR than during BL, ate/drank 507.3±274.9 calories during late-night hours (2200h-0400h) and gained 0.61±1.88 kg during the study. Baseline SWS ranged from 1.6-28.8% of TST and was negatively correlated with increased caloric intake during SR ($r=-0.45$, $p=0.011$), late-night intake ($r=-0.41$, $p=0.03$) and weight gain ($r=-0.48$, $p=0.006$). No other sleep variables were significantly related to all three energy balance variables; however, stage 1 %TST was positively associated with increased caloric intake during SR ($r=0.41$, $p=0.02$), sleep efficiency was negatively related to late-night intake ($r=-0.39$, $p=0.03$) whereas sleep latency was positively related to late-night intake ($r=0.38$, $p=0.04$), and stage 2 %TST was positively associated with weight gain ($r=0.39$, $p=0.03$).

Conclusion: Adults with less slow-wave sleep may be more vulnerable to increased daily caloric intake, late-night eating and weight gain during sleep restriction.