Previous Sleep and Light at Night Affect Biomarkers

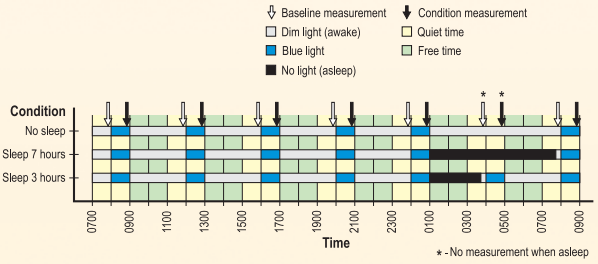
Circadian rhythms repeat approximately every 24 hours and are synchronized to the solar day by light/dark patterns. Examples of circadian rhythms include:

- **Melatonin**, a hormone synthesized by the pineal gland at night and under the condition of darkness;
- **Cortisol**, a hormone synthesized by the adrenal gland, peaks 30-60 minutes after awakening in the morning; and
- **Alpha amylase**, an enzyme used as a marker for the sympathetic system, roughly mirrors cortisol production, peaking in the early afternoon.

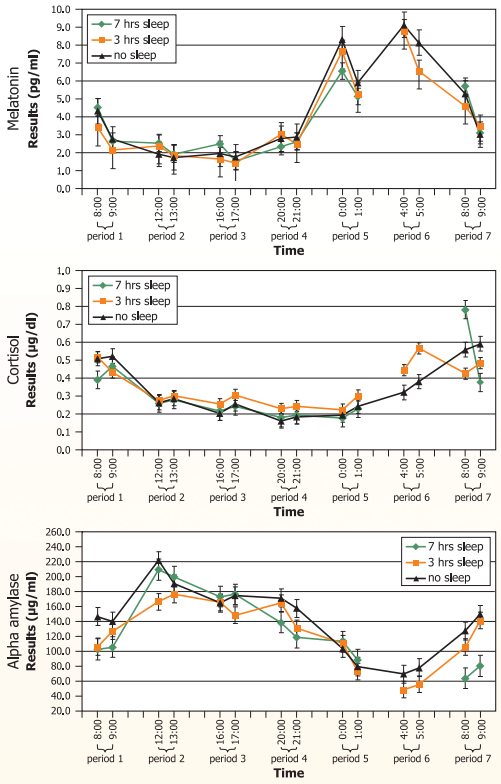
LRC researchers investigated the impact of sleep and light exposure on these biomarkers over a period of 27 hours.

Methods

Ten subjects, ages 18 to 46, participated in the three-session, within-subjects study and were: restricted from sleep; allowed to sleep for 3 hours (01:00-03:45); and allowed to sleep for 7 hours (01:00-07:45). The 27-hour experiment included seven sample times which were instituted to obtain baseline biomarker measurements (open arrows) and another seven sample times which followed one-hour exposures to 470-nm light emitting diodes (LEDs) that delivered 40 μW/cm² (40 lx) at the subject's cornea (filled arrows). Subjects started each session at 07:00 and ended at 10:00 the following day. Saliva samples were collected for biomarker assays just prior to and at the end of the one-hour light exposures.



27-hour timeline: Seven sample times were instituted to obtain the baseline biomarker measurements (open arrows) and seven sample times followed one-hour exposures of the lighting condition (filled arrows). Subjects saw all experimental conditions presented to them at least one week apart from each other.



Melatonin, cortisol, and alpha amylase levels over the course of the 27-hour experiment for the three sleeping conditions.

Results

- All three biomarkers follow a circadian pattern
- Sleep and light interact to affect alpha amylase and cortisol response but not melatonin; only light affects nocturnal melatonin suppression
- Magnitudes of alpha amylase and cortisol responses are dependent upon the duration of sleep and the time of waking
  - The longer the sleep duration and the later the time of waking, the greater the response
- Directions of response to waking are opposite for alpha amylase and cortisol
  - Waking increases cortisol and decreases alpha amylase

Sponsor

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