Reset Your Rhythm:
How meal timing and light cycles affect health

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How the body tells time

• Circadian Rhythm
  • Body’s internal 24-hour clock that regulates the sleep-wake cycle
  • Countless body functions are synchronized by the circadian rhythm

• Key regulators of circadian rhythm
  • Light exposure
  • Food intake

• Altered timing of these inputs can impair sleep and overall health
We aren’t getting enough sleep

• In 1910, Americans slept an average of 9 hours per night
• Today, the average is only 6.8 hours per night
• National Institutes of Health recommends at least 7-8 hours per night
  • Only 20% of adults meet this recommendations
  • One-third of U.S. workers sleep 6 hours or less per night
The effects of not getting enough sleep

• Impaired brain function
  • Learning, problem solving, focus, mood, etc.

• Poor physical health
  • Immunity, muscle/tissue repair, inflammation

• Increased risk of disease
  • Heart disease, diabetes, cancer, obesity
Lack of sleep and weight

- Increased energy intake
  - Total calories
  - Number of meals and snacks
  - Food preferences (high-calorie/carb)

- Decreased energy expenditure
  - Decreased metabolism
  - Decreased physical activity
Lack of sleep and disease risk

• Heart disease
  • Increased blood pressure, LDL (bad) cholesterol, and triglycerides
  • Lower HDL (good) cholesterol
  • Increased inflammation and cortisol

• Diabetes
  • Impaired insulin sensitivity
  • Lower levels of sleep hormone melatonin associated with diabetes

• Cancer
  • Night shift work is classified by WHO as a “probable carcinogen”
  • Shorter sleep duration associated with increased risk of breast cancer
Why are we sleeping so much less?

• Average hours of sleep per night
  • 1910: 9 hours
  • 1942: 7.9 hours
  • 1990: 6.7 hours
  • 2013: 6.8 hours

• Why are we sleeping 25% less than we did 100 years ago?
Types of Body Clocks

• Master Clock
  • Located in the brain
  • Regulated by light exposure

• Peripheral Clocks
  • Located throughout the body
  • Regulated by timing of food intake
How light affects the circadian rhythm

• **Melatonin**
  • Sleep hormone produced by pineal gland in the brain
    • Produced in darkness (night)
    • Production blocked by light (day)
  • Functions
    • Promotes sleep
    • Antioxidant
    • Reduces inflammation
    • Promotes immune function
    • Regulates metabolism
Melatonin & Metabolism

- Melatonin regulates the circadian rhythm of energy metabolism
  - Utilize energy from food during the day
  - Utilize energy from fat stores at night
- Alteration in melatonin rhythm contributes to metabolic dysfunction
  - Diabetes
  - High cholesterol/triglycerides
  - Obesity
Why are we sleeping so much less?

• Average hours of sleep per night
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• Why are we sleeping 25% less than we did 100 years ago?
What happened from 1910 to 1942?

• Average sleep reduced by 1.1 hours (12%)
  • 1910: 9 hours
  • 1942: 7.9 hours

• What happened during these 32 years that caused us to sleep 12% less?
What happened from 1910 to 1942?

U.S. Lightbulb Sales 1885-1945 (in millions)
Artificial light disrupts circadian rhythm

• Natural environment:
  • Melatonin produced only at night (between sunset and sunrise)
  • Melatonin absent during the day (between sunrise and sunset)

• Modern environment:
  • Use of artificial light at night tells the body it is still daytime
  • Blocks melatonin production
  • Sleep onset, duration, and quality are impaired
What happened from 1942 to 1990?

• Average sleep further reduced by 1.2 hours (15%)
  • 1942: 7.9 hours
  • 1990: 6.7 hours

• What happened during these 48 years that caused us to sleep 15% less?
What happened from 1942 to 1990?

% of US Households with Television 1950-1980

- 1950
- 1955
- 1960
- 1965
- 1970
- 1975
- 1980
Sources of Artificial Light

- Lightbulbs
- TVs
- Computers
- Smartphones
- Tablets
E-books affect melatonin production

• Study compared reading electronic book on iPad to reading printed book for four hours prior to bedtime

• E-book reading caused:
  • Decreased evening sleepiness
  • Increased morning sleepiness
  • Longer time to fall asleep
  • Reduced melatonin production
Life without artificial light

• Study subjects spent a week camping in Colorado
• Only light was from sunlight and campfire
• Circadian rhythms shifted to follow light cycle
  • Melatonin production began at sunset and stopped at sunrise
  • Sleep patterns shifted earlier to follow the light cycle
Correcting an altered circadian rhythm

- Goal is to follow natural light cycles
- Two objectives:
  - Increase light exposure during the day (sunlight)
  - Decrease light exposure at night (artificial light)
Increasing light exposure during the day

• Start the day with light
  • Go outside in the morning sunlight
  • Dawn simulation alarm clock
  • Light box

• Spend time outside throughout the day

• Avoid spending time in dark rooms during daytime
Avoiding artificial light at night

• Limit artificial light exposure after sunset (ideally) or at least 1-2 hours before going to sleep
  • Use dim lighting
  • Limit use of electronic devices
  • Reduce brightness of computers, TVs, smartphones, tablets

• Keep bedroom as dark as possible, or wear a sleep mask
Blue Light Spectrum

• Melatonin production is blocked specifically by **blue light**
• Most light sources contain all colors of the visible spectrum, including blue
Strategies to reduce exposure to blue light

• Use orange/yellow tinted lightbulbs at night in place of conventional bulbs
  • Bug lights
  • GE Align bulbs
Strategies to reduce exposure to blue light

• Reduce blue and green color settings on computer and TV
• Install f.lux on computers
  • justgetflux.com
Strategies to reduce exposure to blue light

• Use orange/red LED alarm clock in place of blue/green versions
Strategies to reduce exposure to blue light

• Use candlelight/firelight in place of lightbulbs
Strategies to reduce exposure to blue light

• Use orange/red nightlights or flashlights for navigating in the dark
Strategies to reduce exposure to blue light

• Wear orange-tinted glasses that block blue light
  • Wear glasses during evening hours when exposed to artificial light
  • Take them off after all the lights are shut off when going to bed
How I limit my exposure to blue light at night...
How food intake affects your circadian rhythm

• Food intake should follow light cycle
  • Eat during the day
  • Stop eating at night (within 3-4 hours of bedtime)

• When you eat is as important as what you eat

• Eating at night
  • Impaired metabolic effect (glucose, cholesterol, fat storage)
  • Alters synchronization with master clock (impairs overall health and metabolism)
  • Altered gut microbiome (bacteria have circadian rhythms too!)
The importance of breakfast

• Breakfast synchronizes the circadian rhythm, telling the body it is daytime
  • Similar to light exposure in the morning, but acts on peripheral body clocks

• Breakfast guidelines
  • Moderate to large in size
  • Eat first thing in the morning
  • Include good source of protein (yogurt, eggs, cheese, nuts/nut butters)
  • Focus on whole foods (whole grains, whole fruit, whole proteins)
  • Avoid breakfast junk foods (sugary cereals, donuts, pastries)
Consistency is key!

• Social Jet Lag
  • Staying up later and sleeping in later on the weekend
  • Waking up earlier and going to bed earlier on the weekdays

• Increased social jet lag may have similar health risks as general lack of sleep:
  • Obesity
  • Cancer
  • Diabetes
  • Heart disease
Reset your Rhythm Tips

• Morning
  • Wake up at the same time every day
  • Eat a healthy breakfast upon waking
  • Increase light exposure in the morning, preferably from sunlight

• Day
  • Spend time outdoors during the day
  • Avoid spending time in darkness
Reset your Rhythm Tips

• Evening
  • Finish eating at least 3-4 hours before going to sleep
  • Avoid blue light during this same period

• Night
  • Keep bedtime consistent
  • Allot at least 7-8 hours for sleep
  • Keep your bedroom dark, quiet, and comfortable
References


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Questions?

For additional questions, or to schedule a one-on-one nutrition counseling appointment, email: askanrd@indiana.edu